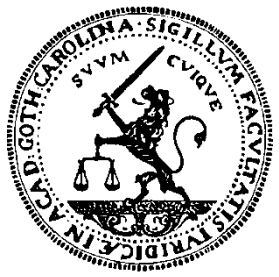

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Blockchain Technology in EU Sustainability Reporting: Legal Analysis

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Summary

Sustainability reporting has become the primary measure of corporate sustainability in the EU, with increasing awareness among companies about the importance of disclosing sustainability matters. Concurrently, the European Union has enacted several pieces of legislation regarding sustainability reporting, notably the Corporate Sustainability Reporting Directive. While blockchain technology initially emerged as a financial tool for the cryptocurrency industry, its application has expanded to corporate environments, particularly in supply chain management. However, the legal implications of using blockchain for sustainability reporting raise several questions. This research provides valuable insights into the legal aspects of blockchain in sustainability reporting. It explores how blockchain can aid companies in complying with double materiality assessments and harmonizing sustainability regulations. Additionally, it delves into legal implications related to blockchain use, specifically concerning contract law, corporate structures, and data privacy issues.

Abbreviations

CRR	Capital Requirements Regulation
CSRD	Corporate Sustainability Reporting Directive
DAO	Decentralized Autonomous Organizations
DLT	Distributed Ledger
ECJ	European Court of Justice
EFRAG	European Financial Reporting Advisory Group
ESG	Environmental, Social and Governance
ESRS	European Sustainability Reporting Standards
EU	European Union
FMP	Financial Market Participants
GDPR	General Data Protection Regulation
GRI	Global Reporting Initiative
IoT	Internet of Things
KPI	Key Productivity Indicator
NFRD	Non-Financial Reporting Directive
PAI	Principal Adverse Impact
PIE	Public Interest Entities
SFDR	Sustainable Finance Reporting Directive
SME	Small and Medium Enterprises
US	United States

1. INTRODUCTION

1.1.Background of the Topic

The European Union (EU) has increased its emphasis on business sustainability in recent years, driven by global agreements such as the 2015 Paris Agreement on Climate Change and the adoption of the Sustainable Development Goals by the United Nations. These milestones have raised public awareness of corporate social responsibility, which goes beyond conventional business Key Productivity Indicators (KPIs) to include things like human rights, labor practices, environmental sustainability, innovation, and general well-being. [1] Consequently, the EU Commission emphasizes the profound impact of corporate actions on society and the environment, highlighting the necessity for corporate accountability and transparency.

To address these concerns, sustainability reporting has emerged as a key component of the regulatory landscape for corporate sustainability in the EU. Legislative frameworks like the Non-Financial Reporting Directive (NFRD) and its successor, the Corporate Sustainability Reporting Directive (CSRD), along with European Sustainability Reporting Standards (ESRS), have been introduced to standardize and enhance sustainability disclosures by companies. Furthermore, disclosure obligations pertaining to environmental effect and sustainable finance are enforced by rules including the Taxonomy Regulation, Sustainable Finance Disclosure Regulation (SFDR), and Capital Requirements Regulation (CRR).

However, the complexity and diversity of these regulations present challenges for companies, with about 75% expressing unpreparedness for upcoming audits related to environmental, social, and governance (ESG) criteria, according to a study by KPMG.[2] This has encouraged businesses to use creative strategies to successfully comply with rules. Among these approaches, technological solutions play a crucial role, given the increasing digitization of business activities. Technologies

[1] 'Corporate Sustainability and Responsibility' <https://single-market-economy.ec.europa.eu/industry/sustainability/corporate-sustainability-and-responsibility_en> accessed 3 April 2024.
[2] Mike Shannon, 'Regulatory Deadlines Loom and Only 25% of Companies Feel Ready to Have ESG Data Independently Assured: KPMG Research - KPMG Global' (*KPMG*, 30 January 2024) <https://kpmg.com/xx/en/home/media/press-releases/2023/09/kpmg-esg-assurance-maturity-index.html> accessed 17 May 2024.

such as Artificial Intelligence and Internet of Things (IoT) have been explored,[3] however, blockchain technology stands out from the others due to its unique benefits, particularly in supply chain management.[4]

Notably, major companies like IBM, Walmart, Nestle, Unilever,[5] Auchan, and Oxfam[6] have already implemented blockchain solutions in their operations to track materials and goods throughout the value chain. Blockchain's decentralized nature minimizes the risk of data tampering or manipulation, fostering trust among stakeholders and enabling more accurate and reliable reporting on environmental impacts and sustainability efforts. Furthermore, blockchain-based smart contracts can automate compliance operations, which lessens administrative work and boosts the effectiveness of sustainability monitoring and verification methods.

However, the innovative nature of blockchain technology introduces novel legal challenges that must be carefully examined within the context of EU sustainability reporting regulations. As blockchain technology becomes more widely used in business settings, issues about its compliance with current legal frameworks—such as those pertaining to data privacy, contractual responsibilities, and liability—appear. Therefore, a legal analysis is important to address the uncertainties and ensure that the integration of blockchain technology aligns with regulatory requirements while mitigating potential legal risks for companies operating within the EU.

1.2.Research Objectives and Questions

The goal of this study is to provide this thorough legal examination of the use of blockchain technology within the corporate sustainability reporting legislative framework of the EU. It encompasses several key objectives:

[3] Staff Writer, 'Empowering Green Innovation: The Environmental Impact of IoT and AI Technologies' (*https://www.environmentenergyleader.com/*) <https://www.environmentenergyleader.com/2024/03/the-green-revolution-how-iot-and-ai-are-paving-the-way-for-a-sustainable-future/> accessed 17 May 2024.
[4] 'Blockchain Funding and Investment | Shaping Europe's Digital Future' (27 September 2023) <https://digital-strategy.ec.europa.eu/en/policies/blockchain-funding> accessed 17 May 2024.
[5] Ryan Browne, 'IBM Partners with Nestle, Unilever and Other Food Giants to Trace Food Contamination with Blockchain' (*CNBC*, 22 August 2017) <https://www.cnbc.com/2017/08/22/ibm-nestle-unilever-walmart-blockchain-food-contamination.html> accessed 17 May 2024.
[6] 'Maximum Transparency: Blockchain in the Food Industry' (*DMEXCO*) <https://dmexco.com/stories/maximum-transparency-blockchain-in-the-food-industry/> accessed 17 May 2024.

Firstly, the research aims to provide an in-depth overview of the EU's legal framework concerning sustainability reporting. This includes identifying present challenges inherent in the current framework from the perspective of companies. By understanding these challenges, the research aims to show how blockchain technology can potentially address companies' concerns in sustainability reporting. Furthermore, the foundation for additional legal analysis will be built upon these highlighted issues.

The second goal of the study is to provide an overview of blockchain technology. This entails recognizing its essential qualities, features, and advantages as well as its function in the modern corporate environment and the business ramifications. The research will examine blockchain technology through the lens of three key areas within a company's operations: corporate governance, supply chain management, and financial reporting since these areas are particularly pertinent to sustainability reporting requirements. This foundational understanding is necessary in comprehending the legal ramifications of integrating blockchain technology into sustainability reporting practices.

Thirdly, the study aims to investigate possible relationships between blockchain technology and EU framework on sustainability reporting. Through examining this relationship, the study aims to provide light on whether blockchain technology might improve sustainability reporting methods for businesses while also efficiently meeting regulatory requirements.

Overall, the primary objective of this research is to provide valuable insights into the practicality and legal implications of utilizing blockchain technology to improve corporate sustainability reporting within the EU.

In pursuing these objectives, the research will address two fundamental research questions:

1) *Is blockchain technology, from a legal standpoint, an effective tool for mitigating the challenges posed by the existing EU legal framework on sustainability reporting?*
2) *What are the potential legal implications for companies utilizing blockchain technology in the context of sustainability reporting requirements within the EU regulatory landscape?*

1.3.Research Methodologies and Materials

The research employs a variety of methodologies to achieve its objectives and address research questions effectively. Firstly, a legal doctrinal method is used to examine key regulations. Smith defines the legal doctrinal method as the objective and systematic description of the current law in a specific area or regarding a particular institution, aiming to inform the audience about how the law reads.[7] This thesis describes the relevant legal requirements and identifying problematic aspects for applicable companies, drawing on current opinions and insights in the literature to provide a comprehensive understanding of the EU's legal framework on sustainability reporting.

Secondly, an overview of blockchain technology and its primary advantages and disadvantages in corporate settings is given using descriptive and comparative research analysis methodologies. A comparative approach entails analyzing phenomena by putting them together to establish points of similarity and difference between them,[8] while descriptive method focuses on detailing the characteristics of the phenomenon being studied.[9] Therefore, these two methods will be used while describing blockchain, summarizing its essential characteristics and related technologies, and contrasting the properties of blockchain with the requirements and activities of businesses.

Thirdly, legal dogmatic methodologies are used to assess the suitability of blockchain for addressing legal challenges and analyze the legal implications it presents for sustainability reporting from the companies' perspective. A key aspect of the legal-dogmatic approach is its capacity to incorporate new developments, such as recent case law and legislation, in the context of societal changes.[10]

Additionally, Generative Artificial Intelligence was used exclusively for language enhancement, translation, grammatical correction, and removal of non-academic words. Nonetheless, all the ideas and arguments presented in the thesis are entirely my own, based on the analysis of the legislation and sources referenced and critically examined throughout the work.

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[7] Jan M Smits, 'What Is Legal Doctrine? On the Aims and Methods of Legal-Dogmatic Research' (1 September 2015) <https://papers.ssrn.com/abstract=2644088> accessed 3 June 2024.
[8] Seyed Mojtaba Miri and Zohreh Dehdashti Shahrokh, 'A Short Introduction to Comparative Research' (2019).
[9] Adi Bhat, 'Descriptive Research: Characteristics, Methods + Examples' (*QuestionPro*, 23 August 2018) <https://www.questionpro.com/blog/descriptive-research/> accessed 3 June 2024.
[10] Smits (n 7).

By employing these diverse research methodologies, the thesis aims to offer a comprehensive of sustainability reporting regulations, blockchain technology, and their intersection within corporate environments.

In terms of materials, EU sources such as CSRD, SFRD, CRR, Taxonomy Regulation, and ESRS will serve as the primary focus. Additionally, other pertinent EU regulations will be examined to demonstrate the legal ramifications of blockchain. Moreover, European Court of Justice (ECJ) case law will be referenced to show the interpretation and definition of specific legal concepts relevant to blockchain. Secondary sources including books, scholarly articles, professional writings, research papers, journals, legal blogs, reports, and official publications from EU will complement the primary sources. These secondary sources are important for providing the appropriate context and professional and scholarly insights into the topic.

1.4.Delimitations

The thesis will focus exclusively on the EU sustainability reporting framework; therefore, Corporate Sustainability Due Diligence Directive will not be examined. Additionally, economic considerations regarding blockchain's support for the EU's Digital Product Passport will not be explored due to the thesis's legal analysis focus.

Furthermore, the research will adopt a company-centric perspective, neglecting the examination of blockchain's implications on stakeholders beyond companies, such as communities, workers, society, and the environment. In addition, while legal challenges within the EU framework will be presented, the emphasis will be on how applicable entities can overcome these challenges rather than discussing the framework's future development.

