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Unveiling corporate digital responsibility disclosure practices in the banking sector: An exploratory analysis of CDR governance

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Abstract. Corporate Digital Responsibility (CDR) has emerged as an important framework for addressing the ethical, governance, and accountability challenges associated with digital transformation. However, the current body of knowledge on CDR remains limited, particularly in the context of the global banking industry. This study explores the developing domain of CDR disclosures in the banking sector. Employing an exploratory qualitative analysis, it examines the extent and nature of CDR disclosures in the annual reports of the top 100 global banks from 2021-2023 and provides qualitative insights into how governance-related CDR aspects are disclosed, drawing from a sample of annual reports and supplementary web-based documents such as codes of conduct and customer privacy. Leveraging stakeholder theory, this study demonstrates how digital responsibility emerges as both an instrumental strategy to mitigate risks and a normative commitment to ethical digital practices, providing a foundation for future work on how ethical governance structures can be embedded into digital business models.

Keywords: Corporate digital responsibility (CDR); banking industry; digital ethics; governance disclosures; stakeholder theory.

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1. INTRODUCTION

Digitalization is widely recognized as a catalyst for social and economic progress (Wessel et al., 2021). However, its implementation has also highlighted potential adverse consequences (Mueller, 2022). The risks associated with e-commerce and the use of digital technologies, combined with weak governance, disrupt business operations (Umanailo et al., 2019; Liyanaarachchi et al., 2021). These challenges require firms to mitigate the potential adverse consequences triggered by digitalization (Cheng & Zhang, 2023). Thus, the concept of corporate digital responsibility (CDR) has emerged to fully leverage benefits while managing the risks of digitalization (Carl et al., 2024).

CDR, closely linked to CSR, is a concept focused on managing the implications of corporate digital activities and establishing ethical practices for data privacy, access, and other digital technologies (Carl et al., 2024). It guides companies in fair, ethical data use within digital contexts, ensuring responsible operation and prioritizing sustainable business processes with AI, customer data and digital technologies (Hartley et al., 2024). CDR encompasses corporate digitized responsibility and stewardship, including activities like data creation, storage, analysis, acquisition, protection, and maintenance (Cheng & Zhang, 2023).

Prior studies have explored CDR from multiple perspectives. Lobschat et al.'s (2021) seminal article proposed CDR as a novel approach to address ethical issues from digital technology use. Herden et al. (2021) expanded on this by identifying twenty key CDR topics within the ESG framework. Wirtz et al. (2021) defined CDR in the service industry, examining the risks of digitization and artificial intelligence, and strategies to mitigate them. Cheng and Zhang (2023) developed a new conceptualization of CDR, focusing on data-related practices in digital technology development. Several studies conducted reviews to provide a holistic understanding of corporate responsibility in the digital context (e.g., Londoño-Cardozo & Pérez de Paz, 2021; Carl & Hinz, 2024). Bednárová and Serpeninova (2023) examined current literature trends and summarized definitions of this emerging concept through a comprehensive bibliometric analysis. Empirical research has examined the implementations of CDR in specific contexts (Merbecks, 2024), including construction (Weber-Lewerenz, 2021) and ICT sectors (Jones & Wynn, 2023) and stakeholders' perspectives (e.g., Carl et al., 2024; Elliott & Copilah-Ali, 2024).

Given the significant digital disruptions in the banking industry like app-only banks, internet, and mobile banking (Contreras Pinochet et al., 2019; Mainardes & de Freitas, 2023; Nguyen et al., 2022; Mogaji, 2023), understanding how banks approach digital responsibility is critical. This study explores governance-related CDR issues, such as system reliability, data storage, and security, in banking, addressing key research questions:

RQ1: To what extent and in what nature do banks disclose governance-related CDR categories in their annual reports?

RQ2: How do banks manage and communicate their commitment to governance-related CDR beyond formal annual reports?

This study applies stakeholder theory to examine CDR disclosures in banking, highlighting how governance practices around digitalization reflect stakeholder demands. While CDR practices in highly regulated industries are influenced by compliance, key dimensions like system reliability, data transparency, and data privacy directly address customer and societal expectations. To capture these dimensions, we draw on Herden et al.'s (2021) framework, which offers a comprehensive model that expands the understanding of CDR within ESG. Utilizing a content analysis approach guided by this model, we assess the extent of governance-related CDR disclosures in the annual reports of the top 100 global banks from 2021 to 2023, supplementing our findings with qualitative insights from corporate reports and web-based disclosures.

Analysis reveals that CDR disclosures grew from 2021 to 2023, with data security being the most reported governance CDR category and robot ethics the least disclosed. The qualitative examination of annual reports and supplementary sources reveals detailed insights into CDR disclosures, challenging the simplistic interpretation of reported scores. Although overall scores for specific categories are low, a closer examination of individual banks shows prioritization of these categories, with initiatives often disclosed beyond annual reports.

This study contributes to the CDR literature in two ways. First, it is one of the early examinations of governance-related CDR disclosures in the global banking sector, offering timely insights into digital responsibility disclosures. Second, it extends the existing literature linking CDR to stakeholder theory (e.g., Oduro et al., 2025) by offering insights into how stakeholder theory operates in the digital banking

domain, thereby enhancing our understanding of corporate accountability in the digital era.

The paper is structured as follows: Section 2 reviews corporate responsibility in banking, focusing on the opportunities and challenges of digital banking, and discusses key governance-related CDR concepts. Section 3 presents the theoretical framework, while Section 4 details the methodology. Results are in Section 5, and Section 6 concludes with implications, limitations, and future research directions.

2. LITERATURE REVIEW

2.1. Corporate responsibility in the banking sector

Corporate responsibility refers to the ethical obligations and sustainable practices that banks adopt to ensure they contribute positively to society, the environment, and the economy. This responsibility encompasses environmental, social, and governance (ESG) factors, as well as compliance with regulations and the mitigation of risk for stakeholders (Edmans, 2023). Prior research highlights the role of the banking sector in sustainable development (Rahman et al., 2024) and examines the factors driving sustainability and green initiatives within that sector (Alsmadi & Al-Omoush, 2025).

Digital transformation has introduced new dimensions to research and practice (Hausberg et al., 2019), prompting greater integration of digital strategies within corporate governance. In this context, Corporate Digital Responsibility (CDR) has emerged to address the ethical and societal implications of digital practices, including data privacy, cybersecurity, algorithmic fairness, and environmental impacts (Dörr, 2021).

