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Corporate digital responsibility (CDR) in Germany: background and first empirical evidence from DAX 30 companies in 2020

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Abstract

Corporate digital responsibility (CDR) is a recently developing new management concept in response to the increasing challenges caused by digital transformation. In Germany, this self-governance approach influenced the political discussions and led to a more integrative and collaborative multi-policy strategy beyond pure regulatory regimes. The launch of the German CDR-code by the German action group in June 2021 is a milestone to capture ethical problems in digitalised firms by voluntary commitments from signatories. However, little empirical evidence on the current state of CDR-initiatives at German corporations is available up-to now. This article addresses the identified research gap by performing a qualitative analysis of the disclosed information on CDR in nonfinancial reports of the DAX 30 companies from 2020. After a brief introduction, a literature review on CDR-related research activities is presented in Sect. 2, and the context and background of the study are specified. Section 3 presents the results of the empirical study on disclosed CDR-related information by German DAX 30 companies. Section 4 concludes with a discussion and discovers future research avenues on CDR. Corporate responsibility in the digital economy is a field of research that is open for different disciplines and especially theoretical normative research on CDR should be accelerated.

Keywords Digitalisation · Sustainability reporting · Corporate responsibility · Business ethics

JEL Classification M48 · M14 · G30

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1 Introduction

Innovations in information and communication technology (ICT) trigger the transformation of society, consumer behaviour and workspace (e.g., Terberger and Dötsch (ed) 2021). However, the related terms “digitalisation” and “digital transformation” are still used in diverse ways in the numerous publications on digital disruptions (e.g., Wirtz 2021; Wirtz et al. 2021; Bockshecker et al. 2018). For a clearer distinction of the terms a life-cycle model is introduced in this article by referring to a socio-technical perspective (see Fig. 1). In the first phase, innovations in ICT were the first dimension that marked the transition to a digital economy. Accordingly, the term *digitization* can be used (see Fig. 1, on the left). In the second phase, the term *digitalisation* is introduced to capture two more socio-economic dimensions of the digital revolution (see Fig. 1, in the middle). First, modified consumer behaviour leads to the acceptance of product and service innovations resulting from digital technologies. Second, changes in the legal and organizational framework facilitate the application of latest ICT in corporations.

Based on the suggested definition of digitalisation, *digital transformation* describes the process of a company’s successful adoption to the three dimensions of digitalisation. The corresponding transformation of business models captures digital opportunities along the various stages of the value chain (e.g., Wirtz 2021; Wirtz et al. 2021; Park and Park 2021; Bleicher and Stanley 2016). Initially, this incremental transformation of business models was perceived quite positively. At present, many societal debates in reaction to the threats caused by disruptive digital transformation are initiated (e.g., World Economic Forum 2021a; Bertelsmann Stiftung and Wittenberg-Zentrum für globale Ethik (ed) 2020; Sun 2020; Müller and Andersen 2019; Filipovic 2015). Accordingly, in the third phase the responsible application of ICT and responsible usage of consumer data is another new socio-economic dimension in the digital age (see Fig. 1, on the right). Ethical problems become increasingly relevant in digitalised firms, and managers ask for guidance to solve conflicts

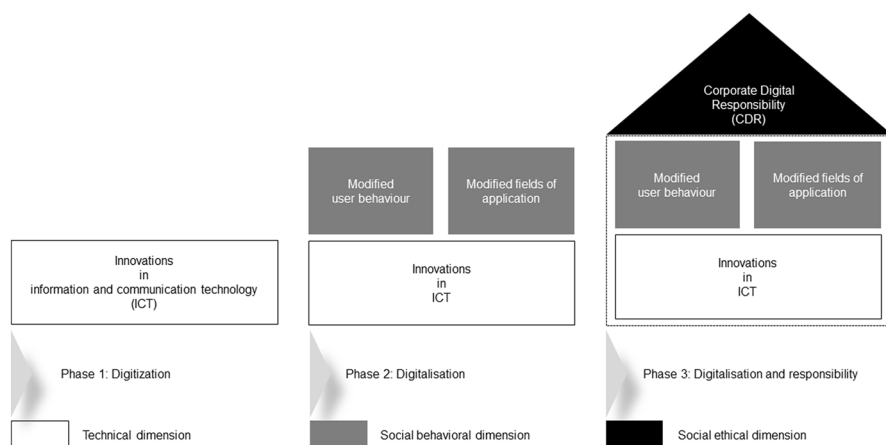


Fig. 1 From digitization to corporate digital responsibility (source: own figure)

between ethical values and economic criteria. Furthermore, related challenges, e.g., maintaining market competition and assuring data privacy, attracted policymaker's attention and initiated many regulatory discussions. The resulting initiatives merely focus on the huge economic power of digital platforms and led to new competition and consumer data protection law e.g., the Digital Services and Digital Market Acts by the European Union (e.g., Kerber and Specht-Riemenschneider 2021; Wirtz 2021; Wirtz et al. 2021). Moreover, artificial intelligence regulation is on the agenda as well (e.g., Benjamin et al. 2021; Stahl 2021; World Economic Forum 2021b).

Meanwhile, the perils of digitalised economies are clearly addressed by firms as well and the new management concept of corporate digital responsibility (CDR) emerged to handle ethical problems caused by digital transformation (e.g., Kempkes et al. 2021; Böhm 2019; Orbik and Zozilakova 2019). In Germany, this self-governance approach by firms influenced the political discussions on the challenges from digital transformation and led to a more integrative and collaborative multi-policy strategy beyond pure regulatory regimes. The launch of the German CDR-code in June 2021 is a milestone in capturing the threats from digital transformation through voluntary commitments from signatories (CDR-Initiative 2021). However, empirical evidence on the current state of internal CDR-initiatives at German corporations is rarely available up-to now. This research gap is addressed in this article by performing a descriptive empirical analysis of the disclosed information on CDR in non-financial reports of DAX 30 companies from 2020. The findings on *how* Germany's large, listed companies are reporting on CDR-related topics is a first step into a more detailed analysis of CDR.