Moreover, the geographical scope of the research will be confined to EU companies, thus avoiding the examination of blockchain implications under other jurisdictions for international companies operating within the EU. Insights from different jurisdictions on certain topics will be provided solely to demonstrate potential implications and interpretations of blockchain within the EU, rather than to identify implications under other jurisdictions.

1.5. Literature Review

Sustainability reporting in the EU

The academic literature on corporate sustainability reporting within the EU primarily focuses on specific legislative components within the framework. Nevertheless, Hummel et al. highlight the interconnectedness of sustainability disclosure mandates, such as the CSRD and the Taxonomy Regulation, which apply to a broad spectrum of EU companies and certain non-EU entities, alongside the SFDR and Pillar 3 disclosures targeting financial market participants and major banks, respectively.[11] Moreover, Stolowy and Paugam underscore the diversity of reporting requirements among influential international standard setters, including EFRAG, the International Sustainability Standards Board, and the Securities and Exchange Commission, leading to varied corporate reporting approaches.[12]

A critical aspect of EU sustainability reporting mandates is the concept of double materiality assessment. In these terms, Mezzanotte identifies challenges in achieving double materiality compliance, such as difficulties in identifying impacts through company-stakeholder engagement, as well as issues concerning the availability and quality of impact-related information.[13] Additionally, uncertainty persists regarding the legal criteria for determining the materiality of impacts and impact-related information. In another article, Mezzanotte proposes that reporting information following an impact materiality approach aims to incentivize corporate activities aligned with sustainable development objectives, foster accountable business conduct through effective impact management mechanisms, and cultivate markets and products for sustainable investments.[14]

Furthermore, Mähönen and Palea advocate for the introduction of an explicit EU accounting law concept, directly linked to the goal of sustainable development.[15] They propose that by

[11] Katrin Hummel and Dominik Jobst, 'An Overview of Corporate Sustainability Reporting Legislation in the European Union' [2024] Accounting in Europe, pp. 1-36 <https://www.tandfonline.com/doi/abs/10.1080/17449480.2024.2312145> accessed 12 April 2024.
[12] Hervé Stolowy and Luc Paugam, 'Sustainability Reporting: Is Convergence Possible?' [2023] Accounting in Europe, pp. 139-165 <https://www.tandfonline.com/doi/full/10.1080/17449480.2023.2189016> accessed 3 May 2024.
[13] Félix E Mezzanotte, 'Corporate Sustainability Reporting: Double Materiality, Impacts, and Legal Risk' (2023) 23 Journal of Corporate Law Studies 633, p. 661.
[14] Félix E Mezzanotte, 'Examining the Reasons for Impact Materiality in EU Corporate Sustainability Reporting' (20 March 2024), p. 32 <https://papers.ssrn.com/abstract=4637172> accessed 5 May 2024.
[15] Jukka Mähönen and Vera Palea, 'Analyzing Double Materiality Through the Lens of the European Political Constitution: Implications for Interoperability and Standards-Setting' (19 February 2024), p. 22 <https://papers.ssrn.com/abstract=4731089> accessed 5 May 2024.

incorporating double materiality as a constitutional concept within accounting regulation, extending to financial reporting, the EU can bolster its commitment to sustainable practices.

Potential of Blockchain for Companies

In academic literature, blockchain technology has undergone thorough examination regarding its applicability in corporate activities. Yaga et al. underscore its decentralized nature, transaction transparency, and tamper-proof characteristics as pivotal features beneficial to companies.[16] Particularly in corporate governance, Yusuf et al. propose that blockchain utilization could enhance the trustworthiness and affordability of shareholder voting processes.[17] Furthermore, Yusuf et al. suggest that businesses could employ blockchain for real-time accounting, potentially reducing reliance on auditing firms, and for executing smart contracts, thereby diminishing litigation costs and financial hardships. Moreover, Kaal and Law assert that blockchain enables transparent recording of members' contributions to institutions, facilitating the supplementation of corporations and other business entities with blockchain-based agency constructs.[18]

Regarding supply management, the European Parliament's study posits that blockchain's ability to track goods throughout the supply chain and store transactions enables retailers to verify product authenticity and empowers consumers to identify genuine products.[19] Additionally, Rejeb et al. emphasize that blockchain's decentralized nature fosters transparent and resilient supply chains, capable of withstanding potential disruptions.[20]

In financial reporting, Chowdhury et al. highlight blockchain's decentralized and transparent attributes as catalysts for enhanced efficiency, transparency, and security.[21] By eliminating intermediaries and introducing a distributed ledger system, blockchain has the potential to revolutionize traditional accounting practices and mitigate fraud risks. Furthermore, Sheela et al. suggests that public blockchains could enable firms to engage in voluntary information disclosure,

[16] Dylan Yaga and others, 'Blockchain Technology Overview' [2018] National Institute of Standards and Technology Internal Report 1, p. 67.
[17] Muhammad Yusuf and others, 'Blockchain Technology for Corporate Governance and IT Governance: A Financial Perspective' (2023) 7 International Journal of Data and Network Science 927.
[18] Wulf A Kaal, 'Blockchain-Based Corporate Governance' [2021] Stanford Journal of Blockchain Law & Policy, p. 27 <https://stanford-jblp.pubpub.org/pub/blockchain-corporate-governance/release/1> accessed 8 May 2024.
[19] European Parliamentary Research Service, 'Blockchain for Supply Chains and International Trade' (2020).
[20] Abderahman Rejeb and others, 'Exploring Blockchain Research in Supply Chain Management: A Latent Dirichlet Allocation-Driven Systematic Review' (2023) 14 Information 557, p. 27.
[21] Emon Chowdhury, Alessandro Stasi and Alfonso Pellegrino, 'Blockchain Technology in Financial Accounting: Emerging Regulatory Issues' (2023) 21 Review of Financial Economics 862, p. 866.

thereby reducing disclosure errors, enhancing accounting information quality, and diminishing information asymmetry.[22]

Blockchain for sustainability reporting

Academic exploration of blockchain technology's impact on sustainability reporting has predominantly focused on the supply chain perspective. Corazza et al. employed scenario analysis to pinpoint challenges and establish objectives for resolving blockchain-related issues within the supply chain context.[23] Furthermore, Paliwal et al. examined the suitability of blockchain technology in achieving supply chain management objectives and highlighted cost-related benefits, particularly in crisis management scenarios involving defective products and breakdowns in partner mechanisms due to low-quality and counterfeit ingredients.[24]

Berg and Myllyma emphasized transparency and traceability as significant advantages for verifying social and environmental practices.[25] They noted that by reducing barriers to entry, blockchain technology can combat counterfeiting while facilitating the measurement of consumer product sustainability.

Additionally, Yontar determined 15 characteristic features of blockchain for supply chain management, including effective information sharing, process integration, trustworthiness, systematic data management, auditability, transparency, stakeholder relationship strength, efficiency, prompt responsiveness, sustainability enhancement, digitization transition, uncertain legal status, novelty, and integration compatibility with other technologies, all while optimizing time criteria.[26]

1.6.Significance of the Study

[22] Sundarasen Sheela and others, 'Navigating the Future: Blockchain's Impact on Accounting and Auditing Practices' (2023) 15 Sustainability 16887, p. 16.
[23] Laura Corazza and others, 'Blockchain and Sustainability Disclosure: A Scenario-Based Application for Supply Chains' (2023) 15 Sustainability 571, p. 8.
[24] Vineet Paliwal, Shalini Chandra and Suneel Sharma, 'Blockchain Technology for Sustainable Supply Chain Management: A Systematic Literature Review and a Classification Framework' (2020) 12 Sustainability 7638, p. 23.
[25] Jonathan Berg and Lauri Myllyma, 'Impact of Blockchain on Sustainable Supply Chain Practices' (Jönköping University 2021).
[26] Emel Yontar, 'The Role of Blockchain Technology in the Sustainability of Supply Chain Management: Grey Based Dematel Implementation' (2023) 8 Cleaner Logistics and Supply Chain 100113, p. 13.

From the literature review presented above, it is seen the legal examination of the implications and compliance challenges associated with blockchain applications for sustainability reporting in the EU is underexplored. Therefore, the legal analysis of blockchain technology implementation for compliance with EU sustainability reporting requirements holds significant importance, particularly, for the following reasons:

1) First of all, it helps businesses comprehend the legal ramifications of using blockchain technology for sustainability reporting solutions. This understanding enables companies to navigate the application of blockchain more effectively, ensuring compliance with relevant regulations.

2) Legal practitioners will also gain valuable insights into the legal landscape surrounding blockchain for sustainability reporting, enabling them to advise clients with more knowledge. With this knowledge, they can navigate complex regulatory environments and offer strategic counselling oriented to the specific needs and challenges of sustainable business practices.

3) The findings of this study are also valuable for future researchers in the field. The absence of comprehensive legal analysis in this area highlights the need for future research. By providing a detailed examination of the legal implications of blockchain technology for sustainability reporting, this thesis attempts to fill a gap in existing literature, laying the groundwork for further exploration and development in this field.

4) Lastly, policymakers can benefit from understanding the primary legal concerns of companies regarding the utilization of blockchain for sustainability reporting in the EU, informing future regulatory decisions and initiatives.

2. EU LEGAL FRAMEWORK FOR SUSTAINABILITY REPORTING

Introduction

In this chapter, the European Union's legal framework for corporate sustainability reporting will be examined. The primary aim is to identify the principal challenges encountered by relevant companies within this framework.

To achieve this objective, an overview of key legislation, notably NFRD/CSRD, SFDR, CRR II and the Taxonomy Regulation, will be provided. Additionally, the main European standards applicable to reporting within the EU will be demonstrated to contextualize the nature of the identified challenges. The discussion of challenges will be approached from three perspectives: legal, economic, and data, as these spheres are paramount in understanding the complexities and implications of sustainability reporting for companies. The challenges identified herein will serve as the foundation for subsequent legal analysis on the role of blockchain in corporate sustainability reporting within the EU.

2.1.Overview of Regulatory Landscape

Non-financial sustainability reporting

The first mandate in non-financial reporting adopted by the EU was the NFRD of September 2014.[27] NFRD imposed disclosure requirements on large companies that are Public Interest Entities (PIEs) with an average number of more than 500 employees and trading transferable securities on the regulated market of any Member State.[28] The NFRD aimed to enhance the relevance, consistency, and comparability of non-financial and diversity information disclosed by these entities across the EU, with the main goal of fostering a sustainable global economy.[29]

Under NFRD, listed public companies were obliged to publish a non-financial report alongside their annual management report, covering areas such as the environment, social and employee

[27] Hummel and Jobst (n 11) p. 1-36.
[28] 'Non-Financial Reporting Directive (NFRD)' (*Plan A*) <https://plana.earth/policy/non-financial-reporting-directive-nfrd> accessed 4 May 2024.
[29] Directive 2014/95/EU of the European Parliament and of the Council of 22 October 2014 amending Directive 2013/34/EU as regards disclosure of non-financial and diversity information by certain large undertakings and groups 2014 (2014/95/EU) (NFRD 2014), rec. 8.

matters, respect for human rights, and anti-corruption and bribery matters.[30] The corporate governance statement for these companies was extended to also include information on diversity.