Corporate responsibility in the banking sector has gained significant attention in recent years as stakeholders increasingly demand ethical practices from financial institutions (Weber, 2018). Within the banking sector, this approach is reflected in ethical banking practices, which prioritize social and environmental considerations alongside financial performance (ElAlfy & Weber, 2019).

The drivers of corporate responsibility in the banking sector are multifaceted. Regulatory pressures, particularly post-financial crisis, have prompted banks to adopt more responsible practices to mitigate risks and enhance their reputations (Weber, 2014). Additionally, stakeholder expectations, including those from customers, investors, and society, play a crucial role in shaping corporate behavior.

Banks that fail to meet these expectations face reputational risk and legitimacy concerns, which can lead to financial losses (Weber & Feltmate, 2016).

Furthermore, ethical banking entails a shift towards social banking models, including microfinance and community-based banking, that prioritize financial inclusion and support underserved populations. Ethical banking initiatives often involve rigorous assessment of the social and environmental implications of lending and investment decisions. For example, Triodos Bank and Co-operative Bank have pioneered integrating ESG criteria into their operations, actively avoiding investments in sectors such as fossil fuels and arms manufacturing (Boitan, 2020). By doing so, these banks not only align their activities with stakeholder values but also contribute to achieving the global sustainability agenda, namely the Sustainable Development Goals (SDGs). Ethical banking practices offer a pathway for banks to enhance their social license to operate, build trust, and achieve sustainable growth.

2.2. The emergence of digital banking: opportunities and challenges

Digital banking has fundamentally reshaped the financial services industry, presenting both significant opportunities and challenges for banks globally. Digital banking includes a broad spectrum of financial activities accessible through online platforms or mobile applications, ranging from basic transactions to complex financial planning and advisory services (Holtgrewe, 2014). This transformation is driven by rapid advancements in financial technology (FinTech) and changing consumer preferences, which demand greater convenience, efficiency, and personalized service delivery. Digital banking can contribute to local economic development by providing local communities with access to credit, saving portfolios, and investment products that were not previously available to some communities (Ozili, 2018).

The integration of innovative FinTech solutions has revolutionized service delivery in the banking sector. Technologies such as artificial intelligence (AI) and machine learning enable banks to offer personalized financial products and services, improving customer experience and satisfaction (Barberis et al., 2019). For example, AI-powered chatbots can provide 24/7 customer support, while predictive analytics can tailor product recommendations based on individual financial behaviors (Cheng & Qu, 2020).

Despite its numerous advantages, the transition to digital banking presents several challenges that must be carefully managed. A primary concern is the increasing risk of cybersecurity threats. As banks digitize their operations, they become more vulnerable to cyberattacks aimed at stealing sensitive customer data or disrupting financial systems (Sekhar & Kumar, 2023). In addition to cybersecurity risks, digital banking faces significant regulatory challenges. Regulations must keep pace with technological advancements to effectively address issues such as data privacy, cross-border data flows, and the use of AI in decision-making (Buckley et al., 2023).

2.3. Defining corporate digital responsibility: A focus on governance-related CDR

One of the foundational concepts in digital responsibility is digital ethics, which addresses the moral principles guiding the development and use of digital technologies (Moor, 2005). Digital ethics emphasizes the need for transparency, accountability, and fairness in digital systems, particularly in areas such as AI, where algorithmic decision-making can have significant social implications (Hanna & Kazim, 2021).

Another key concept is data governance, which refers to the frameworks and policies that guide the collection, use, and management of data responsibly (Khatri & Brown, 2010). Effective data governance is crucial for protecting individual privacy, ensuring data security, and maintaining public trust in digital systems. It includes practices such as data minimization, user consent, and transparency in data processing, which are essential for compliance with regulations such as the General Data Protection Regulation (GDPR) in the European Union (Voigt & Von dem Bussche, 2017).

Several frameworks have been proposed to guide organizations in implementing CDR (Lobschat et al., 2021; Herden et al., 2021; Mueller, 2022). Lobschat et al. (2021) emphasize that CDR requires the integration of values and norms to govern corporate decisions and actions related to digital technologies. Mueller (2022) further conceptualizes CDR as a multi-domain system in which ethical principles are embedded across organizational impacts and stakeholder considerations. Scholars also highlight that robust CDR frameworks can enhance corporate reputation and stakeholder trust, while tools such as the CDR calculus help evaluate

the benefits and costs of responsible digital practices (Floridi, 2021; Seele & Schultz, 2022; Wirtz et al., 2023).

Herden et al. (2021) integrate CDR into the ESG framework, emphasizing environmental, social, and governance aspects relevant to corporate digital practices. The article develops eight governance-related CDR categories, which serve as the analytical foundation of this study. In an age where the world is generating unprecedented amounts of data, companies must ensure that the monitoring and control of both internal and outsourced data are conducted in a reliable and secure manner (Herden et al., 2021). This need is underscored by the first category of governance-related CDR: "reliability of systems". Digital systems should be user-friendly and verifiable by regulators and users. The "digital transparency" category ensures system simplicity and mandates disclosures to promote transparency. Data storage must comply with data protection laws in the operating country. The "data collection and storage" category emphasizes legal compliance in data gathering and retention (Herden et al., 2021).

Given the challenges of the digital world, data ownership must be clearly defined to ensure owners can modify and control their data. Customers must safeguard their privacy and comply with laws. The "data ownership and privacy" category of governance-related CDR highlights this. The "data responsibility and stewardship" category covers all stages of the data lifecycle, from creation to reuse. Companies must act as stewards and protectors, using data to serve customers. Those developing AI systems are also accountable for their functionality (Herden et al., 2021). With increased data practices, effective security measures protect digital data from unauthorized access. Based on the "data security" category, companies should prioritize collecting and storing only essential information to enhance security.

While data security is vital, free data movement is key for economic growth. The "data usage and accessibility" category empowers data owners to choose storage and processing locations. Data center providers should expand globally. Digital trade agreements should be made to enable cross-border data flow. As companies rely increasingly on robots for tasks such as surgery, laboratory research, assembly, and mass production, robot ethics has become a vital issue (Bellis, 2025). To keep robots functioning ethically, organizations need to comply with applicable laws and

regulations governing their behavior and autonomy (Herden et al., 2021). This is particularly emphasized in the final category: “robot ethics”.