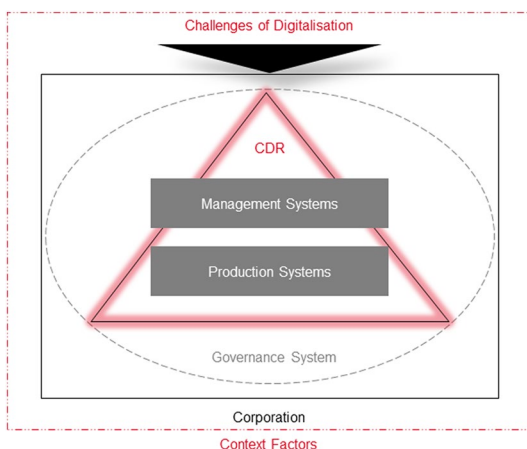
The breakdown of this article is organized as follows. In Sect. 2 the context and background of the study are explained. First, a literature review on CDR-related research activities is given. Second, the German action group on CDR as an initiative for self-regulation in the digital economy is illustrated, and the content of the CDR-code is presented. Third, the German reporting framework on nonfinancial information is sketched and linked to the disclosure policy on CDR. Based on this, a conceptual framework for the empirical analysis of disclosure on CDR-initiatives is introduced. Section 3 presents the results of the empirical study on CDR-related information disclosed by German DAX 30 companies. First, the usage of the content analysis according to Mayring (2015) is motivated. Second, the process of sampling and data collection is described. Next, the findings are presented. Section 4 concludes by critically reflecting the results and drawing conclusions.

2 Context and background of the study

2.1 Corporate digital responsibility

CDR is related to the concept of Corporate *Social* Responsibility (CSR) that emerged in reaction to the sustainability discussion in society (for a summary e.g., Liang and Renneboog 2017). Today, many companies voluntarily address sustainable development goals in various areas, and sustainability reports are well established around the world as an instrument for providing information on corresponding activities to

Fig. 2 Corporate digital responsibility (CDR) (source: own figure)



Research Perspective	Research Conceptions	Research Goal	Research Characteristics		
			Topic	Falsifiability	Impact
(1)	CDR-definition	Essential	Terms, definitions	No	No impact
(2)	CDR-theory	Theoretical	Cause-effect statements	Yes	Descriptive empirical information
(3)	CDR-policy	Technological	Goal-instrument statements	Yes	
(4)	CDR-philosophy	Normative	Normative statements	No	Normative instruction

Fig. 3 Research perspectives on CDR (source: own figure based on Chmielewicz 1994)

the stakeholders (e.g., Cikanek and Landis 2019; Littkemmann et al. 2018; Lackmann 2010). Likewise, ethical challenges caused by the digital transformation are the new context factor that forces companies to adopt quickly (see Fig. 2): CDR is a new management concept to assume responsibility in the digital economy voluntarily by changing management and production systems as well as adopting the governance system (e.g., Lankoski and Smith 2021; Hildebrandt and Landhäußer (ed) 2017).

Emerging CDR-initiatives in practice are an interdisciplinary field of research and can be researched from different perspectives. Initially, ethical aspects of the digital transformation were addressed predominantly in philosophy and political, legal, and social science (e.g., Sun 2020; Schliesky 2019; Filipovic 2015). However, the Digital Transformation Initiative launched by the World Economic Forum (WEF) in 2015 accelerated economic research on moral problems caused by digitalisation. The broad field of *economic research* on CDR can be systemized according to the chosen research perspective. Four research perspectives vary (see Fig. 3) because of the basic research conception, the research goal, and the research characteristics (the topic, the falsifiability of statements, and the intended impact).

Since CDR in practice is in an early stage, researchers are still working on a final *definition* (see Fig. 3, research perspective 1). First definitions of CDR were

found by connecting digital transformation to the concept of sustainability e.g., how digitalisation can help to decarbonize the global economy (World Economic Forum 2015). Later, trials were influenced by an instrumental-economic perspective on CDR assuming an economic motivation for CDR-activities. Some papers use the term CDR to describe how companies can gain competitive advantages by building reputation in the digital economy (e.g., Wirtz 2021; Wirtz et al. 2021; Porter and Kramer 2006). Other parts of the literature started to define the term by addressing stakeholder needs resulting from digital transformation (e.g., Lobschat et al. 2021). Finally, some researchers propose a more content-related definition of CDR by connecting the threats of digital transformation to the Environmental, Social, and Governance (ESG-) factors (e.g., Herden et al. 2021). These ESG-factors are used by institutional investors for sustainable decision making in financial markets (e.g., Gillan et al. 2021). Accordingly, implementing a respective CDR-initiative is expected to be rewarded by reduced financing costs (e.g., Kiron and Unruh 2018). Considering these ongoing discussions on the term CDR in literature, this article will use an activity-based definition: CDR is a management concept that comprises all activities to address the challenges of digitalisation towards all stakeholder groups.

Research perspectives on CDR beyond basic definitions are clearly linked to the interdisciplinary field of business ethics because of the ethical problems of digital transformation behind CDR-initiatives. According to Küpper et al. (2020), two basic concepts can be used for research on CDR-related topics in business ethics: philosophical and analytical. The philosophical concept is linked to the research concept of *CDR-philosophy* (see Fig. 3, research perspective 4) and refers to the methods of ethics for the development of norms in the digital age (e.g., Müller and Andersen 2021; Spiekermann 2019; Thorun et al. 2018; more general Aaken and Schreck 2015). The analytical concept can be used to analyse moral problems caused by digital transformation in firms and is connected to *CDR-theory and CDR-policy* (see Fig. 3, research perspective 2 und 3). According to this more integrative analytical concept, CDR could be researched empirically, theoretically, and normatively (Küpper et al. 2020).

Because of its origins in practice, a substantial part of current CDR-publications presents *descriptive* empirical information by addressing companies' needs for practical help (e.g., Dörr 2021; Brink and Esselmann 2020; Esselmann et al. (ed) 2020; Esselmann and Brink 2016). This part of the literature predominantly instrumentalises CDR for economic success and offers practical guidance by mostly neglecting normative reflections [critically on this instrumental-economic perspective Aalen and Schreck (2015); for a multi-objective theory of the firm Pies et al. (2021)]. But compared to the numerous publications in the field of CSR, there is still a vast lack of research activities. Using the basic CDR-model presented in Fig. 2, the recent management literature can be systematized by the type of discussed solutions: one part of the literature is working on guidance for the adaptation of the management systems and focuses on the value/goal system and CDR-strategies [e.g., Kollmann 2022; Eversheds Sutherlands (ed) 2022; PWC (ed) 2020]. Accordingly, many companies from different industries are working on the development of CDR-initiatives by referring to this hands-on guidance from management research (e.g., Herden

et al. 2021; Dörr 2021). The second part of literature is developing concrete measures for the successful implementation of CDR in companies. Adjustments to the company's management systems accelerate further changes in the governance system and the production processes (see Fig. 2). In some industries concrete measures along the value chain are already being discussed (e.g., Esposito and Ricci (2021) on CDR in museums; Jones and Comfort (2021) on CDR in the hospitality industry; Wirtz et al. (2021) on CDR in the service industry; Altmeppen and Filipović (2019) on CDR in multimedia; Kohlmann (2019) for Internet of Things applications). However, no generally accepted standards have yet emerged for the concrete design of CDR-measures in literature (e.g., Lobschat et al. 2021; Kempkes et al. 2021). Theoretical *normative* research on CDR-philosophy (see Fig. 3, research perspective 4) is not presented sufficiently, and corporations are still missing grounded recommendations for the specific design of CDR-initiatives (see Fig. 3, research perspective 3).