However, the NFRD faced criticism for deficiencies regarding comparability, consistency, and reliability of the information it required and the limited number of companies in scope.[31] As a result, the CSRD was adopted by the EU Commission in 2022 to amend and replace NFRD.[32] Compared to the NFRD, the main changes include: i) expansion in the scope and reporting requirements; ii) expansion of the double materiality assessment; iii) and introduction of governance and enforcement requirements.

Thus, CSRD expands the scope of reporting obligations to cover not only large PIEs but also all large companies, including listed and non-listed ones, with more than 500 employees, and Small and Medium Enterprises (SMEs) listed on EU regulated markets.[33] According to studies, the 11,000 firms covered by the NFRD will now be roughly 50,000, more than quadrupling the number of enterprises required by the CSRD to report on sustainability.[34] Regarding reporting requirements, CSRD extends the content compared to NFRD. Under the CSRD, companies are now mandated to provide a more comprehensive description of various aspects related to sustainability, including their business model and strategy, particularly focusing on sustainability matters.[35] CSRD also necessitates the disclosure of time-bound sustainability-related targets, including potential reductions in greenhouse gas emissions.[36] Companies are required to outline their progress towards achieving these targets, specifying whether they are grounded in scientific evidence. Companies are also mandated to provide insight into the role of administrative, management, and supervisory bodies in sustainability matters, along with their expertise and skills or access to these resources, and to disclose their sustainability-related policies, including information on existing sustainability-linked incentive schemes for members of governance

[30] NFRD 2014, art. 19(a).
[31] Hummel and Jobst (n 11) p. 1-36.
[32] 'Corporate Sustainability Reporting - European Commission' <https://finance.ec.europa.eu/capital-markets-union-and-financial-markets/company-reporting-and-auditing/company-reporting/corporate-sustainability-reporting_en> accessed 3 May 2024.
[33] Hummel and Jobst (n 11), p. 1-36.
[34] 'The Corporate Sustainability Reporting Directive (CSRD), Explained' (*Normative*) <https://normative.io/insight/csrd-explained/> accessed 3 May 2024.
[35] Directive (EU) 2022/2464 of the European Parliament and of the Council of 14 December 2022 amending Regulation (EU) No 537/2014, Directive 2004/109/EC, Directive 2006/43/EC and Directive 2013/34/EU, as regards corporate sustainability reporting 2022 (CSRD 2022), art. 1, paras. 3,4 and 7.
[36] CSRD 2022, art.1, para. 3.

bodies.[37] In summary, the CSRD emphasizes the inclusion of the entire value chain of a company in its reporting obligations, encompassing its own operations, business partnerships, and supply chain.[38] Moreover, if there are any gaps in the information regarding the value chain within the initial three years of implementation, companies are obligated to disclose their endeavors, rationales, and strategies for acquiring the missing data.[39]

Another key element of CSRD is the expansion of double materiality assessment, which was also present in NFRD. According to CSRD, companies need to identify which sustainability matters are most material to the organization and its stakeholders by evaluating their impact on environmental and social factors (inside-out perspective)[40], while also considering how these factors influence the organization (outside-in perspective)[41]. In simple words, companies must figure out which environmental and social issues are most important to them and their stakeholders by looking at how these issues affect their own operations and how they impact the world around them.

CSRD has also brought significant changes to how sustainability reporting is governed and enforced. It has influenced corporate governance, such as the makeup of boards, and how this affects corporate social responsibility disclosure practices.[42] Additionally, the importance of audit committees in sustainability reporting has been mentioned, highlighting how governance structures can improve reporting practices.[43] CSRD has also made reporting mandatory rather than voluntary, highlighting the need for stricter enforcement to ensure companies comply with reporting requirements. Furthermore, strengthening government enforcement and regulations has been suggested to improve reporting practices. Under CSRD, sustainability information must now be included in the management report, making it impossible to provide this disclosure separately.[44]

[37] CSRD 2022, art. 1, para. 3.
[38] Tami Dinh, Anna Husmann and Gaia Melloni, 'Corporate Sustainability Reporting in Europe: A Scoping Review' [2023] Accounting in Europe, pp. 1-29 <https://www.tandfonline.com/doi/abs/10.1080/17449480.2022.2149345> accessed 3 May 2024.
[39] CSRD 2022, art.1, par. 7
[40] CSRD 2022, art. 1.
[41] CSRD 2022, art. 1 and recital 29.
[42] 'Corporate Sustainability Reporting Directive - KPMG Netherlands' (*KPMG*, 30 April 2024) <https://kpmg.com/nl/en/home/topics/environmental-social-governance/corporate-sustainability-reporting-directive.html> accessed 4 May 2024.
[43] ibid.
[44] Hummel and Jobst (n 11) p. 1-36.

Overall, the main aims of the CSRD are to decrease climate risk and enhance sustainability across the EU. However, from a practical standpoint, the directive brings about more demanding and wide-ranging effects. CSRD enhances the disclosure process, offering investors and consumers a clearer, more uniform method to grasp and compare an organization's ESG impact. This enables them to make more informed decisions based on reported sustainability information.

Sustainability-related financial disclosure

The EU's first regulation to refocus capital flow toward sustainable finance is the SFDR of November 2019.[45] SFDR, initiated by the European Commission as part of its Sustainable Finance Action Plan, sets mandatory ESG disclosure obligations for financial market participants (FMPs) and financial advisers.[46] Effective from March 10, 2021, SFDR aims to ensure transparency regarding sustainability risks, adverse impacts, and sustainability-related information in financial products.[47] It operates on two levels: Level 1 and Level 2.

Level 1, mandates entity-level disclosures on FMPs' policies regarding identifying and prioritizing principal adverse sustainability impacts (PAIs), along with engagement policies.[48] Compliance with these disclosures is on a "comply or explain" basis[49], meaning that entities are required to either adhere to specified requirements or provide a valid explanation for non-compliance.

Level 2, applicable from January 1, 2022, includes more detailed entity and product-level disclosures, including the 'principal adverse sustainability impacts statement' (PAI disclosure).[50] PAI disclosure refers to any negative effect on sustainability factors resulting from investment decisions or advice.[51] SFDR mandates two distinct levels of PAI disclosure:

[45] 'What Is SFDR, EU's Sustainable Finance Disclosure Regulation?' <https://blog.worldfavor.com/whats-sfdr-eu-sustainable-finance-disclosure-regulation> accessed 4 May 2024.
[46] Hummel and Jobst (n 11) p. 1-36.
[47] Regulation (EU) 2019/2088 of the European Parliament and of the Council of 27 November 2019 on sustainability-related disclosures in the financial services sector 2019 [2019/2088] (SFDR 2019), art. 1.
[48] SFDR 2019, art. 4.
[49] ibid.
[50] SFDR 2019, art .7.
[51] 'Principal Adverse Impact (PAI) Disclosures under the SFDR' (*Deloitte Netherlands*) <https://www2.deloitte.com/nl/nl/pages/legal/articles/pai-disclosures-under-the-sfdr.html> accessed 4 May 2024.

Entity-Level Disclosure: Both financial market participants and financial advisers must annually publish a PAI statement on their websites, outlining the adverse impacts of their investment decisions or advice on sustainability factors.[52]

Product-Level Disclosure: Financial market participants are required to disclose PAI information in pre-contractual financial product documentation, such as fund information memoranda or prospectuses, highlighting the adverse impacts of their financial products on sustainability factors.[53]

Furthermore, SFDR distinguishes between disclosures for entities and products. Entity-level disclosures involve website transparency on sustainability risk integration, PAI consideration in decisions, and sustainability risk incorporation in remuneration policies. Product-level disclosures, for both Article 8 (environmental or social characteristics) and Article 9 (sustainable investment objectives) financial products, require pre-contractual, website, and periodic disclosures.[54]

Pre-contractual disclosures are implied include information on sustainability risk integration and an assessment of sustainability risks' impacts on financial returns.[55] Moreover, financial products addressing PAIs at entity level must explain how PAIs are considered in investment decisions. Article 8 products necessitate disclosure on how environmental and social characteristics are met, while Article 9 products require disclosure on how objectives are pursued.[56]

Another important document adopted by the EU to address issues with regards to sustainability reporting for financial industry is the CRR II adopted in May 2019 by the EU. CRR II amends the original CRR and incorporates Basel Committee on Banking Supervision reform measures, particularly focusing on Pillar 3 disclosure requirements.[57] One significant amendment introduced is Article 449a, which mandates large institutions with publicly listed securities on regulated EU markets to disclose their ESG risks starting from the end of June 2022.[58]

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[52] SFDR 2019, art. 4.
[53] SFRD, art. 7.
[54] SFRD 2019, article 7 and 8.
[55] Hummel and Jobst (n 11).
[56] SFDR 2019, article 8 and 9.
[57] European Central Bank, 'ESG Data Quality: Pillar 3 Disclosures in Focus' <https://www.bankingsupervision.europa.eu/press/publications/newsletter/2024/html/ssm.nl240221_1.en.html> accessed 4 May 2024.
[58] Hummel and Jobst (n 11) p. 1-36.

Unlike other EU regulations such as the CSRD, SFRD and Taxonomy Regulation (will be discussed further in this section) which emphasize broader sustainability-related disclosures, CRR II's Pillar 3 requirements specifically target risk disclosures. These disclosures aim to enhance market discipline by providing stakeholders with insight into the ESG risks faced by financial institutions.[59]

A key aspect of CRR II is the integration of Pillar 3 disclosure requirements with supervisory reporting. Thus, the European Banking Authority has strategically aligned these requirements, facilitating institutions' compliance by utilizing the same data for both reporting and disclosure obligations.[60] This integration not only streamlines compliance efforts but also enhances the quality of disclosed information. By subjecting reporting data to supervisory scrutiny, the alignment ensures improved disclosure quality, benefiting all market participants and enabling better-informed decision-making.[61]

Taxonomy

The Taxonomy Regulation was adopted by the EU in June 2020 as part of its broader Action Plan on Financing Sustainable Growth. Taxonomy Regulation, similar to the SFRD, is also a tool in fostering investments in environmentally sustainable activities.[62] The main goal of the Taxonomy Regulation is establishing a comprehensive classification system aimed at providing clarity and transparency regarding environmental sustainability to businesses and investors.[63] While the regulation is primarily applicable to large public interest entities engaged in activities involving publicly traded securities, it also applies to listed SMEs and other financial market participants, that offer and distribute financial products in the EU. The regulation also places an obligation on financial market participants to either consider the criteria for environmentally sustainable investments or provide a statement indicating their stance if they choose not to do so.[64]

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[59] ibid.
[60] Sean Smith, 'Pillar 3 Is Evolving: CRR 2 Introduces Many Changes Including a Focus on ESG' (22 April 2021).
[61] 'Implications of CRR II on Reporting Requirements for the Asset Management Industry' <https://www.ey.com/en_lu/wealth-asset-management/luxembourg-market-pulse/implications-of-crr-ii-on-reporting-requirements-for-the-asset-m> accessed 4 May 2024.
[62] Hummel and Jobst (n 11) p. 1-36.
[63] Regulation (EU) 2020/852 of the European Parliament and of the Council of 18 June 2020 on the establishment of a framework to facilitate sustainable investment, and amending Regulation (EU) 2019/2088 2020 (OJ L) (Taxonomy Regulation 2020), rec. 15.
[64] Taxonomy Regulation 2020, art. 8.