3. THEORETICAL FRAMEWORK

Stakeholder theory offers a powerful lens for understanding CDR agendas and disclosures, particularly in the banking sector, where organizational success depends on managing complex stakeholder relationships. Freeman’s (1984) seminal work reconceptualized the firm as accountable to a wide network of stakeholders beyond shareholders, emphasizing the need to consider the interests of customers, employees, regulators, and communities affected by corporate activities. In the context of digital transformation, banks’ practices, such as data governance, cybersecurity, and AI-driven decision-making, directly affect these stakeholders, positioning CDR as an extension of corporate responsibility into the digital domain (Aguinis & Glavas, 2012).

Donaldson and Preston (1995) further conceptualize stakeholder theory in terms of three complementary dimensions: descriptive, instrumental, and normative. Descriptively, banks increasingly institutionalize digital governance through formal policies and oversight structures addressing cybersecurity, data privacy, and digital risk (Herden et al., 2021). Instrumentally, responsible digital practices, such as transparency and strong data protection, can enhance reputation, strengthen customer trust, and reduce regulatory risk (Aguinis et al., 2020). Normatively, stakeholder theory emphasizes that organizations have an ethical obligation to respect stakeholder interests as ends in themselves (Donaldson & Preston, 1995). In the digital context, this implies safeguarding client data, ensuring fairness in algorithmic decision-making, and mitigating potential harms associated with digital technologies (Floridi, 2018).

Importantly, instrumental and normative perspectives are not mutually exclusive but are often integrated through governance mechanisms. While instrumental approaches highlight the performance benefits of stakeholder management, the normative perspective emphasizes moral responsibility and stakeholder rights (Donaldson & Preston, 1995; Freeman et al., 2018). Within CDR, this integration suggests that banks disclose digital governance practices not only to maintain legitimacy and competitive advantage but also to demonstrate accountability and ethical stewardship in an increasingly data-driven environment (Buhmann & Fieseler, 2021; Lobschat et al., 2021).

4. METHODOLOGY

Given the understudied nature of the research area, an exploratory qualitative approach was adopted to address the research questions. To analyze the frequency and depth of CDR disclosures in the annual reports of the top 100 global banks over a three-year period (2021-2023), a content analysis approach was used. This method provides a comprehensive analysis of CDR-related information, emphasizing its importance in the reports. Some reports were missing or not in English and were excluded. The final samples for 2023, 2022, and 2021 include 91, 99, and 99 reports. The sample was drawn from S&P Global Market Intelligence's (2023) ranking of the top 100 global banks by total assets. Excluding banks with missing or non-English reports may have disproportionately affected non-Western banks. The implications for the regional findings are discussed in Sections 5.1 and 6.

The first research phase involved analyzing the annual reports of the top 100 global banks. NVivo software (Release 14, Lumivero) was used to conduct word count analyses of CDR disclosures for each of the studied years. The AI-assisted features available within the software were not utilized in this study. The PDF search function was used to locate exact occurrences of predefined, specific keywords. Each keyword was searched separately rather than combining them with AND or OR. This focus on specific word counts was chosen because mention frequency directly reflects topic importance (Guthrie et al., 2004). Furthermore, utilizing individual words rather than full sentences or sections ensures higher reliability and ease of replication (Gamerschlag et al., 2011). This systematic analysis aligns with prior studies (e.g., Merbecks, 2024; Gamerschlag et al., 2011; El-Bassiouny & El-Bassiouny, 2019).

To guide our data extraction, we operationalized the governance-related CDR categories developed by Herden et al. (2021). The lead author trained two research assistants to independently extract keywords for each category from the text as explained in Herden et al. (2021). To ensure consistency in this initial keyword selection, inter-rater reliability was calculated using a sentence-level presence/absence analysis across these source explanations. The percentage of agreement was 84.4%, exceeding the inter-rater agreement threshold (Wilhelm et al., 2018). In addition, inter-rater reliability was evaluated using Cohen’s Kappa, yielding a Kappa of 0.591, indicating a moderate level of agreement and placing the inter-rater agreement immediately below the threshold for substantial agreement

(above 0.6) (Landis & Koch, 1977). The lead author then reviewed the keywords extracted by both assistants against the source text and refined and combined the keyword lists into a comprehensive list. Following this, the combined list was validated by the expert panel described below to produce the final keyword list used in the analysis. The final keyword list and codebook are available upon request.

A quantitative keyword count was conducted using the developed CDR keyword list to explore the specific governance-related CDR categories disclosed by banks and their development over three years. Disclosure counts were normalized by report length, calculating the final CDR scores based on the number of keywords found per 1,000 pages. An interpretative analysis further examined CDR disclosures, highlighting patterns and gaps, and deepening understanding of CDR's role in corporate responsibility and ethics.

To refine the research instrument and validate the results, input was gathered from a panel of three purposively selected banking experts, all contacted through professional networks. Each expert possessed over 15 years of banking experience and served in senior management roles. This panel contributed to instrument validation, verifying the keyword list, and findings validation. The first expert, a banking professional who is also a co-author of this study, contributed to both stages of validation. The input of this internal practitioner perspective was sought during a 60-minute online semi-structured interview conducted to ensure the findings aligned with banking realities, explore the underlying reasons for observed trends, and gather recommendations for enhancing the study, which led to the inclusion of qualitative insights from annual reports and supplementary sources in the study’s findings.

To ensure independent validation and mitigate potential bias from relying on a single informant, two additional anonymized external experts were engaged. The second expert, an external banking practitioner, provided an independent review of the findings via email. This second expert was not involved in the keyword list validation process. Conversely, a third external expert was engaged strictly during the initial phase to review the keyword list, remaining completely uninvolved in the validation of the study’s results. However, given the small number of experts relied on in this study, this limitation is noted in Section 6.

The second phase involved analyzing annual reports and supplementary sources such as sustainability reports, codes of conduct, and privacy reports, specifically by

CDR category. A thorough review of scores over three years identified the top- and low-scoring banks for further qualitative analysis. Banks were also selected if phase one scores indicated a need for deeper insight, such as declining trends. Selected banks' reports were downloaded and manually examined by the lead author to extract the relevant information and to ensure familiarity with the analyzed reports. NotebookLM was also utilized to extract relevant data from the analyzed annual reports. Standardized prompts were applied systematically across all reports. Specifically, three main prompts were utilized to summarize disclosures and keywords for each CDR category, identify differences between selected reports, and map stakeholder relationships. Secondary prompts were also utilized to extract information regarding specific categories, for instance, highlighting explicit reasons for low disclosure levels within specific CDR categories, and tracking data usage and accessibility declines between 2021 and 2023 within a selected bank's report. Every NotebookLM output was manually verified by the lead author against the original report text before inclusion. Passages that could not be traced back to the source document were discarded, and no AI-generated text was used in the reported findings or quotations.