In addition to the more descriptive management literature, some empirical research projects on the *explanation* of CDR were initiated (see Fig. 3, research perspective 2). Because of the early stage of the research programme, current studies are characterized by an explorative research design, and rely on qualitative research methods. Since a critical objective of CDR-activities can be the privacy of consumer data, some first studies were initiated to understand the attitudes of consumers towards the challenges of digitalisation (e.g., Kettner and Thoroun 2021; Deutschland sicher im Netz e.V. (ed) 2020). Other empirical studies focus on the understanding of the current role of CDR in corporate management: Wirtz et al. (2021) present the results of semi-structured interviews conducted with seven international experts in the service industry. Based on the results, a data and life-cycle oriented perspective on CDR was developed. Herden et al. (2021) try to give an initial overview of relevant topics that need to be addressed by corporations in their CDR-strategy. The authors carried out an online survey among 509 US-based companies. Esselmann et al. (2021) conducted a detailed online survey on the relevance of CDR in German corporate management (n=50). Based on the results, additional expert interviews were carried out. Many managers confirmed the necessity of a CDR-strategy in general and currently focus on developing CDR-measures along the value chain. Finally, corporate representatives in this recent survey pointed out to the key role of governmental initiatives for the further enhancement of CDR.

2.2 Enhancing corporate digital responsibility in Germany: the corporate digital responsibility-code

So far, the idea of corporate digital responsibility has not been implemented legally through legislative reforms and rulings. In contrast, shareholder value orientation and the existing legal framework in many countries led companies to neglect their fundamental responsibilities in the digital economy (e.g., Sun 2020). Hence, until now the concept of corporate digital responsibility has remained weak around the world.

In Germany, the emergence of CDR in practice was closely monitored by politicians, and the government quickly took a leading role by enhancing a self-regulation

initiative by German companies. The Corporate Digital Responsibility action group was launched by the Ministry of Justice and Consumer Protection in May 2018 (for details Möslin 2020). Representatives from politics and business were invited to work together on guidelines and recommendations for corporate responsibility in the digital age. The action group refers to the analysis of different scenarios and the method of case study analysis (e.g., Pelters 2021; Möslin 2020). Moreover, the expert group agreed on the release of the German CDR-code in June 2021 (for further details Merbecks 2022). This code is introduced as a guideline for signatory companies. In line with the origins of the CSR-concept, signatory companies are not fulfilling any binding legal obligations up-to now.

The framework developed by the German action group on CDR is quite similar to the CDR-principles launched by the private ETHOS foundation in Switzerland in response to the needs of institutional investors (Ethos 2020). Both soft-law instruments offer basic orientation for the design of a CDR-strategy. Therefore, three categories of principles are derived: basic principles, ICT-oriented principles, and stakeholder-orientated principles (see Fig. 4, on the left). Although the German CDR-code is more predominant according to the number of principles (see Fig. 4), the Swiss CDR-code is more focused and offers detailed guidance for the specification of the principles (see Fig. 4). Besides the nine principles, the German CDR-code introduces five specific fields of action: data handling, education, climate and resource protection, employee involvement and inclusion (CDR-Initiative 2021).

The impact of self-regulation approaches on corporate responsibility in the digital economy depends on many factors and CDR can be addressed by firms in many

Principles	German CDR-code Principles (P)	Swiss Ethos CDR-expectations (E)
Basic Principles	Digitalisation is in line with the United Nations Sustainability Goals (P9).	Establish a CDR-code (E1).
ICT-oriented Principles	Technical systems are deployed consistently with core social values (e.g., social market economy) (P1).	Comply with the highest standards of data processing and protection (E3).
	People are at the centre of the development and use of technical systems (P2).	Establish ethical principles for Artificial Intelligence use (E4).
	The risks of technical systems remain calculable and manageable from a technical and social perspective (P3).	Exclude sensitive activities related to digitalisation (E5).
	Design and use of our technical systems is assigned to a clearly designated human officer (P8).	Help reduce the environmental footprint of digital technology (E7).
Stakeholder-oriented Principles	The benefits to consumers must far outweigh the risks of technical systems (P4).	-
	The development and implementation of technical systems respects the self-determination of consumers (P5).	-
	Consumers are not unfairly discriminated against (P6).	Ensure a fair and responsible social transition (E6).
	Open and intelligible information on the basic functions and effects of technical systems are given directly to consumers (P7).	Transparency on digital practices and footprint (E2).

Fig. 4 Comparison of self-governed CDR-principles in Germany and Switzerland (source: own figure)

ways: first, internal CDR-initiatives can be released (e.g., Wirtz et al. 2021). Second, information on internal measures can be shared on social media channels and via the company's website to address the needs of stakeholders (e.g., Okazaki et al. 2020). Third, institutional investors can be addressed when taking digital responsible behaviour into account in sustainability-oriented decision-making in financial markets. Like well-established sustainability reporting on CSR (e.g., Bergmann et al. 2021; Littkemann et al. 2018), information on CDR-initiatives is supposed to be disclosed in nonfinancial reports.

2.3 Reporting on corporate digital responsibility in Germany

Nonfinancial reports are published voluntarily or by legal requirements. As a result from the implementation of the European Non-Financial Reporting Directive (NFRD) in 2017, German listed companies that meet certain size criteria are legally bound to prepare nonfinancial reports according to German General Accepted Accounting Standards (GAAP) in addition to their financial reports (e.g., Kajüter 2017; for a worldwide overview of mandatory nonfinancial reports e.g., Haji et al. 2022). The extension of International Financial Reporting Standards (IFRS) that are compulsory for many German companies as well by sustainability reporting standards is currently compiled (e.g., Christ et al. 2022; Sellhorn and Wagner 2022).

Mandatory nonfinancial reporting is codified in sections 289b–e and sections 315b–c Commercial Code (Handelsgesetzbuch). Since the list of topics addressed by mandatory nonfinancial reports is not conclusively regulated (e.g., Kajüter 2017; Hinze 2016), essential information on CDR can be given there in systematic and standardized manner as well. However, disclosure activities on nonfinancial topics are currently narrowed by the strong twofold principle of materiality (Nietsch 2022; for details e.g., Müller-Burmeister 2019): disclosure on CDR is required, if the business model of the company is supposed to harm stakeholders (inside-out perspective) *and* context factors are supposed to display consequences to the firm (outside-in perspective). If CDR is relevant to the company, nonfinancial reporting on CDR must comprise three areas (section 289c (3) HGB): information on the CDR-concept, information on the results achieved by CDR-measures and information on risks related to CDR. For further clarification and standardisation, the German action group on CDR promised the publication of more detailed CDR-reporting standards (CDR-Initiative 2021). The launched German CDR-code only offers a comprehensive framework for reporting on CDR: “By signing the Code, we further commit ... to improve the effectiveness of our measures continuously, and to report in line with the signed requirements”.