Economic activity is considered as environmentally sustainable under Taxonomy Regulation if it meets specific criteria. Firstly, the activity should make a "substantial contribution" to one of the six specified environmental objectives outlined in the regulation.[65] Second criteria is “do not significant harm” assessment[66], meaning that economic activity that falls under the substantial contribution category may still be disqualified as environmentally sustainable if it results in more harm than benefit to an environmental objective.[67] Finally, the activity, in order to be environmentally sustainable, should avoid violation of minimum “social safeguards”, such as adverse social impacts, as well as should comply with “technical screening criteria”.[68]

In regards of reporting requirements, entities, which are subject to reporting obligations under Taxonomy Regulation, must provide detailed information on how their operations align with ecologically sustainable standards outlined in the regulation. This includes disclosing how their activities are linked to environmentally sustainable economic activities in their non-financial statements.[69] Additionally, non-financial enterprises must reveal the percentage of revenue derived from environmentally friendly goods or services, along with corresponding percentages of capital and operational expenses.[70]

Entities covered by the SFDR are required to disclose information on the alignment of their products with social or environmental features specified in Articles 8 and 9 of the SFDR.[71] This entails revealing the percentage of investments made in environmentally friendly economic activities and specifying the percentages of enabling and transitional activities within the financial instrument description. The "do no significant harm" guideline must also be emphasized in the disclosure, alongside details on the deductions criteria for investments in ecologically friendly activities. Furthermore, companies must outline their sustainability transition plans as part of their reporting obligations under the Taxonomy Regulation.[72] This entails providing a roadmap for transitioning towards more sustainable practices.

[65] Taxonomy Regulation 2020, art. 9.
[66] Taxonomy Regulation 2020, art. 6.
[67] Meneghini de L, ‘A CRITICAL ANALYSIS OF THE EU GREEN TAXONOMY: IS IT FIT FOR PURPOSE?’ (2022).
[68] Taxonomy Regulation 2020, art. 18.
[69] Taxonomy Regulation 2020, art. 8.
[70] ibid.
[71] Taxonomy Regulation 2020, art. 5 and 6.
[72] Taxonomy Regulation 2020, art. 19.

2.2.Standards for Reporting

ESRS

In addition to key regulations on sustainability reporting, standards for such reporting are crucial in promoting transparency and accountability in corporate practices. Standards governing this reporting serve as essential guidelines, directing companies on how to structure their reporting policies and procedures. Within the EU, various standards exist to assist companies in disclosing their ESG performance effectively.

One of the most important and recent standards in this realm is ESRS, which companies subject to the CSRD must adhere to. These standards, developed by the European Financial Reporting Advisory Group and adopted by the EU Commission in July 2023, aim to ensure that companies provide comparable, relevant, and reliable sustainability information while clearly outlining reporting expectations.[73] Work towards developing ESRS have leveraged existing international standards and EU initiatives such as the SFDR and Taxonomy Regulation, aiming to maintain coherence and uniformity.[74] The ESRS encompasses three types of standards: cross-cutting, topical, and sector-specific. The initial adopted set includes cross-cutting and topical standards, applicable to companies across all sectors in the EU.[75]

Regarding cross-cutting standards, ESRS 1 establishes mandatory principles for preparing and disclosing sustainability statements under the CSRD, focusing on the basis on which reports must be prepared rather than specific content of the report.[76] It also outlines requirements for collecting and presenting sustainability information. ESRS 1 clarifies the double materiality principle, which was present in NFRD and expanded in CSRD: 'impact' signifies the sustainability-related effects of a company's operations on people or the environment (referred to as impact materiality), while 'risks and opportunities' denote the financial risks and opportunities stemming from sustainability

[73] 'The Commission Adopts the European Sustainability Reporting Standards - European Commission' <https://finance.ec.europa.eu/news/commission-adopts-european-sustainability-reporting-standards-2023-07-31_en> accessed 5 May 2024.
[74] Deirdre M Ahern, 'The Sustainability Reporting Ripple: Direct and Indirect Implications of the EU Corporate Sustainability Reporting Directive for SME Actors' (30 June 2023) <https://papers.ssrn.com/abstract=4517356> accessed 5 May 2024.
[75] 'ESRS in a Nutshell: Achieving CSRD Compliance | Denkstatt' (22 August 2023) <https://denkstatt.at/en/esrs-standards-explained/> accessed 5 May 2024.
[76] Hummel and Jobst (n 11).

factors (i.e., financial materiality).[77] Additionally, ESRS states that materiality assessments serve as the foundation for disclosures on sustainability concerns in accordance with topical standards, while also outlines the sustainability matters that a corporation must take into consideration and that fall within the purview of topical standards.[78] Hence, it is evident that the EU Commission intends to prioritize the double materiality assessment as the designated and primary method for refining the reporting scope. However, it is also worth noting that ESRS 2 is an exception to this materiality assessment according to ESRS. ESRS 2, on the other side, concentrates on the substance and format of the ESRS topical standards. It specifies essential elements and details, such as policies, actions, and goals, that necessitate reporting in the four key disclosure categories: governance; strategy; management of impacts, risks, and opportunities; and metrics and targets.[79]

The topical standards encompass additional disclosure requirements concerning significant sustainability issues, categorized into environmental (ESRS E1 to E5), social (ESRS S1 to S4), and governance (ESRS G1) aspects.[80] According to these standards, if a particular sustainability concern is deemed material by the company (based on double materiality), it must disclose information in accordance with the relevant topical standard.[81] The five environmental standards cover reporting content on climate change, pollution, water and marine resources, biodiversity and ecosystems, and resource use and circular economy.[82] Similarly, the four social standards pertain to reporting information on the company's workforce, employees in the value chain, communities affected by the company's activities, and affected consumers and end users.[83] Notably, all social reporting standards mandate qualitative information rather than quantitative. The sole governance standard entails reporting information on corporate policy, corporate culture, including the company's approach to combating corruption or bribery, managing supplier relationships, and political influence.[84]

[77] Commission Delegated Regulation (EU) 2023/2772 of 31 July 2023 supplementing Directive 2013/34/EU of the European Parliament and of the Council as regards sustainability reporting standards 2023 (ESRS 2023), art. 3.3.
[78] ESRS 2023, art. 16.
[79] ESRS 2023, ESRS 2 General Disclosures.
[80] Ahern (n 74).
[81] ESRS 2023.
[82] ESRS 2023, E1-E5.
[83] ESRS 2023, S1-S4.
[84] ESRS 2023, G1.

Finally, sector-specific standards, which are currently under development by EFRAG, will outline crucial reporting details tailored to different industries. These standards will complement the mandatory disclosures already established, providing sector-specific information and key metrics. Additionally, simplified standards are anticipated for capital market-oriented SMEs.[85] In case of adoption of such standards, they will cater to the needs of smaller companies, ensuring that sustainability reporting obligations are proportionate while still maintaining stringent sustainability reporting requirements.[86]

Global Reporting Initiative

The Global Reporting Initiative (GRI) is the most well-known and widely used standard for the development of sustainability reports. The unique characteristic of GRI standards lies in their founding purpose, which is to ensure corporate accountability to all stakeholders, not solely to shareholders.[87] With over 10,000 participating companies across more than 100 countries[88], GRI reporting is voluntary, unlike the mandatory ESRS standards in the EU. Nevertheless, GRI standards align closely with ESRS standards. Thus, studies show that GRI covers approximately 80% of social and environmental impact requirements outlined in ESRS.[89]

GRI Standards are structured into three categories: Universal, Sector, and Topic Standards. All companies adhere to the Universal Standards, which encompass core sustainability considerations regarding economic, social, and environmental impacts. Additional reporting criteria include Sector Standards tailored for specific industries, such as oil and gas, coal, agriculture, aquaculture, and fisheries. Meanwhile, Topic Standards cover a wide range of potentially material topics, allowing companies to select disclosures based on their material assessments.

The Universal Standards serve as the foundation for GRI reporting. Sector-specific standards are applied where applicable, while topic-specific reporting remains optional.[90] GRI prioritizes sectors

[85] 'ESRS in a Nutshell: Achieving CSRD Compliance | Denkstatt' (n 75).
[86] Mähönen and Palea (n 15).
[87] David Hess, 'The Future of Sustainability Reporting as a Regulatory Mechanism' (1 March 2014), p. 15 <https://papers.ssrn.com/abstract=2416920> accessed 5 May 2024.
[88] 'GRI Standards and Reporting | GRI Explained | Sustain.Life' <https://www.sustain.life/blog/gri-standards> accessed 5 May 2024.
[89] Natalie Runyon, 'How Global Reporting Initiative Standards Meet the EU's ESG Reporting Requirements' (*Thomson Reuters Institute*, 16 January 2024) <https://www.thomsonreuters.com/en-us/posts/esg/gri-standards/> accessed 5 May 2024.
[90] 'GRI Standards and Reporting | GRI Explained | Sustain.Life' (n 88).

with significant environmental impacts, such as fossil fuels, for sector-specific standards development.[91] Reports are made publicly available on the GRI website, with the option for third-party review, which becomes mandatory for companies opting in.

With regards to double materiality assessment, emphasized in CSRD and ESRS, GRI, while not explicitly mentioning double materiality assessment, introduced impact materiality and financial materiality in its 2021 update.[92] However, there is a greater focus on impact materiality in GRI standards compared to financial materiality, meaning that GRI standards mostly cover reporting on how activities have the impact on environment, people and society, rather than how ESG performance effect the company itself.[93] However, in 2023, GRI published 3 guides, including one on double materiality assessment, recognizing its importance and stating that GRI reporting prepares companies for double materiality by linking impacts to associated financial risks and opportunities.[94]

2.3.Challenges of EU Sustainability Reporting: Legal, Economic, and Data Perspectives.

Legal perspective

One of the primary challenges posed by the EU framework on sustainability reporting is the absence of harmonization of laws and uniform rules. As it was described previously in this chapter, the various laws governing sustainability reporting in the EU target different sectors, aspects of ESG performance, and types of companies, each with its own scope and objectives. For instance, the CSRD focuses on large companies and listed SMEs with public interest, while the SFRD and Pillar 3 disclosure pertain to financial institutions and advisors, and the Taxonomy Regulation applies to both large companies and SMEs, mandating reporting on environmental aspects of ESG. This lack of consistency across regulations and directives creates confusion for companies operating within the EU, as they grapple with varying requirements and interpretations.[95] Without

[91] Dinh, Husmann and Melloni (n 38).
[92] 'Understanding Double Materiality and the Updated GRI Standards' (*Antea Group*) <https://us.anteagroup.com/news-events/blog/understanding-double-materiality-and-the-updated-gri-standards> accessed 5 May 2024.
[93] Vanessa Otto-Mentz and Wim Bartels, 'Balancing Your Materiality Assessment. How to Move beyond the Matrix' (Delloite 2022).
[94] 'GRI - Shaping the Future of Sustainability Policy' <https://www.globalreporting.org/news/news-center/shaping-the-future-of-sustainability-policy/> accessed 5 May 2024.
[95] '5 Challenges of Sustainability Reporting: How Are Companies Preparing for ESRS Disclosures?' (*5 Challenges of Sustainability Reporting: How Are Companies Preparing for ESRS Disclosures? | Workiva*)

clear and standardized guidelines, businesses struggle to decipher what exactly needs to be reported and how to do so accurately.[96] This confusion, in its turn, results in inconsistencies in reporting practices, making it difficult for stakeholders to assess and compare companies' sustainability performance accurately.[97] Moreover, without clear guidelines, companies may inadvertently overlook certain aspects of their ESG performance, leading to gaps in their reporting and potentially damaging their reputation among investors and consumers.[98]

Another legal challenge presented by the EU framework on sustainability revolves around the concept of double materiality assessment, since it is the key to EU sustainability reporting. This assessment, as outlined in regulations such as the CSRD, ESRS, and Taxonomy Regulation, introduces uncertainties regarding stakeholder engagement and data availability and collection. These concepts will be discussed *infra* from economic and data perspectives. However, from a legal perspective, it remains unclear whether concepts such as negligence, gross negligence, and intention or will should be considered in the assessment of double materiality, particularly concerning greenwashing misconduct under these regulations.[99] Additionally, the complex interplay of standards, impact thresholds, discretionary powers, and broad criteria for determining the materiality of impact-related information complicates the legal landscape, making it challenging to predict legal risks and implications.