Based on the lead author's review of the annual reports, NotebookLM data, and bank website reports, a critical review of disclosures by selected banks across all CDR categories was conducted. This validated the quantitative data of phase one, offering explanations for scores, discrepancies, and differences between what the scores indicated and the qualitative analysis.

5. RESULTS AND DISCUSSION

5.1. Content analysis: CDR disclosures

Figure 1 shows the composition of normalized CDR disclosures in sample banks in 2023. Data security accounts for over 50% (51.4%) of disclosures, followed by data ownership and privacy (18.3%), and data transparency (14.8%). Other categories, each under 10%, include data usage and accessibility (8.4%), system reliability (2.7%), data collection and storage (1.7%), data stewardship (2.5%), and robot ethics (0.14%). These findings highlight the significance of data security, privacy, and transparency in banking.

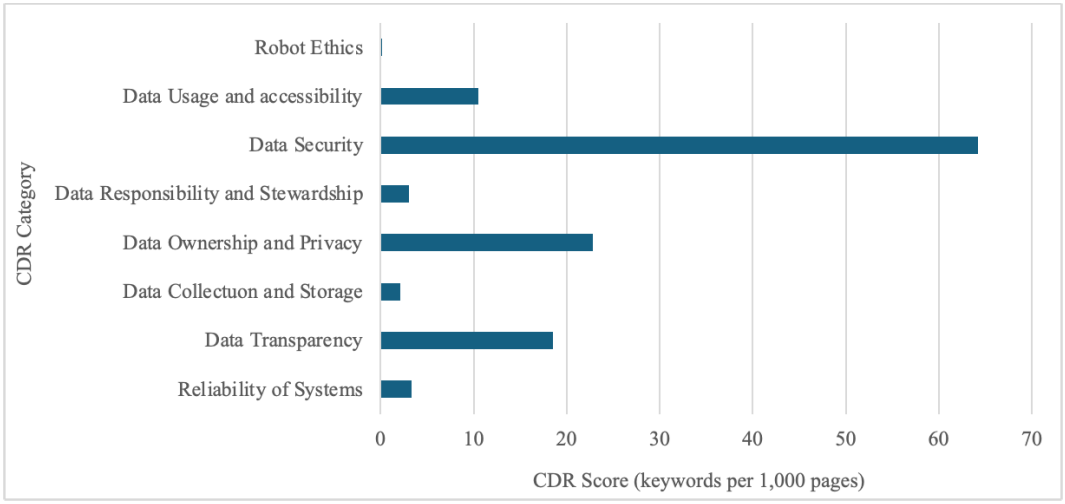


Figure 1. Normalized CDR disclosures by category for year 2023

Source: Authors' elaboration

As shown in Figure 2, normalized CDR disclosure scores increased by 34.5% in 2023 compared to 2021, reflecting a growing emphasis on digital responsibility driven by stakeholder needs and regulatory demands, as noted by an expert.

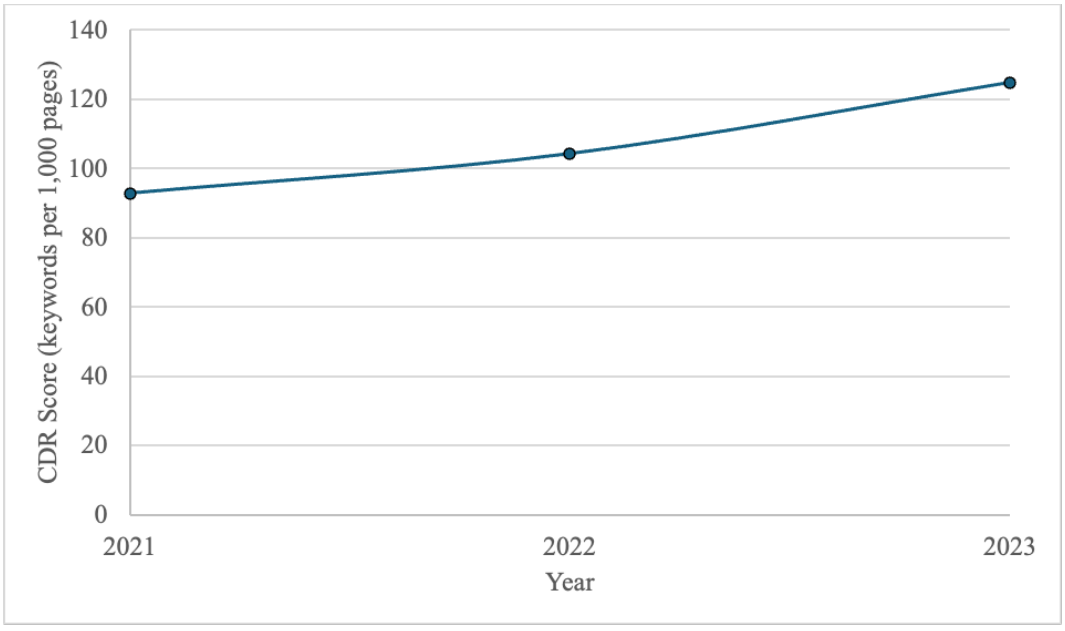


Figure 2. Normalized trends of total CDR disclosures: 2021-2023

Source: Authors' elaboration

Analyzed by category, Figure 3 shows changes in normalized CDR disclosures from 2021 to 2023. The high volume of CDR disclosures on data security reflects sample banks' increased focus on addressing security challenges. From 2021 to 2023, data security normalized disclosure scores rose by 61.6%. A professional expert states that this surge in data security disclosures is mainly because they are understandable to stakeholders. Data security, being more mature than AI, naturally sees more disclosures, especially where regulation and practice are well developed. As shown in the figure, the CDR disclosures from sample banks grew in 2023 versus 2021, except for the data collection and storage category, which witnessed a slight decrease of 2.26% in 2023 compared to 2021. Section 5.2 provides detailed insights into these disclosure patterns.