So far, little research is done to describe CDR-related reporting by German firms. Pelster et al. (2020) conducted a more general qualitative study by analysing reporting on digital transformation. Lischka (2020) has analysed annual reports of DAX 30 companies in 2017 and presented a list of CDR-related topics addressed in their reports. However, the research method used is not explained in detail. Recently, a qualitative study on CDR-reporting in Germany was conducted by Merbecks (2021). In line with the explorative research goal, the author

opted for a case study approach, and information given on CDR in nonfinancial reports by signatory companies to the CDR-code in 2020 was described and analysed. Hence, a theoretical research perspective on CDR was chosen (see Fig. 3, research perspective 2). According to the results signatory companies do not rely on a general accepted standard and format for nonfinancial reporting on CDR. Moreover, the information given is not easily accessible for stakeholders. Based on these first findings, this article extends qualitative research on CDR-reporting to exchange listed large German companies. This is in line with corresponding research activities on CSR reporting (e.g., Gawenko et al. 2020).

2.4 Conceptual framework and research question

To facilitate the structured identification of relevant research questions, this article recommends relying on the conceptual framework as sketched in Fig. 5. The underlying basic economic model of corporate communication, is not ignoring that CDR can and should be embedded in the more general philosophical debate on the ethics of digital responsibility.

Based on the conceptual framework, a structured identification of five fields of CDR-related research is performed (see Fig. 5):

- Research field 1: Research on internal CDR-initiatives.
- Research field 2: Research on disclosed information on CDR-initiatives.
- Research field 3: Research on processing CDR-related information.
- Research field 4: Research on market reactions to disclosed CDR-related information.
- Research field 5: Research on the institutional framework for CDR.

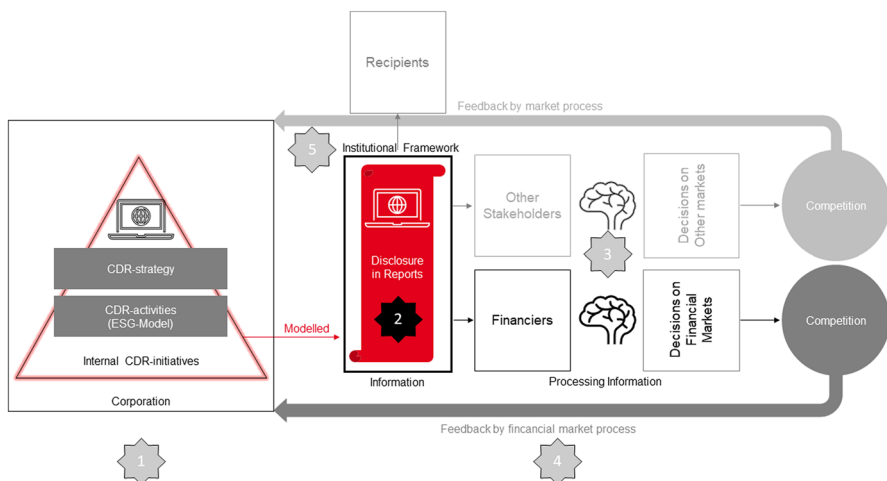


Fig. 5 Conceptual framework for the economic analysis of CDR and research questions (source: own figure)

Recent economic papers focus on describing the current state of existing internal CDR-initiatives and some of them offer guidance for improvements (see Fig. 5, field 1). The research methods used are typically surveys and expert interviews. Since many authors do not explicitly name their normative fundamentals, more theoretical research projects using the methods and instruments from analytical business ethics should be initiated. A substantial normative theory on CDR could address management's open questions on the design of meaningful CDR-initiatives. However, this descriptive part of the literature is not explaining why companies opt for CDR-related activities. Like in the field of CSR, the motivation for companies to develop a CDR-strategy and to invest into corresponding CDR-measures can be explained by taking an instrumental-economic perspective on reduced costs or increased reputation (e.g., Orlitzky and Benjamin 2016; critically on this perspective in business ethics Aaken and Schreck 2015). Prior accounting research documents that companies publish corporate reports to legitimize their operations (for the legitimacy theory, e.g., Suchman 1995) and to manage the variety of stakeholders (for the stakeholder theory, e.g., Donaldson and Preston 1995). Hence, the second CDR-related field of research could focus on disclosed information (see Fig. 5, field 2). *Research field 2 will be addressed in this article* by conducting a descriptive empirical study on how German large, listed companies report on their CDR-initiatives in mandatory reports in 2020. The research question derived is: *how do companies report on their CDR-initiatives in Germany?*

The findings of this analysis can be used to conduct further research projects (see Fig. 5): first, insights into the processing of disclosed information could be addressed (research field 3). Second, feedback reactions from financial markets could be analysed in detail (research field 4). Finally, after understanding how and why companies disclose information on CDR, the institutional framework for CDR-related disclosure can be reviewed (research field 5). This reflection on the design of regulations should take into consideration results from normative research in business ethics as well as results from CDR-related research in other disciplines. The results of the study presented in this article are a first step into a critical evaluation of the German soft law on CDR. This will support cross-sectoral research since the shift to hard-law regulation on CDR is already discussed in legal sciences (e.g., Möslin 2020).

3 Empirical analysis: reporting on corporate digital responsibility by German DAX 30 companies in 2020

3.1 Methodology

In line with the derived research question on *how* German listed companies are currently reporting on internal CDR-initiatives, an explorative qualitative research design is selected for the study. The results presented will facilitate the development of cause-effect statements on the outcome expected by CDR and will initiate further normative inquiries into the design of internal CDR-initiatives and the regulatory framework.

First, a qualitative content analysis of nonfinancial reports of selected German listed companies is performed by using the software MAXQDA. Over the last years, there has been an increase in the verbal content within the reports of companies. Using a qualitative research methodology allows for an in-depth analysis of the narratives surrounding CDR in nonfinancial reports and is in line with other studies in current accounting research (e.g., Al-Shaer et al. 2022). The intended systematic review on disclosed information on CDR-initiatives is quite similar to Gawenko et al. (2020) which present the results of a content analysis on CSR-reporting by German DAX 30 companies. Furthermore, Lee et al. (2018) analysed the relationship between reported text patterns and the financial performance of largest US companies. Lewis and Young (2019) also used a similar approach to investigate narratives by performing an automated analysis.