Moreover, compliance with double materiality requirements places significant burdens on companies, increasing the risk of unintentional breaches.[100] The complexity of rules and unclear legal criteria exacerbate compliance challenges, particularly during the initial stages of rule implementation.[101] Consequently, companies reporting external impacts under the CSRD regime may encounter serious compliance hurdles, such as data interpretation problems, leading to unintentional breaches.

<https://www.workiva.com/blog/5-challenges-sustainability-reporting-how-are-companies-preparing-esrs-disclosures> accessed 6 May 2024.

[96] ibid.

[97] Daniel Kinderman, 'The Challenges of Upward Regulatory Harmonization: The Case of Sustainability Reporting in the European Union: Politics of Upward Regulatory Harmonization' (2019) 14 Regulation & Governance, pp. 674-697.

[98] Dinh, Husmann and Melloni (n 38).

[99] Mezzanotte (n 13), p. 650.

[100] ibid.

[101] Mähönen and Palea (n 15), p. 9.

Economic perspective

One of the challenges within the EU framework on sustainability reporting from an economic perspective concerns the correct identification of stakeholders involved in reporting processes. It's important to highlight that stakeholder engagement is crucial in the double materiality assessment process and sustainability reporting.[102] Engaging correct stakeholders allows companies to highlight significant issues affecting their operations and society as a whole.[103] This comprehensive approach directly addresses the concerns of those impacted by the company's operations, leading to enhanced trust, empowerment, and ultimately, fostering growth. Thus, effective stakeholder engagement is indispensable for sustainability reporting. However, the comprehensive nature of the laws, which encompass finance, strategy, operations, and communication, complicates stakeholder identification.[104] For instance, while one standard may directly pertain to workers in the value chain such as social standards of CSRD, another may focus on supervisory management such as Pillar 3 disclosure requirements, necessitating engagement with different stakeholder groups for each aspect of compliance.

It is noteworthy to state that the EU Commission made an effort to address this complexity in ESRS. The ESRS identifies two primary stakeholder groups for consideration in materiality assessments: affected stakeholders and users of sustainability statements.[105] Affected stakeholders encompass individuals or groups potentially impacted by a company's activities, including employees, suppliers, consumers, and customers. Users of sustainability statements primarily consist of investors, business partners, and trade unions. Such categorization aims to assist companies in selecting appropriate stakeholders. However, the broad scope of the ESRS framework poses challenges in aligning stakeholder identification with individual company goals

[102] 'Impact of ESRS on Stakeholder Trust & Engagement - Thecsrdcompass.Com' (30 May 2023) <https://thecsrdcompass.com/impact-of-esrs-on-stakeholder-trust-and-engagement-in-corporate-sustainability-reporting/> accessed 6 May 2024.
[103] 'Unlocking the Power of Stakeholders in the ESRS Double Materiality Assessment' (*Position Green*, 27 April 2023) <https://www.positiongreen.com/insights/news/unlocking-the-power-of-stakeholders-in-the-esrs-double-materiality-assessment/> accessed 6 May 2024.
[104] Adele Ronciere, 'Implementing CSRD: Challenges and Opportunities' (*Cority*, 17 January 2024) <https://www.cority.com/blog/implementing-csrd-challenges-and-opportunities/> accessed 6 May 2024.
[105] 'Impact of ESRS on Stakeholder Trust & Engagement - Thecsrdcompass.Com' (n 102).

and objectives.[106] Consequently, the issue of stakeholder engagement in sustainability reporting persists within the EU.

Another economic challenge presented by sustainability reporting regulations in the EU is their impact on SMEs. The European Commission acknowledges SMEs as crucial drivers of the EU economy, generating 70% of all jobs and representing over 50% of the European GDP.[107] At the same time, listed SMEs are directly affected by both CSRD and Taxonomy regulation. For listed SMEs, the direct applicability of these regulations introduces uncertainty and complexity. While the objective is to provide meaningful information to financial institutions and investors for the transition to sustainable finance, SMEs may struggle to navigate broad scope and requirements regulations. This is mainly evidenced by disruption of the corporate balance, leaving SMEs uncertain about future compliance requirements.[108] Additionally, SMEs struggle with integrating sustainability practices into their business models due to constraints such as limited resources, knowledge, and skills.[109] These challenges hinder SMEs from effectively engaging in sustainability reporting and adopting sustainable business practices.

Moreover, non-listed SMEs are indirectly impacted by sustainability reporting regulations. Banks and larger companies within their value chains may demand specific sustainability performance information to meet their own ESG requirements.[110] The rising expectations of customers, employees, and business partners regarding sustainability performance further pressure SMEs to comply with ESG standards.[111] The primary challenge in this context revolves around data collection and accuracy. Research findings indicate that gathering information poses difficulties, particularly concerning compliance with both the CSRD and the taxonomy regulations.[112] The

[106] Jilde Garst, Jeroen Suijs and Karen Maas, 'The Reality of Materiality - Empirical Evidence on the Implementation of Materiality Assessments' (21 February 2024) <https://papers.ssrn.com/abstract=4733987> accessed 6 May 2024.
[107] Jessie Westerberg and Sofia Gren, 'Exploring Implications of the EU Taxonomy on Funding and Disclosure for Swedish SMEs.' (Swedish University of Agricultural Sciences, SLU 2023).
[108] Accountancy Europe, '5 Reasons Why Sustainability Matters for SMEs' [2023] European Sustainable Business Federation.
[109] Westerberg and Gren (n 107).
[110] Ahern (n 74), p. 13.
[111] ibid.
[112] Westerberg and Gren (n 107).

challenge essentially stems from the time and resources required for data gathering, while SMEs might need to duplicate their reporting efforts to comply with the regulatory framework.[113]

Although sector-specific standards under the ESRS are expected to provide clarity for SMEs, the current state of regulations poses challenges and demands for both listed and non-listed SMEs. While standards for listed SMEs are anticipated to be published by June 2024[114], the overall impact of sustainability regulations on SMEs remains complex and demanding.

Data perspective

One significant requirement mandated by EU legislators in sustainable reporting is the thorough collection and compilation of data and information for reporting purposes. Companies subject to reporting obligations must gather information from all participants within their value chains, encompassing both financial and non-financial data. For instance, the CSRD emphasizes not only quantitative data but also monitors the company's practices, initiatives, actions, and implementations related to governance and strategy.[115] This approach presents challenges for companies, particularly concerning materiality assessment and resource management.

In particular, the challenge arises from the determination of external facts, which may be affected by factual uncertainty, observability issues, and measurement problems.[116] Limited resources or capacity hinder a company's ability to observe and measure these facts accurately. Moreover, data quality may suffer from errors, particularly when impact metrics are presented as estimations based on weak assumptions.[117] Furthermore, companies must report material impacts throughout their value chain processes, such as scope 3 emissions standards requiring the disclosure of greenhouse gas emissions across the entire value chain.[118] Given the broad definition of a company's value chain in EU legislation, operational challenges are anticipated in terms of identifying impacts and collecting quality information that is accurate, comparable, and reliable, all while managing costs effectively.

[113] ibid.
[114] Hummel and Jobst (n 11), p. 1-36.
[115] Mezzanotte (n 13), p. 648.
[116] '5 Challenges of Sustainability Reporting: How Are Companies Preparing for ESRS Disclosures?' (n 95).
[117] Mezzanotte (n 13), p. 649.
[118] ibid.

It's important to note that neither the CSRD, Taxonomy Regulation, nor ESRS mandates fully automating the data gathering process. Despite the absence of a fully automated tool for sustainability compliance, there is growing consensus that technological innovations, notably blockchain and AI, may offer solutions for accurate data collection challenges.[119]

Conclusion

The European Union over the past years has made several efforts to establish primary directions in sustainability reporting for undertakings. These efforts are reflected in adopted regulations, each addressing various aspects of ESG performance and applying to different categories of companies and services. CSRD stands as the primary legislation governing sustainability reporting, encompassing a broad spectrum of businesses, and defining key ESG reporting obligations and KPIs. Conversely, regulations such as SFDR, Taxonomy Regulation and CRR II target specific sectors or types of ESG performance, leading to the primary legal challenge: the lack of harmonization and uniformity in rules and guidelines across companies. This results in confusion among companies regarding the content and extent of reporting applicable to them, consequently giving rise to challenges from legal, economic, and data perspectives. Particularly, the double materiality assessment presents challenges across different perspectives within the framework. Legally, there is uncertainty regarding whether negligence or intention is considered for the assessment. Economically, there is ambiguity in correctly identifying stakeholders in the reporting process. From a data perspective, the extensive data collection required, covering all stages and participants of value chains, poses challenges, particularly for SMEs. Finally, the adverse impact of sustainability reporting obligations on SMEs, due to their limited resources and expertise, is also recognized as a significant concern.

In summary, the challenges identified in this chapter are closely interconnected. Therefore, addressing one challenge has the potential to influence others.

[119] Ronciere (n 104).

3. BLOCKCHAIN TECHNOLOGY FOR CORPORATE SUSTAINABILITY

Introduction

Blockchain technology has become a disruptive force with effective potential in many different sectors of the modern corporate environment. This chapter provides a detailed analysis of blockchain technology and its utilization in corporate settings, particularly focusing on the EU context.

The main objective of the chapter is to give understanding on the operational mechanisms and core characteristics of blockchain, along with their impact on business operations and responsibilities. The chapter commences with an overview of blockchain and an exploration of its legal status within the EU, setting the stage for a deeper exploration of its practical implications for companies. Consequently, the chapter delves into three key areas of corporate activities in terms of sustainability: corporate governance, supply chain management, and financial reporting. These areas are selected due to their relevance in defining blockchain's implications for sustainable reporting, which constitutes the primary focus of the thesis. Through analyzing the practical implementation of blockchain in the corporate environment, readers will gain insights on the primary advantages and drawbacks it presents for businesses. These insights will be further used in the legal analysis of blockchain's application for sustainable reporting within the thesis.