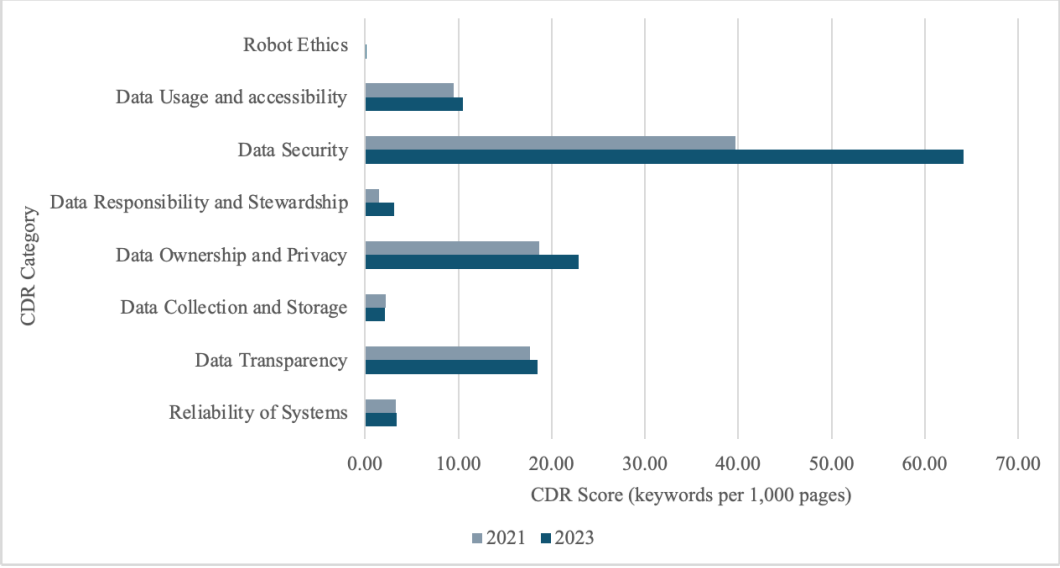


Figure 3. Normalized CDR disclosures scores by category for 2021 and 2023

Source: Authors' elaboration

Other CDR categories, specifically system reliability, data transparency, and data usage and accessibility, witnessed a slight increase in 2023 compared to 2021, with a 1.2%, 4.57%, and 9.84% increase, respectively. Despite rising internet threats, prior studies on electronic banking often overlook system reliability, neglecting its nature, importance, and influencing factors (Tworek, 2018). Tworek (2018) found that in the Polish banking sector, people often view information system reliability as part of, or included in, information system security. Although their definitions differ, perception varies with context. This may explain why data security

disclosures increased while the increase in the mentions of the other CDR categories was not as significant. The focus on data security might overshadow these other aspects.

Data stewardship is central to data governance (Plotkin, 2020), but its disclosures in sample bank reports are only around 1.5 keywords per 1000 pages. However, from 2021 to 2023, disclosures doubled to reach 3 keywords per 1000 pages, showing a growing focus. This upward trend may result from increased regulations or customer interest, as a professional expert notes. Another expert states that data stewards are responsible for customer data security. As data security disclosures rise, policies on data ethics, management, and governance are also likely to increase.

As the security of automation improves, monitoring software robots is key to safeguarding data and preventing misuse. Ethical issues in banking primarily concern AI decision accountability (Villar and Khan, 2021). Robotics-related disclosures are low, with only three banks mentioning the keywords. While disclosures on this category remain significantly low in both years, the normalized score of this CDR category increased by 3.5 times in 2023 compared to 2021. An expert noted that future regulations and stakeholder interests will increase disclosure. Low disclosure volumes don't necessarily mean low performance. Incorporating AI ethics in reports could signal its importance. This is discussed further in Section 5.2.

A comparative analysis of normalized CDR disclosures by region among the top 100 global banks in 2023 shows uneven distribution across categories, as in Figure 4. All regions prioritize data security due to global concerns about breaches and cyberattacks but focus elsewhere varies. Asian banks emphasize data transparency (38.25 keywords per 1000 pages), while European banks focus on data ownership and privacy (36.48 keywords per 1000 pages). Disclosures on data responsibility and stewardship remain low, though Asian banks show slightly more emphasis. The robot ethics category is under-disclosed, with only European banks reporting, highlighting a gap in addressing AI and automation ethics in banking.

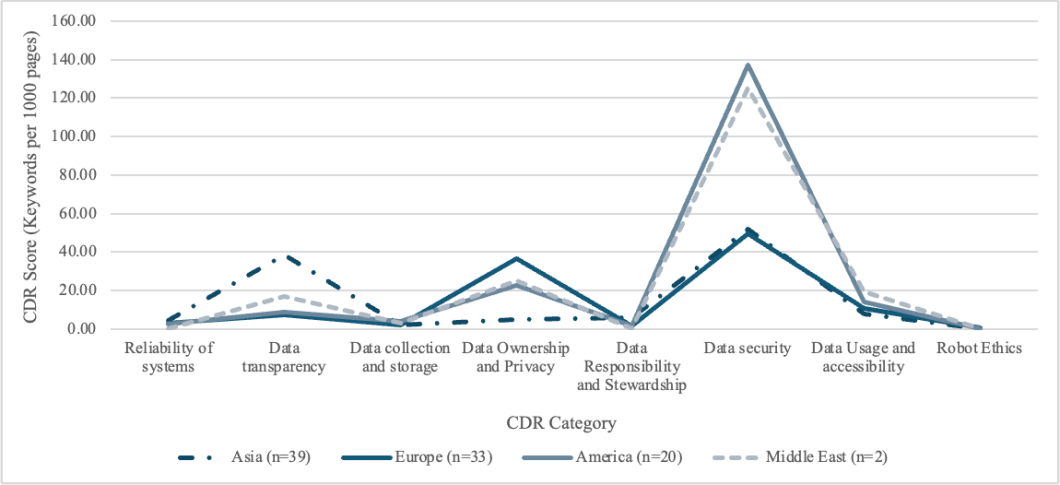


Figure 4. Normalized CDR disclosures by region in 2023

Source: Authors' elaboration

Banks operating in the Americas region collectively show more reporting on governance-related CDR categories than other regions, with a total normalized CDR score of 190 keywords per 1000 pages, followed by sample banks in the Middle East region (189 keywords), Asia (114 keywords), and Europe (111 keywords). These regional comparisons should nevertheless be interpreted with caution, because missing and non-English reports were excluded, non-Western banks are underrepresented in the final sample. Thus, part of the apparent lead in disclosure in some regions over others may reflect this sampling artifact, alongside the regulatory environment, rather than substantively stronger reporting practices.

Globally, data protection regulations are common. The banking industry is highly regulated, with banks required to follow strict rules on data collection, storage, use, and protection, as noted by an expert. Consequently, regional variations in CDR disclosures among the top 100 sample global banks are not high. However, regulations often vary by country. For example, in the Middle East, banks follow national laws and central bank rules. Since our sample includes only two Gulf banks from Qatar and the UAE, only their regulations are considered.