Second, a quantitative analysis of the results is carried out. Hence, the data collected are exported from MAQDA to MS Excel. This facilitates the presentation of results and their interpretation.

3.2 Process of data collection

The qualitative content analysis conducted in this study follows the structured process recommended by Mayring (2020) and Mayring (2015). Accordingly, the first step is defining the material that will be analysed. Since German exchange listed companies must fulfil strong nonfinancial reporting standards, the population for this study consists of all corporations listed in Germany by the end of March 2021. There are 438 domestic organizations listed across the multiple exchanges in Germany (Trading Economics 2021). However, in this research project a sample of the DAX 30 companies is chosen (as of 31st March 2021). The DAX 30 index is formed by the thirty largest companies in Germany in terms of market capitalization and liquidity (see Fig. 6 for descriptive statistics of the sample).

As emphasized above, only large listed German companies are required to present nonfinancial reports according to the transformed European NFRD. Furthermore, larger corporations are supposed to be more interested in reputation building due to the expected decline in financing costs (e.g., Orlitzky 2001), and the origins of corporate responsibility go back to the role of large corporations in the industrial revolution (e.g., Carrol 2009). Lastly, many larger companies already have digitalised their business models and became aware on ethical challenges caused by digital transformation (e.g., Wirtz 2021; Wirtz et al. 2021; Pelster et al. 2020). Thus, DAX 30 companies are expected to be the first movers in the third phase of digitalisation.

Mandatory nonfinancial information by German large companies can be disclosed in different formats (see Nothelfer and Burgemeister 2019 for a comprehensive overview). Thus, these formats can be used for disclosure on CDR-initiatives as well (Lobschat et al. 2021; Lischka 2020). In this article data on CDR-initiatives in DAX 30 companies have been collected by referring to all formats.

As pointed out by Mayring (2015), the development of categories used for data collection is in the centre of a qualitative content analysis. Hence, a valid system of categories and sub-categories has been derived next by referring to the

Industry	Name	Market Capitalization
Automobiles and Parts (n=4)	BMW AG	Intermediate ten
	Continental AG	Intermediate ten
	Daimler AG	Top ten
	Volkswagen AG	Top ten
Chemicals and Pharmaceutical (n=4)	BASF SE	Top ten
	Bayer AG	Intermediate ten
	Covestro AG	Bottom ten
	Merck KGaA	Top ten
Construction/Engineering/Electronics (n=4)	Heidelberg Cement AG	Bottom ten
	Linde PLC	Intermediate ten
	MTU Aero Engines	Intermediate ten
	Siemens AG	Top ten
Consumer Goods and Services (n=3)	Adidas AG	Top ten
	Delivery Hero SE	Intermediate ten
	Henkel AG & Co. KGaA	Intermediate ten
Energy (n=3)	E.ON SE	Bottom ten
	RWE AG	Bottom ten
	Siemens Energy	Bottom ten
Financial Services (n=4)	Allianz SE	Top ten
	Deutsche Bank AG	Bottom ten
	Deutsche Börse	Intermediate ten
	Munich Re Group	Intermediate ten
Healthcare/Equipment and Services (n=2)	Fresenius SE & Co KGaA	Bottom ten
	Fresenius Medical Care KGaA	Bottom ten
ICT (n=3)	Deutsche Telekom AG	Top ten
	Infineon Technologie AG	Intermediate ten
	SAP SE	Top ten
Logistics (n=1)	Deutsche Post AG	Intermediate ten
Property/Real Estate (n=2)	Deutsche Wohnen SE	Bottom ten
	Vonovia SE	Intermediate ten

Fig. 6 Descriptive statistics of the DAX 30 *sample* (source: own figure)

given literature review. This technique is stricter than the one used by Lischka (2020) and refers to studies conducted in the related field of CSR research (e.g., Andrade et al. 2020; Georgiana-Loredana 2017). The category system used for the collected data on CDR-initiatives consists of four main categories derived from German GAAP regulation on nonfinancial reporting: the CDR-concept, the CDR-measures, results from CDR-related activities, and risks concerning CDR (see Fig. 7). This category system was designed by Merbecks (2021) when analysing the signatory companies to the German CDR-code by using the case-study method. In line with Mayring (2015) the four categories are elaborated into further sub-categories (see Fig. 7).

Since multiple studies on related topics, particularly on CSR policies and disclosure, have relied on the MAXQDA software, the content analysis is performed using

Fig. 7 Category system for the content analysis of CDR-related reporting (source: own figure)

Category	Sub-categories	
CDR-concept	Philosophy	
	Goals	Value-driven
		Stakeholder-driven
		Performance-driven
CDR-activities	Environmental	
	Social	Employee-related
		Customer-related
		Supplier-related
	Governance	Performance-related
CDR-results		
CDR-risks		

this software. For instance, El-Bassiouny and El-Bassiouny (2019) have analysed CSR policies and disclosures by DAX 30 companies in Germany, the United States and Egypt utilizing MAXQDA. Moreover, Bergman et al. (2019) have used MAXQDA for the analysis of textual data in reporting. Referring to Mayring (2015), the categories were defined and coded as a next step. After running a pre-test, the final codes relevant to CDR-initiatives in companies were fed into the MAXQDA code system.

In line with the process recommended by Mayring (2015), the document analysis is done next. Therefore, relevant reports for the DAX 30 companies were put into the document system of MAXQDA. After this, the “Text Search & Autocode” option available in MAXQDA was used to identify passages relevant to each of the codes developed for the analysis. These searches were conducted using keywords that are relevant to the code. Such search results led to the identification of passages and sentences that corresponded to the specific codes, finally highlighting them in the reports. The colour codes and highlights can be edited manually to include supplementary information that had been omitted, or to remove extra information included because of the auto-code process. This procedure was repeated for all codes, resulting in the identification of passages and texts that correspond to the category system.

For presenting the findings, results from MAXQDA were exported to MS Excel. The description of deliverables and their critical reflection are the last steps in a content analysis according to the guidelines of Mayring (2015).

3.3 Findings

3.3.1 Structure of disclosed corporate digital responsibility-quotes

Performing the content analysis for all DAX 30 companies led to 741 CDR-related quotes in total (see Fig. 8). This large *quantity* of disclosed information is one first indicator that large German listed companies have accepted their role for responsible behaviour in the digital economy and respond to the initiated discussions in society (e.g., Bertelsmann Stiftung and Wittenberg-Zentrum für globale Ethik (ed) 2020; Müller and Andersen 2019). However, a deeper understanding of decisions on responsible digital behaviour prerequisites further research on internal CDR-initiatives.