3.1. Overview of Blockchain Technology

What is Blockchain Technology?

Blockchain technology is a decentralized and distributed ledger system that enables secure recording, storing, and sharing of data across a network of computers.[120] The history of blockchain traces back to the works of David Chaum in 1982 and the advancements made by Haber, Stornetta, and Bayer in 1992, leading to the creation of the first modern decentralized blockchain by Satoshi Nakamoto in 2008.[121] In that year, it also rose to prominence as the foundational technology supporting Bitcoin, the pioneering cryptocurrency. However, its applications over the years

[120] 'Blockchain Technology and Its Transformative Potential for the Legal Industry | Emory Lawyer' <https://law.emory.edu/lawyer/issues/2018/spring/features/feature-article/index.html> accessed 7 May 2024.
[121] 'A Timeline and History of Blockchain Technology' (*WhatIs*) <https://www.techtarget.com/whatis/feature/A-timeline-and-history-of-blockchain-technology> accessed 7 May 2024.

extended far beyond cryptocurrencies, with potential uses in various sectors, including finance, supply chain management, healthcare, and sustainability reporting.

In simple words, blockchain is like a notebook, but instead of being kept by one person or organization, it's shared across a network of computers. Whenever a new transaction happens, it gets added to this ledger as a "block" of data, while each block contains information about the transaction and a unique code.[122] Consequently, at its core, a blockchain consists of a chain of such blocks, each containing a list of transactions. Once a transaction is recorded on the blockchain, it is extremely difficult to alter or delete, which offers a high level of transparency and security.

On of the distinctive characters of blockchain is the absence of the need for intermediaries for transactions. Before blockchain, trust in transactions leaned heavily on intermediaries trusted by both parties.[123] However, blockchain disrupts this reliance by offering four key features: a ledger for transparent transactions, secure character of transactions, shared and verified transaction data across multiple nodes, and a distributed network architecture.[124] Eliminating intermediaries lead to more efficient and cost savings through automation and reduced paperwork, streamlining operations.

Another key feature of blockchain technology is its decentralization. Traditional centralized systems rely on a single authority to maintain and validate transactions. In contrast, blockchain operates on a peer-to-peer network, where each participant, or node, maintains a copy of the ledger.[125] Transactions are validated through a consensus mechanism, which is the protocol or set of rules that ensures all the computers in the network agree on the validity of transactions.[126] This mechanism ensures agreement among the network participants before adding them to the blockchain and can be compared to signing a contract in legal terms. The decentralized nature, and consensus mechanism within blockchain, makes it resistant to hacking attempts, as altering the data on one node requires consensus among the entire networks.[127]

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[122] Marc Pilkington, 'Blockchain Technology: Principles and Applications' (18 September 2015), p. 6 <https://papers.ssrn.com/abstract=2662660> accessed 7 May 2024.
[123] Yaga and others (n 16) p. 6.
[124] ibid.
[125] Satarupa Saha, Bappaditya Jana and Jayanta Poray, 'A Study on Blockchain Technology' (15 October 2019) <https://papers.ssrn.com/abstract=3477373> accessed 7 May 2024, p. 4.
[126] ibid.
[127] 'Blockchain Technology and Its Transformative Potential for the Legal Industry | Emory Lawyer' (n 120).

Another important aspect, which blockchain technology offers, is transparency across transactions. Since the ledger is distributed across multiple nodes, anyone with access to the network can view the transaction history.[128] Such transparency helps to prevent fraud and corruption by enabling stakeholders to verify the integrity of the data.

As to the classification of blockchains, they can be classified based on network publicity. Public blockchains are open-source, with no centralized owner, allowing anyone to access and participate in the network.[129] In contrast, private or "permissioned" blockchains run on private software owned by an entity, restricting network access to selected users chosen by the owner or consortium.[130] Particularly, it means that only authorized users can read or write on the blockchain, limiting accessibility compared to public blockchains.

Smart contracts

In addition to its core features, blockchain technology can be customized to meet the specific requirements of different applications. One of examples of such customized technologies is smart contracts. Smart contracts are self-executing contracts with the terms of the agreement written directly into code.[131] They run on blockchain networks and automatically execute actions when predefined conditions are met. Essentially, they are programmable contracts that facilitate, verify, or enforce the negotiation or performance of an agreement, without the need for intermediaries. Communication among smart contract participants is securely authenticated and transmitted through encryption.[132] This automated contract offers benefits by enabling parties to enforce terms, thereby mitigating risks of malicious behavior, distrust, and reducing intermediary costs.[133] Smart contracts facilitate diverse business processes, asset exchanges, and deals, customized based on parties' cooperation level and desired outcomes.

An essential feature of smart contracts is blockchain oracles, acting as intermediaries between blockchains and external data sources. Blockchain oracles facilitate access to off-chain data crucial

[128] Yaga and others (n 16).
[129] Pilkington (n 122).
[130] ibid.
[131] Lennart Ante, 'Smart Contracts on the Blockchain – A Bibliometric Analysis and Review' (15 April 2020) <https://papers.ssrn.com/abstract=3576393> accessed 16 May 2023.
[132] Tharika Lamappulage Donn, 'Smart Contracts and International Trade: European Legal Strategies for Managing Challenges' (2023) 1 Journal of Digital Technologies and Law 1042.
[133] Marie-Françoise Mbaye, 'The Application of Blockchain for the Intellectual Property Protection' (Master Thesis, Lund University 2020).

for executing contractual agreements, broadening the scope of smart contract functionality within the blockchain ecosystem.[134] Oracles operate by querying, verifying, and authenticating external data, transmitting diverse forms of external information to smart contracts.[135] Without oracles, smart contracts would be limited to accessing only on-chain data, restricting their utility. While not the data source itself, oracles play a crucial role in relaying information such as payment completions or sensor measurements.[136] Invocation of smart contracts and allocation of network resources are required to access external data, with some oracles capable of bidirectional data transmission.[137]

Legal status of blockchains in the EU

First off, it should be mentioned that despite the increasing popularity of blockchain technology within the business landscape, EU has not yet introduced legislation regarding the legality and legal status of blockchains, leaving these aspects surrounded by uncertainties. Despite this absence of specific regulations, both the EU Parliament and Commission have underscored the significance of blockchain across various sectors. Thus, the European Parliament, in its resolutions of 2018, acknowledges the transformative potential of blockchain in addressing trade challenges, advocating for an innovation-friendly regulatory approach to implement its benefits.[138] As per the resolutions, by fostering a supportive regulatory environment, policymakers aim to encourage experimentation and adoption of blockchain solutions, with a focus on enhancing transparency, traceability, and integrity within the EU market.[139]

Additionally, in 2023, the EU Commission took a significant step by adopting a comprehensive legislative package aimed at regulating crypto-assets, seeking to enhance investments and safeguard consumer and investor interests. Within this package, the Commission emphasized the importance of legal certainty and a clear regulatory framework for blockchain-based applications, highlighting the need for harmonized EU-wide rules to prevent regulatory fragmentation.[140]

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[134] Abdeljalil Beniiche, *A Study of Blockchain Oracles* (2020).
[135] ibid.
[136] Mbaye (n 133).
[137] Beniiche (n 134).
[138] 'European Parliament Resolution of 13 December 2018 on Blockchain: A Forward-Looking Trade Policy (2018/2085(INI))'.
[139] ibid.
[140] 'Legal and Regulatory Framework for Blockchain | Shaping Europe's Digital Future' (27 September 2023) <https://digital-strategy.ec.europa.eu/en/policies/regulatory-framework-blockchain> accessed 8 May 2024.

Notably, the package introduced the European Blockchain Regulatory Sandbox (EBRS), embedded within the broader European Blockchain Services Infrastructure.[141] The EBRS serves as a platform for fostering dialogue between regulators and companies, offering legal certainty for blockchain projects.[142] Its primary objective is to provide a regulatory framework conducive to rapid technological innovation, facilitating cross-border dialogue between regulators and industry players.[143] The EBRS annually supports up to 20 projects, including those in the public sector. Participants encompass companies from diverse sectors and public entities, with projects utilizing DLT beyond the proof-of-concept stage.[144]

Another regulatory document shaping the legal status of blockchains is the DLT Regulation of 2022, primarily focusing on financial activities. This regulation introduces a pilot regime allowing market infrastructures to leverage DLT for trading and settling securities transactions within the EU. Under the pilot regime, market infrastructures can seek exemptions from certain financial regulations to foster DLT development while ensuring investor protection, transparency, and market integrity.[145] Entities subject to EU financial services legislation, such as investment firms or central securities depositories, can apply for authorization to operate a DLT market infrastructure.[146] The pilot regime operates for up to six years, with stringent liability provisions, stringent requirements, and evaluations enforced to maintain market integrity and safeguard investor interests.[147]

The Data Act is another regulation relevant to blockchain. The Data Act is the EU's first legislation regarding IoT (devices and imposes specific requirements for users and vendors of smart contracts in the EU.[148] Smart contract is defined in the regulation as “computer program used for the

[141] ibid.
[142] ‘Launch of the European Blockchain Regulatory Sandbox | Shaping Europe’s Digital Future’ (14 February 2023) <https://digital-strategy.ec.europa.eu/en/news/launch-european-blockchain-regulatory-sandbox> accessed 8 May 2024.
[143] ibid.
[144] ibid.
[145] Regulation (EU) of the European Parliament and of the Council of 30 May 2022 on a pilot regime for market infrastructures based on distributed ledger technology, and amending Regulations (EU) No 600/2014 and (EU) No 909/2014 and Directive 2014/65/EU [2022/858] (DLT Regulation 2022), art. 4.
[146] DLT Regulation 2022, art. 4.
[147] DLT Regulation 2022, rec. 48.
[148] Jan Kramer and others, ‘DATA ACT: TOWARDS A BALANCED EU DATA REGULATION’ (Centre on Regulation in Europe 2023).

automated execution of an agreement or part thereof, using a sequence of electronic data records and ensuring their integrity and the accuracy of their chronological ordering".[149]

The requirements imposed on vendors utilizing smart contracts for data sharing include ensuring robustness and access control to prevent errors and manipulation, implementing data archiving for continuity, enforcing access control mechanisms, and maintaining consistency with data sharing agreement terms.[150] Additionally, smart contracts must include a "kill switch" mechanism to terminate execution of transactions in case of accidents, data breaches, or attacks.[151] This mechanism enables halting transactions and includes functions to reset or stop the contract to prevent future accidental executions.

3.2. Blockchain Applications for sustainability solutions

Blockchain as corporate governance tool

The application of blockchain for corporate governance has been lauded as an innovative solution by some while criticized by others as a utopian vision.[152] Advantages which blockchain offers for corporate governance include, *inter alia*, enhancing the issuing and trading of corporate securities on blockchains and making voting in corporate elections more transparent and efficient.