5.2. Beyond the scores: Insights from annual reports and supplementary sources

To improve understanding of the CDR disclosure practices of the top 100 Global Banks from section 5.1, this section provides qualitative insights from a sample of annual reports and communication channels by CDR category.

5.2.1. Reliability of systems

While normalized scores related to system reliability are low across sample banks, the two cases highlighted here prioritize this category through related initiative disclosures. For instance, HSBC, which recorded approximately 9 keywords per 1000 pages for system reliability, emphasizes investing in resilient IT systems to protect customers and reduce disruptions. Its annual report states, *"We remain committed to investing in the reliability and resilience of our IT systems and critical services"* (HSBC, 2024a, p. 311)

HSBC highlights initiatives beyond IT infrastructure, focusing on data quality, timeliness, and resilience controls. The annual report states they *"continue to focus on improving the quality and timeliness of the data used to inform management decisions"* and are implementing strategic and regulatory changes for better outcomes (HSBC, 2024a, p. 38). Under "*resilience risk*", the Group Risk Committee received reports on system incidents, outages, immediate actions to enhance system continuity, customer communication, and measures to improve resilience controls to prevent recurrence (HSBC, 2024a, p. 277). HSBC's "*Risk Review*" section within its 2023 annual report highlights system reliability and emphasizes internal controls within its risk management framework. It categorizes risk due to processes, people, system failures, or external events as material, explaining how HSBC measures and manages it. (HSBC, 2024a, p. 136)

The Industrial Bank of Korea (IBK), recording 127 keywords per 1000 pages in its 2023 annual report, highlights quality improvements and digital innovation. It states, "*The company focused on stabilizing its IT services through continuous quality improvements*" (Industrial Bank of Korea (IBK), 2024, p. 128). The report also notes ongoing efforts to enhance IT system reliability, including a strategic investment in a new data center ensuring continuous, downtime-free operation. The section "Advancing Reliability and Leadership of IT Competencies" notes: "*IBK is actively advancing the development of an IT system that operates seamlessly,*

without interruption, year-round." (IBK, 2024, p. 84). In its 2023 sustainability report, IBK noted that the new data center will cause the bank to adjust its greenhouse gas emissions and reduction goals. To achieve carbon neutrality by 2040, IBK highlights climate initiatives like energy-saving systems and an eco-friendly data center (IBK, 2023).

While IBK records a relatively higher normalized score in this category, HSBC adopts a more strategic approach by integrating system reliability into its broader risk management framework. HSBC also addresses challenges with data quality, particularly ESG data. Yet, both banks tend to prioritize system reliability in their reporting, demonstrating that qualitative depth does not always mirror quantitative keyword frequency.

5.2.2. Data transparency

Although data transparency disclosures are low within normalized CDR scores, they cover more than just word count, including disclosures about data systems for easy auditing by regulators and users (Herden et al., 2021). This is evident in the annual reports of two sample banks: the Postal Savings Bank of China (PSBC), which recorded approximately 60 keywords per 1000 pages in its 2023 annual report, and the Australia and New Zealand (ANZ) Banking Group Limited, with a relatively low normalized score of 4.5.

While China lacks specific open banking regulations (Woodburn Accountants & Advisors, 2025), PSBC prioritizes information disclosure, boosting its data transparency score. The 2023 annual report links transparency to disclosure: *"While ensuring compliance, the Bank proactively expanded the scope and depth of voluntary information disclosure, enhanced the quality and effectiveness of information disclosure, improved the transparency of the Bank…"* (Postal Savings Bank of China (PSBC), 2024, p. 204). It also notes receiving an A (Excellent) rating for disclosure from the SSE in 2023 (PSBC, 2024, p. 205).

Although it scores relatively low in data transparency, ANZ shows transparency through ongoing disclosures based on stakeholder feedback, legislative, and framework requirements. The report also explains how data is used and managed for specific purposes, demonstrating transparency (Australia and New Zealand Banking Group Limited (ANZ), 2023, p. 24). ANZ's transparency extends beyond its annual report to include its corporate governance report and ESG supplements.

The bank states that it produces various reports for stakeholders, including shareholders, customers, employees, regulators, NGOs, and the community (ANZ, 2023, p. 2). The Australian Banking Association's Banking Code of Practice highlights "transparency and accountability" as core principles, urging banks to communicate clearly and be accountable (Australian Banking Association, 2025, p. 7). While PSBC emphasizes increasing transparency and protecting shareholders' rights (PSBC, 2024, p. 204), ANZ's disclosure diversification reflects a stakeholder-centric commitment to data transparency.

5.2.3. Data collection and storage

Data collection and storage have low disclosures among sample banks, likely because they focus on internal operational systems that ensure data accuracy. Banks may see less need to publicly disclose these internal processes, prioritizing compliance with local legal requirements. An analysis of data collection and storage disclosures for Banco Bilbao Vizcaya Argentaria SA (BBVA) (Spain) and Woori Financial Group (Korea) was conducted. While BBVA (56.3 keywords per 1,000 pages) recorded a higher score than Woori Group (4 keywords per 1,000 pages), disclosure remains collectively low across all sampled banks. Despite this generally limited reporting, both banks actively incorporate cloud computing, data storage, and collection into their core strategies.

In its 2023 report, BBVA emphasizes data and technology as key priorities, stating, "*BBVA is a 'data-driven' company in which the quality and advanced integration of data, together with Artificial Intelligence, are key accelerators"* (Banco Bilbao Vizcaya Argentaria SA (BBVA), 2024, p. 11). Their data strategy rests on three pillars: ensuring data quality and availability, enhancing advanced analytics for personalized solutions, and leveraging generative AI to optimize operations and customer service. Woori Group's 2023 report highlights achievements in digital innovation, including system enhancements for data collection and analysis that enable new business ventures. For 2024, it plans to boost digital competitiveness with a data platform for "collection, storage, utilization, and management", supporting "data-driven management" (Woori Financial Group, 2024, p. 24).

Disclosure about this CDR category isn't limited to annual reports. Woori Group's website states that customer personal data is collected, used, and retained in accordance with laws (Woori Financial Group, 2025). Similarly, BBVA's "General Data Privacy and Protection Policy Summary" highlights data confidentiality to

safeguard personal information (BBVA, n.d.). To meet diverse stakeholder needs, including customers who may not review annual reports, banks use various channels for data-related disclosures. While BBVA integrates data strategy into its corporate purpose and Woori Group focuses on technological advancements to boost digital competitiveness, both banks actively enhance data collection and storage systems.