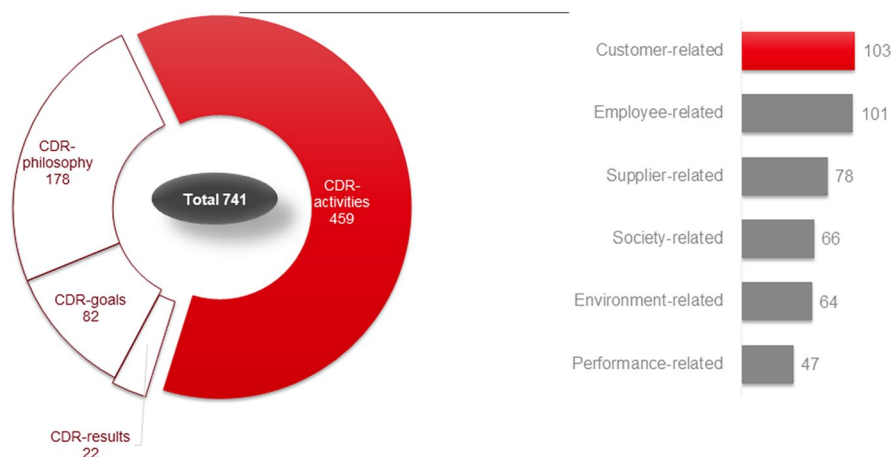


Fig. 8 Structure of disclosed CDR-categories in all DAX 30 companies in 2020 (source: own figure)

A closer look at the *structure of disclosed information* shows that CDR-activities account for most quotes in the analysed reports (see Fig. 8, circular chart on the left side). This result contrasts with the focus of conceptualizing CDR in recent management-related research that was identified by the literature review given above (e.g., Kempkes et al. 2021). However, disclosure on the CDR-concept has been a subject of numerous quotes as well. CDR-philosophy and CDR-goals are a prerequisite for driving actions (e.g., Park et al. 2017). Accordingly, the presence of the multiple disclosures shows that DAX 30 companies already have laid down their concepts towards CDR and focus on CDR-activities subsequently.

A more detailed inspection of disclosures on CDR-activities confirms that customer-related activities are in the limelight of activities performed by German DAX 30 companies in 2020 (see Fig. 8, bar chart on the right side). The primary reason behind this seems to be an increasing concern regarding security and privacy of customer-related data (e.g., Beke et al. 2021). This result is also in line with the current focus on consumer protection by German and European regulators (e.g., Wirtz 2021; Wirtz et al. 2021). In anticipation of hard-law regulation, companies have already increased initiatives that focus on the protection of customers, thus explaining the popularity of customer-related CDR-activities. Furthermore, most DAX 30 companies make disclosures regarding employee-related CDR-activities, leading to a significant high number of quotes as well (see Fig. 8; bar chart on the right side). This result is in line with the numerous effects of digital transformation on workplaces discussed by many researchers (e.g., Dörr 2021; Bertelsmann Stiftung and Wittenberg-Zentrum für globale Ethik (ed) 2020). Finally, the number of disclosed information on supplier-related CDR-activities is third in row (see Fig. 8, bar chart on the right side). This seems to mirror the preparation for the German Sustainable Supply Chain Law, finally launched in 2021, and the similar draft presented by the European Union (EU Commission 2022; a comparison is given by Nietsch 2022).



Fig. 9 Disclosure on CDR-initiatives and firm size (*source: own figure*)

According to the instrumental-economic research strand of business ethics, corporations instrumentalize CDR-initiatives for expected advantages in relative competitiveness and for reducing financing costs by increased reputation (critically on this research concept Aalen and Schreck 2015). As pointed out by Lobschat et al. (2021), CDR is strongly linked to firm performance. Therefore, the small number of quotes on performance-related CDR-activities is unexpected (see Fig. 8, bar chart on the right side). This aspect of CDR also contrasts with the results found in empirical studies on ESG-reporting (for a meta-analysis Friede et al. 2015). Performance-related perspectives on CDR might not be in the centre of CDR-related initiatives, and activities seem to focus more on moral problems. This outcome is supported by the fact that reporting on CDR-results is quite uncommon among DAX 30 companies as well (see Fig. 8, circular chart on the left side). Moreover, the quotes found mainly address awards received in CDR-related competitions. These competitions are initiated by the German government to support the self-governance approach on corporate responsibility in the digital economy (for the theoretical background e.g., Frey 2010; Frey and Neckermann 2006). Unsurprisingly, signatories to the German CDR-code are quite successful in winning these certificates (see Merbecks 2021). The absence of sufficient disclosure regarding CDR-results could also be explained by the fact that CDR is a new concept (e.g., Lobschat et al. 2021). In contrast to the many Key Performance Indicators (KPI) designed for sustainability reporting on ESG-factors, companies are probably missing corresponding KPIs for reporting meaningfully on CDR-results (relevant first ideas are presented by Kempkes et al. 2021). Finally, reporting on CDR-related risks is completely neglected in nonfinancial reports by all DAX 30 companies.

Disclosure on CDR-initiatives is not homogenously distributed among the DAX 30 companies. Unlike, the quotes differ between the individual corporations and two determinants can be identified: size and industry.

First, *company size* matters for the decision to disclose information on CDR-initiatives: the top ten DAX 30 companies (according to their market capitalization) are performing a leadership role in CDR (see Fig. 9). However, the range of CDR-related quotes between 82 and two is quite large. Because of the disclosure of 82 CDR-related quotes, and since the corporation is one of the founding members of the German CDR-initiative back in 2018, Deutsche Telekom AG is the champion in CDR-related disclosure in 2020 (see Fig. 9). According to the detailed case study performed by Merbecks (2021), the quality of all disclosed elements is in a quite matured state too. In contrast to Deutsche Telekom AG, Linde public limited company (PLC) is last in the group of top ten market capitalization reporting only two CDR-related quotes (see Fig. 9). Materiality of CDR seems to be missing for the business model of providing industrial gases.

When it comes to the bottom ten DAX 30 companies, Fresenius SE & KGaA is the champion with 40 CDR-related quotes (see Fig. 9). The diversified healthcare group is a champion in the healthcare industry that already initiated the digital transformation of business models (e.g., Pelster et al. 2020). As a result, the company is in the third phase of digitalisation and addresses responsibility issues. Finally, CDR-initiatives are beyond the interest of some smaller DAX 30 companies: RWE AG is the corporation with the lowest number of quotes on CDR-categories, followed by Deutsche Wohnen SE, Deutsche Bank AG and E.ON SE (see Fig. 9). Assuming corporate digital responsibility is not yet on the agenda of these companies. Instead, they still seem to wrestle around with the digital transformation of their business models. Especially for Deutsche Bank AG the low interest in corporate responsibility is non-surprising, since the financial services industry just started to disclose information on corporate *social* responsibility (e.g., Cikanek and Landis 2019).