Particularly, traditional corporate governance relies on centralized organizations with hierarchical relationships among shareholders, the board of directors, corporate management, and employees.[153] This structure poses risks of opportunistic behavior by corporate management due to information asymmetry and shareholder coordination problems. In contrast, blockchain enables the establishment of decentralized autonomous organizations (DAOs) that operate without hierarchical structures.[154] DAOs are community-driven organizations powered by blockchain technology, connecting creators and users directly. In a DAO, governance is established by the founding community through smart contracts, tokens, and governance conditions for voting and

[149] Regulation (EU) of the European Parliament and of the Council of 13 December 2023 on harmonised rules on fair access to and use of data and amending Regulation (EU) 2017/2394 and Directive (EU) 2020/1828 [2023/2854] (Data Act 2023), article 2(39).
[150] Data Act 2023, article 36.
[151] ibid.
[152] Anna Lafarre and Christoph Van der Elst, 'The Viability of Blockchain in Corporate Governance' (Tillburg University 2023), p. 2.
[153] ibid. p. 6
[154] Kaal and Law (Minneapolis) (n 18) p. 4.

proposals.[155] Governance rights are distributed among participants holding governance tokens, enabling them to propose and vote on actions for the DAO.[156] Smart contracts execute proposals meeting predetermined conditions, ensuring democratic decision-making and accountability.

DAOs offer several advantages for corporate governance. Firstly, power is decentralized within DAOs, unlike in traditional corporate governance, again leading to a more democratic decision-making process.[157] Secondly, DAOs allow for global participation of shareholders, transcending geographical limitations and fostering diversity of perspectives.[158] This global reach is particularly beneficial for listed companies with shareholders from diverse regions. Additionally, all transactions and voting in DAOs are transparently recorded on the blockchain, promoting trust and accountability among stakeholders.[159] This transparency contrasts with the opaque decision-making processes often found in traditional corporate setups. Finally, DAOs streamline bureaucratic processes through smart contracts, automating administrative tasks and enabling more efficient operations.[160] Moreover, investors in DAOs are frequently participants themselves, directly engaged in governance through token ownership. This alignment of interests between investors and operators has the potential to enhance value creation in a sustainable and long-term manner.

It is worth noting that The Shareholder Rights Directive II within the EU has advocated for the adoption of blockchain technology to enhance shareholder involvement in corporate governance processes.[161] This friendly approach towards blockchain stems from its potential to improve shareholder voting process, fostering greater transparency, accuracy, and cost-effectiveness. Moreover, blockchain facilitates direct communication channels between issuers and shareholders, leading to more timely and meaningful engagement.[162]

[155] Lafarre and Van der Elst (n 152) p 7.
[156] 'DAOs and the Future of Corporate Governance' <https://www.fanews.co.za/cryptocurrencies-blockchain/1407/general/1408/daos-and-the-future-of-corporate-governance/38488> accessed 8 May 2024.
[157] Lafarre and Van der Elst (n 152) p. 10.
[158] 'DAOs and the Future of Corporate Governance' (n 156).
[159] Lafarre and Van der Elst (n 152) p. 10.
[160] 'DAOs and the Future of Corporate Governance' (n 156).
[161] Directive (EU) 2017/828 of the European Parliament and of the Council of 17 May 2017 amending Directive 2007/36/EC as regards the encouragement of long-term shareholder engagement (Text with EEA relevance) 2017, rec. 48.
[162] Yusuf and others (n 17) p. 930.

Furthermore, blockchain's utility extends beyond shareholder voting to encompass broader stakeholder engagement in corporate decision-making. Similar to shareholders, other stakeholders can utilize blockchain for advisory roles, thereby contributing to the decision-making process within companies.[163] The collaborative approach taken in blockchain-based corporate governance enables stakeholders to present proposals directly to corporate boards after achieving a consensus.[164] Such an approach would lead to effective changes in how decisions are made within companies. This is particularly relevant in the realm of ESG due diligence and reporting. Thus, corporate board can also use blockchain to directly consult stakeholders on ESG matters, which lead to more quick and transparent sustainability governance. Additionally, blockchain strengthens communication between institutional investors and beneficiaries, which is also important in sustainability governance.[165] Transparent interaction between investors and asset managers facilitates informed decision-making and ensures alignment with stakeholders' interests.

While blockchain offers significant benefits for corporate governance and stakeholder engagement, there are notable drawbacks to its application. Foremost among these is the legal uncertainty surrounding the legal status of DAOs in the EU and liability issues within them.[166] The lack of established regulations for blockchains at the EU level may result in varying interpretations of DAOs as a legal entity, potentially leading to DAO participants being treated as general partners in a partnership lacking formal legal structure.[167] This ambiguity complicates compliance issues, particularly concerning reporting and due diligence matters. Another challenge in implementing blockchain for corporate governance is the dilemma regarding data privacy and security of blockchains.[168] Striking a balance between blockchain's inherent transparency and immutability and the requirements of data protection laws poses significant difficulties,[169] while depending heavily on technology may raise concerns about security and the risk of systemic failures.[170] Finally, despite blockchain's decentralized foundation, certain implementations may exhibit centralized features, which undermine its fundamental principles. Centralization can take diverse

[163] Lafarre and Van der Elst (n 152) p. 19.
[164] ibid.
[165] Yusuf and others (n 17) p. 931.
[166] 'DAOs and the Future of Corporate Governance' (n 156).
[167] Lafarre and Van der Elst (n 152) p. 10.
[168] Kaal and Law (Minneapolis) (n 18) p. 17.
[169] ibid.
[170] 'DAOs and the Future of Corporate Governance' (n 156).

forms, such as control concentrated among a select few stakeholders, governance structures favoring specific participants, and technical designs relying on centralized intermediaries for transaction validation or data storage.[171] This deviation from decentralization not only contradicts blockchain's ethos but also introduces risks like censorship, manipulation, and collusion.

Blockchain in supply chain management

The supply chain is the primary non-financial use of blockchain technology, and it is becoming more widely recognized as a powerful tool for sustainable supply chain management in business settings.[172] This recognition mostly arises from the fact that data on blockchain is available to all users, coupled with the absence of concentrated power in the hands of any single participant.

One of the primary benefits of blockchain in sustainable supply chain management is its capacity to promote transparency. Transparency is crucial for establishing accountability and trust among various stakeholders in the supply chain, including suppliers, manufacturers, distributors, and consumers. Traditional supply chains often suffer from a lack of transparency, particularly concerning product origins, authenticity verification, and adherence to sustainability standards.[173] However, by leveraging its decentralized and immutable ledger, which records every transaction or event in the supply chain, blockchain proves to be an effective tool in ensuring transparency throughout the entire chain.[174] Such transparency empowers stakeholders to access real-time information regarding the movement, production, and sourcing of goods, thereby facilitating enhanced visibility and accountability.[175] Additionally, this transparency allows blockchain's application in the supply chain to address various aspects of ESG performance, including, *inter alia*, environmental impact, ethical sourcing, and fair labor practices. For instance, by tracing the entire journey of raw materials from their source to the finished product, blockchain offers consumers confidence in the sustainability and ethical standards of the supply chain.[176] Finally, the transparency facilitated by blockchain can highlight areas for improvement, such as reducing

[171] Lafarre and Van der Elst (n 152).
[172] Paliwal, Chandra and Sharma (n 20) p. 15.
[173] Lucas Antonio Risso and others, 'Present and Future Perspectives of Blockchain in Supply Chain Management: A Review of Reviews and Research Agenda' (2023) 179 Computers & Industrial Engineering 109195.
[174] European Parliament (n 19).
[175] Berg and Myllyma (n 25).
[176] Rejeb and others (n 20) p. 19.

carbon footprints, minimizing waste generation, and guaranteeing equitable treatment of workers across the supply chain.[177]

Blockchain's transparency in transactions also facilitates traceability, which is another aspect of supply chain management that blockchain technology can enhance. Traditionally, tracking the movement and origin of products or materials across the supply chain has been challenging due to the complexity of global supply chains and the lack of interoperability between different systems and databases.[178] However, blockchain's decentralized and tamper-proof ledger system enables seamless traceability by recording every transaction or event in an immutable manner. Therefore, companies can leverage blockchain to authenticate and trace the origin of products, while also ensuring compliance with sustainability standards and certifications.[179] Moreover, blockchain can assist in identifying and resolving issues such as product recalls, counterfeit products, and supply chain disruptions, thereby enhancing overall supply chain resilience and reliability.[180]

Furthermore, blockchain's transparency and traceability features empower companies to enhance their ESG performance in terms of social responsibility and environmental impact. As companies endeavor to minimize their environmental footprint and adopt more sustainable practices, blockchain offers a robust platform for tracking and managing environmental data across the supply chain. Thus, by integrating blockchain, companies can improve their capacity to measure, monitor, and report on their environmental impact.[181] This, at the same time, enables companies to make well-informed decisions regarding resource utilization, waste management, and sustainability initiatives, ultimately leading to reduced environmental harm.[182]

Moreover, blockchain can help companies in tracking and verifying social responsibility practices throughout the supply chain. Social responsibility entails ensuring equitable and ethical treatment of workers, suppliers, and communities across the supply chain. A key feature of blockchain application in terms of social responsibility presented in recording and verifying data related to labor conditions, and community impact, providing stakeholders with assurance that ethical

[177] Pîrvu and others (n 119) p. 17.
[178] European Parliament (n 19).
[179] Paliwal, Chandra and Sharma (n 24).
[180] ibid.
[181] Berg and Myllyma (n 25).
[182] ibid.

standards are upheld.[183] In addition, blockchain can streamline the implementation of smart contracts that automatically enforce social responsibility requirements and penalties, thereby ensuring adherence to sustainability standards.[184]

However, blockchain, at the same time, also presents certain problems in supply chain management. One of them is interdisciplinary collaboration, essential for leveraging technologies like IoT alongside blockchain.[185] Blockchain, in its turn, lacks thorough exploration in such collaboration, which hinders integration and limits the technology's effectiveness. Moreover, economic feasibility poses another challenge, particularly for SMEs. Thus, the high upfront costs associated with blockchain implementation, coupled with uncertain return on investment prospects, pose significant barriers.[186] Additionally, regulatory compliance further complicates adoption of blockchain, with varying regulations across regions creating barriers to standardization.[187] Without clear guidelines and governance structures, achieving industry-wide adoption becomes unclear.

Blockchain in financial reporting

Blockchain technology has emerged as a transformative solution to the persistent challenges of accuracy, integrity, and trust in financial reporting. Its primary benefits revolve around improving report accuracy, reducing fraud errors, simplifying certification procedures, and enhancing data validation. One of its key features is immutability, ensuring the permanent recording of financial transactions and safeguarding the integrity of financial data.[188] This addresses a longstanding issue in financial reporting, where data integrity and accuracy are crucial. With blockchain, authorized network users can promptly access and verify transactions, minimizing data conflicts and ensuring that financial reports always reflect the latest data.[189] Consequently, financial statements generated using blockchain data are inherently more reliable and trustworthy, serving as a dependable source for decision-making.

[183] Paliwal, Chandra and Sharma (n 20) p.15.
[184] ibid.
[185] Risso and others (n 178) p.10.
[186] Rejeb and others (n 20) p. 23.
[187] ibid.
[188] Kassem Danach and others, 'Assessing the Impact of Blockchain Technology on Financial Reporting and Audit Practices' (2024) Vol. 9 30, p. 31.
[189] ibid.