5.2.4. Data ownership and privacy

High scores in data privacy across the sampled banks likely stem from stringent data security, protection, and privacy laws. Capital One ranks relatively highly in Data Ownership and Privacy, with approximately 156 keywords per 1,000 pages, emphasizing the interconnected concepts of data privacy, protection, and security within its risk and compliance strategies. The report places an even stronger emphasis on data security, citing 250 keywords per 1,000 pages encompassing terms such as cybersecurity and data protection, and highlighting substantial cybersecurity investments. Reflecting this interconnectedness, Capital One's normalized scores for data privacy increased by 23.8% in 2023 compared to 2021, while its normalized data security score grew by 33% over the same period. In its 2023 annual report, Capital One (US) states, "*We are subject to a variety of continuously evolving and developing laws and regulations regarding privacy, data protection and data security*" (Capital One, 2024, p. 14).

BNP Paribas, on the other hand, mentions data privacy only twice in its 2023 integrated report (with a relatively lower normalized score of 46.5), but highlights it in its materiality matrix alongside data security, signifying its importance (BNP Paribas, 2024, p. 75). Additionally, the bank's supplementary information sources provide information on data privacy (BNP Paribas, 2025; BNP Paribas, 2022). The bank provides privacy information in supplementary documents, such as its code of conduct, data privacy charter, and data protection notice, which detail how it protects privacy, the types of data collected, customer rights, and its compliance with GDPR.

5.2.5. Data responsibility and stewardship

This CDR category generally ranks low among the top 100 global banks analyzed, averaging just 3 keywords per 1,000 pages. A notable exception is the PSBC whose 2023 report recorded 88.7 keywords per 1,000 pages in this category, witnessing a

substantial increase from 7.14 in 2022 and 2.2 in 2021. This growth mainly stems from detailed disclosures on data asset management and governance, key elements of this category. Although related keywords like data stewardship, accountability, and accessibility were not addressed in its 2023 report, the bank's discussion on data management and governance reflects the core concept. Its focus on a "*unified data asset management system*" to enhance data quality and responsibilities shows a commitment to data stewardship. (PSBC, 2024, p. 102).

Evidence suggests data stewardship is referred to by different terms, such as data ethics, as seen at Danske Bank, a relatively low scorer (7 keywords per 1000 pages in 2023). The 2023 report shows a strong focus on data ethics, emphasizing transparency about data use and risk, with clear principles and impact assessment. In its 2023 annual report, the bank states that it "*strives to be transparent about the purposes for which data is used and to communicate this clearly*" (Danske Bank, 2024, p. 40). The bank's Data Ethics Principles report details these core elements (Danske Bank, 2022).

A low score in the annual report, like other CDR categories, doesn't always indicate weak performance. Relevant disclosures may use diverse terminology or appear in supplementary documents rather than exclusively in annual reports.

5.2.6. Data security

Over three years, disclosures on data security increased significantly, as shown in section 5.1. Although banks aim for robust security, there are differences in disclosures. Sberbank's 2023 report (Russia), with a normalized score of 211 keywords per 1000 pages, details cybersecurity metrics, such as a 90% threat occurrence rate, zero downtime, and no financial losses, highlighting the bank's effective defenses (Sberbank, 2024, p. 197). On the other hand, the 2023 Goldman Sachs report from the US, with a normalized score of 292.5, describes initiatives qualitatively, emphasizing risk management and regulations. It also provides detailed disclosures on its cybersecurity risk management and how it conducts internal and external assessments (Goldman Sachs, 2024).

Despite extensive regulation, Goldman Sachs's data security disclosures in 2021 were much lower than in 2023, accounting for only 64 keywords per 1,000 pages in the earlier year (Goldman Sachs, 2022). While 2021 focused on information security as a key priority, the 2023 report highlights a broader integration into

governance and risk management. The increased emphasis may be due to growing reliance on technology and cybersecurity threats.

Danske Bank is a relatively low-scoring bank (7 keywords per 1000 pages in 2023), mainly due to its focus on ethical data principles and on integrating data risk into risk management, rather than on detailed data security initiatives. In its 2023 annual report, the bank states, "*Danske Bank's data ethics principles define how Danske Bank strives to act with regard to data use across the Group and in its business relations*" (Danske Bank, 2024, p. 40). The report also notes that IT and security risk management are integrated into the Group's risk framework and follow the Board's policies (p. 211).

The "Data Ethics Principles" document on the Bank's website provides a detailed explanation of these guidelines, emphasizing data confidentiality and security as its fourth key principle, showing commitment to data protection through ethical principles (Danske Bank, 2022, p. 2). Although Danske Bank does not detail specific security initiatives, it addresses this at the principal and governance levels, reflecting strategic efforts.

5.2.7. Data usage and accessibility

This CDR category covers data movement, processing, digital trade, cross-border flow, sharing, and access. In their 2023 reports, NatWest (29 keywords per 1,000 pages) and Lloyds (33 keywords per 1,000 pages) both scored above the category average of 10.49, focusing their disclosures primarily on data usage. The reports lack details on data sharing, cross-border data flow, and digital trade agreements, but frequently mention "*Open Banking*", indicating different industry terms for the same CDR category. This term is mentioned in the annual reports of both selected banks (NatWest Group, 2024; Lloyds Banking Group, 2024) and dedicated webpages explaining Open Banking (NatWest Group, n.d.; Lloyds Banking Group, 2025), especially regarding the sharing of information with service providers (NatWest Group, 2025).

A review of the 2023 annual report from the Bank of Montreal, a relatively low scorer in that category (4.5 keywords per 1000 pages), found a single mention of "*Open Banking*," within the context of "*investing in digital capabilities*" for business customers (Bank of Montreal, 2024, p. 45). More details are on the bank's website, including "*our stories,*" which highlight partnerships with companies

offering innovative services to better meet customer needs (Bank of Montreal, 2022).

The annual reports of Lloyds Banking Group showed a slight decrease in the normalized score for this CDR category. In 2021, the report contained 40 keywords per 1000 pages, which is slightly higher than the 33 keywords per 1000 pages recorded in 2023. These occurrences were mainly found in the auditor's report. The 2021 increase was due to two key audit issues: "Insurance Actuarial Assumptions," involving data testing and key judgments on ECL estimates, particularly "model assumptions and data used" (Lloyds Banking Group, 2022, pp. 198-199). These were no longer key audit matters in 2023, causing a slight decrease in disclosures.