The size of a company is not the only characteristic to be associated with CDR-disclosure. *Industry* is a second determinant for the number of CDR-related quotes. In line with the lifecycle model of digital phases initially presented, the average number of quotes is highest in the ICT industry (see Fig. 10). These companies initiated and accelerated digital transformation (e.g., Demary and Goecke 2021) and now assume a leading role in the third phase of digitalisation. However, the range of documented CDR-information is quite large with the lowest number of quotes at seven and the highest at 82. Chemical and Pharmaceutical industry ranks second when looking to the average number of CDR-quotes (see Fig. 10). The leading role of this German industry in digital transformation roots in the data-driven business model and is approved by many studies (e.g., Wirtz 2021; Wirtz et al. 2021). Accordingly, CDR seems to be on the agenda right from the beginning of digitalisation because of the importance of data privacy in these companies. This interpretation is validated by the lower range of CDR-quotes compared to the ICT industry (see Fig. 10). The automotive industry is the third champion in CDR presenting an average number of related quotes of 34 (see Fig. 10). R&D and applications of ICT technology are of large concern to this industry and come with many challenges in the field of data privacy (e.g., Demary and Goecke 2021). Therefore, the disclosure

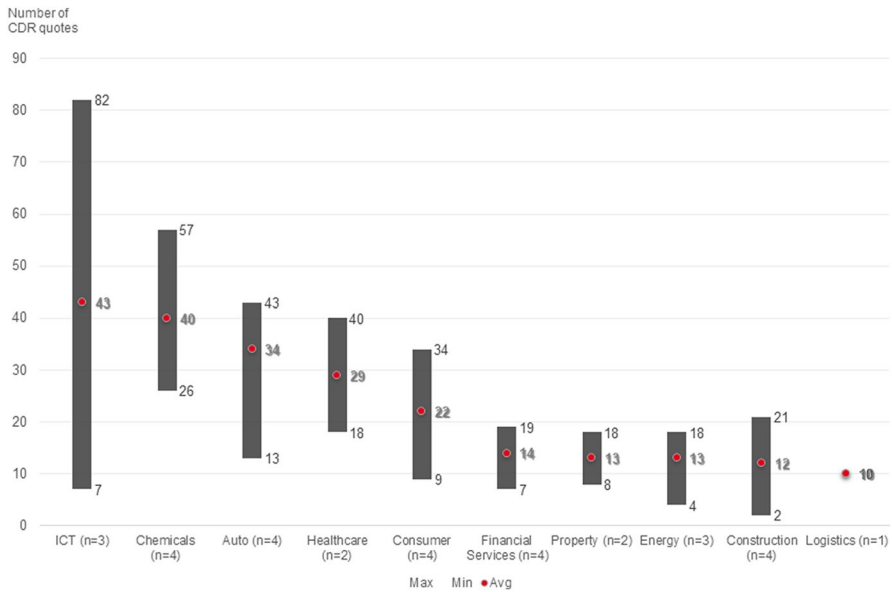


Fig. 10 CDR-quotes among industries in DAX 30 companies in 2020 (source: own figure)

of CDR-related information is reasonable and in line with the principle of materiality. However, the range of quotes is surprisingly large (see Fig. 10).

Apart from detected clear champions and some advanced industries like the healthcare and consumer industry, many of the industries seem to be real beginners in the field of CDR-initiatives showing an extremely low average number of approximate 14 to ten CDR-quotes (see Fig. 10). While this can be explained by the lower relevance of the topic for some industries (e.g., construction and logistics), the low performance of the financial service industry is striking (see Fig. 10). Traditional banks and insurance companies in the DAX 30 seem to be still on their way to capture benefits from the digital transformation of their business models. In contrast to many regulatory initiatives on consumer protection in the financial services industry (e.g., Kenning et al. (ed) 2021), the threats of digital transformation seem to be beyond the agenda of these firms. This impression is further affirmed by the result of the case study analysis on signatories to the German CDR-code: in the reporting year 2019 ING Deutschland disclosed no CDR-related information to the stakeholders (see Merbecks 2021). Since substantial gaps and weaknesses in CSR-related disclosure activities are identified in research as well (e.g., Löw 2021), corporate responsibility in general seems to be less important in the financial services industry.

3.3.2 Ranking of DAX 30 companies

Since strong normative research on the appropriate design of CDR-initiatives is still missing, the evaluation of disclosed quotes is difficult (for a comprehensive

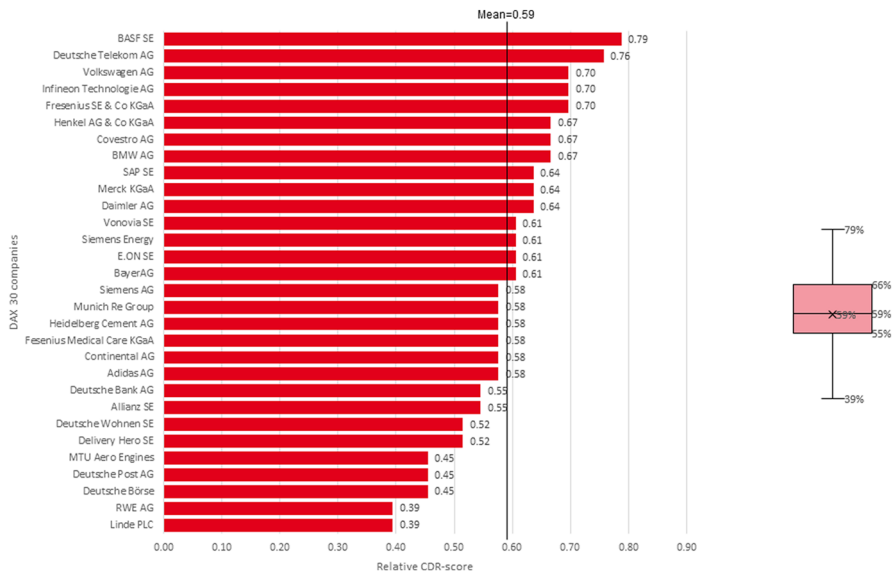


Fig. 11 CDR-disclosure index for all DAX 30 companies in 2020 (source: own figure)

discussion of approaches for the qualitative analysis of narratives in reporting Beattie et al. 2004). In line with literature, the extent of CDR-quotes is used as a first attempt in this article to design a basic CDR-disclosure index (for an exhaustive critical reflection on indices in accounting research Marston and Shrives 1991). The eleven items used for the construction of the index refer to the category system that was developed theoretically based on the presented literature review (see Fig. 7). Since the needs of specific user groups are beyond the scope of this article, an unweighted CDR-index is created (e.g., Beattie et al. 2004). Thelisson et al. (2019) present a CDR-index that only focuses on Artificial Intelligence categories.