The decline in a CDR category in some banks from 2021 to 2023 may not reflect fewer disclosures. Instead, it could be due to factors increasing keyword use in a specific year.

5.2.8. Robot ethics

While this category is named "robot ethics", keywords cover both AI ethics and robotics laws. An expert noted ethical issues may relate more to AI "mind" than robots' "body", since without AI, robots just perform repetitive tasks and lack decision-making. Since AI is relatively new compared to established issues such as data security, the top 100 global banks disclosed little about robot ethics and AI use in their 2023 reports.

KBC Group (Belgium) is one of the few banks to provide disclosures in this category within its 2023 annual report, with total mentions of approximately 6 keywords per 1,000 pages. While the Group acknowledges challenges and uncertainties in digital transformation and commits to ethical AI, it only mentions ethical AI in its 2023 annual report within operational risk management without concrete strategies. The report states that controls are in place for cyber and model risks, including avoiding bias and ensuring ethical AI (KBC Group, 2024, p. 120). Its 2024 sustainability report, under 'Our Responsibility," features a "Trustworthy AI" section where the Senior General Manager of Compliance states that ethical AI is crucial, especially in healthcare and finance, and stresses the need for transparency, fairness, and bias-free AI (KBC Group, 2025, p. 55).

Similarly, NatWest Group (UK), which scored 2.2 keywords per 1,000 pages in its 2023 annual report, emphasizes the impact of technology on its customers and

business models, focusing on the safe and ethical use of AI and machine learning. It states, "*We're also focusing on how we use AI and machine-learning technologies safely and ethically*" (NatWest Group, 2024, p. 15). The bank also highlights its strategic focus on the long-term effects of emerging technologies (p. 24). Model risk is addressed within the board risk committee, which examined the validation process for AI models (p. 116). NatWest has developed an "*AI and Data Ethics Code of Conduct*" to guide ethical AI use, emphasizing human oversight, transparent decisions, and bias prevention (NatWest Group, 2025).

Qualitative review of other banks with high CDR scores and zero in robot ethics disclosure found that HSBC, for instance, referenced AI and emerging technologies ethics in its 2023 report, despite lacking specific keywords. Specifically, the bank outlined this commitment under the section titled "*The ethical use of data and AI*" in its 2023 annual report (HSBC, 2024a, p. 97). Additionally, the bank published a dedicated report outlining its ethical data and AI principles (HSBC, 2024b), demonstrating a commitment that extends beyond mere keyword detection.

6. SUMMARY AND CONCLUSION

This study extends stakeholder theory into digital governance, emphasizing banks' digital obligations. While prior research focused on CSR in physical and social contexts (Freeman, 1984; Aguinis & Glavas, 2012), our findings reveal banks disclose governance-related CDR practices to meet stakeholder expectations. Digital responsibility acts as a risk mitigation and ethical commitment (Donaldson & Preston, 1995; Floridi, 2018). This connects stakeholder theory and CDR, paving the way for future research on ethical governance in digital business models. More specifically, our findings map onto Donaldson and Preston's (1995) three dimensions of stakeholder theory (see also Freeman, 1984; Freeman et al., 2018). Descriptively, the dominance of data security disclosures and the GDPR-linked emphasis on data ownership and privacy among European banks illustrate how banks institutionalize digital governance in response to identifiable stakeholder and regulatory pressures (Herden et al., 2021; Voigt & Von dem Bussche, 2017). Instrumentally, the marked growth in disclosures between 2021 and 2023 is consistent with banks using CDR reporting to build customer trust, protect reputation, and pre-empt regulatory risk (Aguinis et al., 2020). Normatively, however, while the near-absence of robot ethics disclosure and relatively low data responsibility and stewardship disclosure suggest that banks' ethical obligations

remain largely unarticulated in traditional reporting (Villar & Khan, 2021), this gap may reflect a limitation in keyword-based metrics and reliance on traditional annual reports rather than a lack of normative commitment. In practice, several banks demonstrate a commitment through dedicated, external policy documents rather than annual report disclosures.

The study advances CDR research by integrating Herden et al.'s (2021) framework into empirical work, demonstrating its applicability across regions and regulatory contexts. Viewing governance-related CDR as a key area for stakeholder-centric governance contributes to debates on digital ethics, accountability, and sustainability (Freeman et al., 2018). Consistent with prior studies on information security (Ambhire & Teltumde, 2011; Wang et al., 2024), results show that data security is considered the most dominant governance-related CDR disclosure, reflecting banks' protection of customer data and digital assets, followed by data ownership, privacy, and transparency. This supports Wang et al.'s (2024) claim that digitalization raises privacy issues. The sector's focus on protecting sensitive data reflects increasing digital risks (Ambhire & Teltumde, 2011).

The rise in CDR disclosures over the examined period reflects growing awareness of digital responsibilities, in contrast to Jones and Wynn's (2023) claim that few firms report on these areas. Limited disclosures in a category do not mean it is not prioritized. Some banks disclose initiatives through other channels or in annual reports. A category's decline witnessed in some banks may result from specific incidents affecting banks rather than from a systemic issue.

This study has limitations. It focuses on CDR disclosures, not actual CDR performance, since banks may not disclose actions related to digital responsibility. Future research could use qualitative methods, such as interviews, to better understand unreported practices. The analysis covers only governance-related CDR, ignoring environmental and social aspects that could provide context. Including digital waste, inclusion, and empowerment would provide a broader view of the role of digital responsibility in sustainability. The keyword list for CDR scoring might contain subjective elements, but efforts were made to reduce this by involving multiple researchers and consulting experts before analysis. In addition, the exclusion of missing and non-English reports disproportionately removed non-Western banks from the sample, which may partially confound the regional comparisons. The finding that banks in the Americas region lead in disclosure

should therefore be interpreted with this sampling limitation in mind. Finally, expert validation relied on a small panel of three informants to validate the research instrument and the study's results. Future research should draw on a larger and more diverse panel of experts.

This research highlights digital responsibility in banking, providing insights for industry leaders, regulators, and society. Improving data governance promotes ethical digital practices across industries. The study identifies key focus areas and gaps in CDR disclosure, offering regulators practical guidance. It also allows banking executives to compare their CDR practices with global peers, encouraging the adoption of the best international practices.

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DATA AVAILABILITY STATEMENT

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

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