The formed CDR-index incorporates an ordinal measure. Disclosed items are categorized into three groups: for each item, a score of one (no disclosure), two (some disclosure: between one and nine items) or three (extensive disclosure: more than nine items) was awarded (e.g., Beattie et al. 2004). This contrasts with the index construction in current studies in the field of CSR-reporting (e.g., Bergmann et al. 2021; Gawenko et al. 2020) which predominantly introduce scoring models that model quality by referring to disclosed *quantitative* terms (e.g., KPIs for ESG-factors). As pointed out in chapter 2, research on CDR is in an early phase and management literature did not yet address the issue of developing quantitative KPIs for CDR-measures (e.g., Kempkes et al. 2021). After awarding the score to the CDR-item, the total CDR-score is computed by summing up the individual points. Finally, this score is transformed into a relative CDR-score by dividing the individual company score by the highest number of scores, thirty-three in the scale introduced here (eleven times three). Introducing relative CDR-scores considers the problem that in case of non-disclosure it is not necessarily clear that the item is not relevant (e.g., Marston and Shrives 1991). The ranking for all DAX 30 companies resulting from

computed relative CDR-scores based on the designed CDR-index is presented in Fig. 11, left side.

The interquartile range of computed relative CDR-scores is between 55 and 66% (see Fig. 11, boxplot on the right). While the highest data point in the sample is at 79% (BASF SE), the lowest data point is at 39% (RWE AG and Linde PLC). Since none of the DAX 30 companies is showing a high score near to 100%, the extension of reported items on CDR-initiatives could be increased. However, the average score of 55% (mean and median) shows the overall relevance of CDR in 2020 reports.

To sum up, the high number of reported quotes on CDR-initiatives confirms that the chosen sample of DAX30 companies already started internal initiatives on CDR and is performing a pioneering role. Thus, evidence of emerging responsibility in the digital economy is clearly confirmed. However, this leadership role is not accepted by all companies of the DAX 30. When it comes to industries, companies from ICT and Chemical industry are identified as open-minded towards disclosure on CDR-related information. In contrast to their role by providing basic needs, the financial services sector is currently not focussing on responsibility in the digital age. For the first assessment of CDR-related disclosures a basic CDR-disclosure index was constructed by referring to relative CDR-disclosure scores.

4 Discussion and conclusions

Following the structured process recommended by Mayring (2015) for the content analysis of disclosed CDR-related information, a high degree of *methodical rigor* is intended. Moreover, the sampling procedure and the process of data collection are documented in detail and thus highly transparent. The results of the study can be replicated by other researchers. Consequently, the conducted study is *reliable*. Additionally, *internal validity* is accomplished by using a system of eleven CDR-categories. However, this system is grounded on the presented literature review on recent CDR-research, thus neglecting the recommended review of at least two experts (e.g., Mayring 2015). Improving the category-system by conducting surveys with CDR-experts is one first avenue for further CDR-related research. Transferability of the results was not intended primarily when conducting an explorative study in the new research-field of CDR. Corresponding limitations in *external validity* can be alleviated by the adoption of the category-system developed to other samples. The presented study opted for the German DAX 30 companies due to their obligation to report on nonfinancial topics. Therefore, international comparisons could be provided by similar empirical studies in other countries with a mandatory non-financial reporting framework (e.g., in other member-states of the European Union). Measuring the development of CDR-related disclosure over time is promising as well and should refer to the new DAX 40 index that was introduced after doing this research. Hence, conducting longitudinal studies presents another research avenue, especially when it comes to the evaluation of the launched German CDR-code. Moreover, further empirical studies could analyse company samples with voluntary CDR-disclosure (e.g., small-and-medium sized companies and family businesses, and companies that address ETHOS CDR-expectations). Lastly, the document

analysis of nonfinancial reports is neglecting other ways of corporate communication with stakeholders. The exhaustive attainment of the consumer protection goal creates needs for further research studies analysing company websites and social media activities as well.

In addition to these implications for further research projects, the results from the presented study directly contribute to *managerial practice*. Since DAX 30 companies are clearly on their way to share CDR-related information, corporate responsibility in the digital economy should be addressed by private and smaller firms in practice, too. The topic will also be pushed further by the current review of the NFRD in the European Union. The Corporate Sustainability Reporting (CSRD) proposal in line with the release of the new European Sustainability Reporting Standards (ESRS) intend to expand sustainability reporting to private and smaller companies. Champions in CDR-reporting from top ten market capitalization (e.g., BASF SE, Deutsche Telekom AG and Volkswagen AG) offer initial guidance for the design of internal CDR-initiatives and can be used for benchmarking. Second, up-to now the importance of naming CDR-related goals and corresponding indicators is not clearly understood in practice. Financial management and institutional investors should address this topic for the development of meaningful CDR-KPIs. Third, no disclosure on CDR-related risks is given by DAX 30 companies. This amazing result contrasts with the importance of legal risks caused by current developments in the regulatory environment of digitalised societies and neglects risk from cyberattacks as well. Accordingly, CDR-related risks should be addressed and communicated.

Lastly, the findings derived from the study complete existing empirical research on internal CDR-initiatives and can be used by *policy makers*. First, enhanced political debates and soft-law initiatives on corporate responsibilities in the digital age seem to act as a catalyst: consumers are in the limelight of recently disclosed CDR-activities by the DAX 30 companies. Second, missing national and international accounting standards for CDR complicate the collection of information presented in nonfinancial reports. Therefore, limitations of the assumed market-based governance-mechanisms by the German CDR-code are presumable. Guidelines for reporting on CDR, like announced by the German action group on CDR, are highly appreciated. Since the impact of awards and certificates is clearly understood in economic theory, awarding CDR-initiatives and reports can facilitate the growth and acceptance of CDR. However, the design of CDR-related rules and regulations in society and CDR-initiatives in corporations as well need more additional theoretical foundation by normative research in business ethics. Normative reflections on CDR were beyond the scope of this study.

In conclusion, this article documents that CDR is an important internal management approach and some information on CDR is available in the analysed non-financial reports. Grounded by the results of the empirical study of CDR-related disclosure by German DAX 30 companies new research avenues were deduced and implications for corporate manager and political decision maker were summarized.

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Data availability statement The data that support the findings of this study are available from the corresponding author upon request.

Declarations

Conflict of interest The author has no relevant financial or non-financial interests to disclose.

Compliance with ethical standards Accepted principles of ethical and professional conduct have been followed.

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