Furthermore, blockchain technology streamlines certification processes by providing auditors with a transparent and secure environment to validate financial facts.[190] Auditors can easily access blockchain ledgers to confirm transaction accuracy, thereby enhancing the efficiency of financial statement audits.[191] This simplification of certification procedures reduces audit time and resources, leading to cost savings for companies. Moreover, simplified certification fosters greater transparency and trust in financial reporting, improving the sustainability performance of companies.[192] By producing accurate and reliable financial statements, companies can demonstrate their commitment to ethical business practices and responsible financial management.

Lastly, blockchain enables secure and reliable data validation, strengthening financial reporting by instilling confidence in the information stored on the blockchain. Investors, regulators, and other stakeholders can rely on blockchain technology to verify the accuracy and integrity of financial reports, promoting transparency and accountability in financial reporting practices.[193] This validation not only enhances the reliability of financial reporting but also contributes to the sustainability performance of companies. By providing stakeholders with precise and transparent financial information, companies can showcase their dedication to responsible corporate governance and sustainable business practices.

Therefore, blockchain technology offers substantial benefits for financial reporting. These advantages not only enhance the reliability of financial reporting but also support the sustainability performance of companies by promoting transparency, accountability, and responsible financial management practices.

At the same time, blockchain technology also presents several challenges and disadvantages for financial reporting. One major obstacle is the complexity of integration, which can be resource-intensive and require significant upgrades to existing systems.[194] This complexity arises from the need to ensure smooth data flow between blockchain and traditional databases, as well as compatibility issues.[195] Additionally, blockchain's transparency may conflict with data privacy

[190] Chowdhury, Stasi and Pellegrino (n 21) p. 866.
[191] ibid.
[192] Luis Leon and Adnan Tuffaha, 'Application of Blockchain Technology in the Financial Services Industry Perspectives from the Big Four' (Lund University 2022).
[193] ibid.
[194] ibid.
[195] ibid.

laws, posing risks to sensitive financial information. Thus, the dynamic nature of standards and regulatory frameworks adds a layer of complexity, as global regulatory agencies are still adapting to blockchain technology in financial reporting.[196] This is particularly relevant as companies must adhere to Know Your Customer and Anti-Money Laundering laws while preserving data and network security.[197] These disadvantages underscore the need for careful consideration and strategic planning when implementing blockchain technology in financial reporting practices.

Conclusion

In essence, blockchain is a decentralized and distributed ledger system facilitating the recording, storage, and sharing of data across a network of computers. Its core principles of transparency and security make altering or deleting recorded transactions extremely challenging. Additionally, the concept of smart contracts, a tailored technology within blockchain, enhances its functionality. However, due to its novelty, the legal status of blockchain remains subject to ongoing discussions and inquiries. Despite the uncertainty of legal status, the EU showed it support of blockchain applications in corporate settings. Particularly, initiatives like EBRS promote direct dialogue between companies and lawmakers, aiding in clarifying the legal framework. Moreover, the DLT regulation offers guidance on financial aspects for blockchain undertakings, although sustainability reporting regulations are not explicitly covered.

Blockchain offers numerous advantages for companies across various aspects of operations. Enhanced transparency and decentralization improve corporate governance by streamlining voting procedures and facilitating stakeholder engagement, crucial for democratic decision-making and sustainability performance. In supply chain management, transparency enables the traceability of goods and information, addressing critical issues like environmental impact and social responsibility throughout the value chain. Similarly, in financial reporting, blockchain's transparency ensures more accurate records, minimizing errors and fraud. Additionally, its data collection and storage capabilities streamline processes in supply chain management and financial reporting, simplifying data validation and addressing interoperability challenges.

The primary drawback of blockchain pertains to the regulatory framework and insufficient legislation, leading to uncertainties across all discussed areas of company activities in terms of

[196] Sheela and others (n 22).
[197] ibid.

data protection matters and regulatory compliance. Moreover, blockchain faces a challenge of trust among stakeholders because of its technological complexity, thereby limiting its adoption by companies and posing an additional hurdle for those that have already implemented blockchain technology.

4. LEGAL ANALYSIS OF BLOCKCHAIN IN EU SUSTAINABILITY REPORTING

Introduction

Having established an understanding of the EU framework on sustainability reporting and provided an overview of blockchain in the corporate environment, we can now examine the intersection of these two areas. Consequently, this chapter analyzes the characteristics and features of blockchain technology within the context of EU sustainability reporting from a legal perspective. It focuses on the challenges posed by the EU framework for corporate sustainability reporting and aims to assess how blockchain technology aligns with EU sustainability regulations.

The chapter begins by examining the legal challenges presented by the EU framework and explores how blockchain can aid businesses in complying with sustainability reporting regulations. Additionally, it assesses the drawbacks of blockchain from a legal standpoint, particularly in relation to EU sustainability reporting. This involves evaluating blockchain's role in various areas of EU law and its impact on sustainability reporting obligations. To provide a comprehensive understanding and support the analysis, general principles of EU legislation and interpretations by the ECJ will be utilized.

4.1 Blockchain for legal challenges under EU framework for sustainability reporting

Harmonization of rules

As previously discussed, the absence of standardized and harmonized regulations for sustainability reporting within the European Union often causes confusion among companies regarding the scope and specifics of their reporting obligations. To mitigate this confusion, blockchain technology can serve as a valuable tool, particularly through the implementation of smart contracts.

Firstly, companies can utilize smart contracts to encode regulatory standards and reporting requirements into the blockchain network.[198] For instance, a company operating in multiple EU jurisdictions can customize smart contracts to reflect the specific reporting obligations applicable to its operations in each jurisdiction. As transactions occur on the blockchain, smart contracts automatically ensure compliance with the predefined standards, thereby promoting consistency and harmonization across reporting practices.[199] In essence, while there may not be consistent

[198] Maitrayee Pathak, 'Smart Compliance: Smart Contracts for Financial Regulatory Compliance' (3 February 2024) <https://papers.ssrn.com/abstract=4715505> accessed 10 May 2024.
[199] ibid.

legislation governing sustainability reporting across companies, those utilizing blockchain technology have the ability to preset all the criteria and regulations for reporting within smart contracts. These contracts can then automatically apply the relevant standards based on a company's activities and transactions recorded on the blockchain, thus streamlining the reporting process.[200]

Additionally, blockchain's transparency and real-time data availability enable enhanced monitoring of transactions, aiding in the detection of suspicious activities or red flags.[201] By leveraging blockchain for regulatory risk management, companies can implement real-time transaction tracking, allowing compliance teams to promptly identify and address potential compliance issues or fraudulent activities.[202] Such assistance can further lead to more effective tracking of the extensive regulations within the EU.

Finally, blockchain facilitates real-time reconciliation among market participants by enabling shared access to common datasets. As transactions are recorded on the blockchain ledger, reconciliation occurs simultaneously among all participating nodes, minimizing discrepancies and disputes.[203] This real-time data availability enhances settlement operations and accounting data reconciliation, contributing to streamlined reporting processes and increased efficiency. Additionally, blockchain-based platforms offer companies access to standardized templates, guidelines, and reporting tools, reducing the burden of compliance, and providing clarity regarding reporting obligations.[204] Through these platforms, companies can align their reporting practices with industry best practices and regulatory requirements, fostering harmonization across the reporting landscape.[205]

However, it is essential to keep in mind that blockchain, like any technology, is not immune to vulnerabilities and errors. Therefore, manual verification of blockchain-generated results may be necessary to ensure accuracy and reliability. Additionally, the role of blockchain in harmonizing

[200] Chirag Bhardwaj, 'How Enterprises Can Ensure Compliance Using Blockchain' (*Appinventiv*, 28 July 2023) <https://appinventiv.com/blog/enterprises-compliance-using-blockchain/> accessed 10 May 2024.
[201] ibid.
[202] Ashish Jadhav, 'Blockchain Based Compliance Management System'.
[203] ibid.
[204] Susan Lin, 'Corporate Sustainability Reporting And Blockchain' (*The FinReg Blog*, 10 January 2024) <https://sites.duke.edu/thefinregblog/2024/01/10/corporate-sustainability-reporting-and-blockchain/> accessed 3 May 2024.
[205] ibid.

rules is still largely theoretical, and practical challenges such as scalability, interoperability, and regulatory acceptance need to be addressed for widespread adoption.

Double materiality assessment

Both ESRS and CSRD emphasize the need for double materiality assessment in sustainability reporting inside the EU. This assessment serves as the cornerstone for sustainability reporting, but it carries a great deal of legal risk, especially when it comes to the ambiguity surrounding the application of legal concepts like "negligence" and "intent." These concerns are especially pertinent when it comes to corporate greenwashing.

A critical aspect of this legal risk is connected to the correct engagement of stakeholders. Insufficient involvement from stakeholders may result in the disregard or omission of important matters that hold significance for these stakeholders.[206] For example, a company might prioritize certain sustainability metrics without adequately considering the perspectives of local communities affected by its operations.[207] In this context, blockchain technology proves effective for identifying and ensuring proper engagement with relevant stakeholders. In particular, since blockchain technology is decentralized, each node on the network has an equal amount of authority to approve and reject transactions. This is especially helpful for sustainability reporting due to the fact that correct identification of material concerns in double materiality assessment involves input from several stakeholders.[208] Thus, identifying applicable stakeholders can be done through smart contracts, which can be pre-coded to highlight transactions to relevant stakeholders based on predefined conditions in the smart contract. With the complicated relationships among all parties involved in the value chain, such pre-coded automation may help businesses avoid the difficulties of manually identifying stakeholders.[209]

Furthermore, blockchain technology makes direct communication between businesses and stakeholders possible. Each relevant stakeholder can see all transactions made on the blockchain and trust that these transactions have not been altered, due to the blockchain's immutable nature.[210]

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[206] Team IRIS CARBON, 'Sustainability Reporting Challenges: Where Companies Often Miss the Mark' (*IRIS CARBON®*, 9 November 2023) <https://www.iriscarbon.com/sustainability-reporting-challenges-where-companies-often-miss-the-mark/> accessed 15 May 2024.
[207] ibid.
[208] Mezzanotte (n 14) p. 11.
[209] Berg and Myllyma (n 25).
[210] Jadhav (n 202).

This transparency ensures that stakeholders view accurate transaction data related to a company's ESG performance and can verify its potential impact on society and the environment. As a result, this procedure helps businesses use this verification for financial materiality evaluations, which is analyzing how transactions affect the business as a whole, in addition to supporting the identification of major consequences. In addition, blockchain can also assist businesses in avoiding unintentional breaches of ESG rules. While blockchain itself cannot interpret legal concepts like "negligence" or "intent," nor differentiate between negligence and gross negligence, it can assist in determining if a transaction that is recorded on the blockchain—which is essentially a real-time activity of the company — may have an effect on society. This identification process involves verification and direct dialogue with stakeholders,[211] which can reveal issues that might at first glance be deemed as non-breaching of sustainability performance obligations. Therefore, blockchain may help companies to consider potential impacts that might otherwise be overlooked.

Stakeholder interaction and double materiality evaluation can therefore be supported by blockchain technology's decentralized, transparent, and irreversible nature. It may ensure that all relevant stakeholders are properly identified and engaged, which is crucial for comprehensive and accurate sustainability reporting. Moreover, by facilitating real-time tracking and verification of data, blockchain helps companies avoid unintentional breaches and negligent acts in their sustainability performance. The capacity of all stakeholders to view and validate transactions guarantees the transparency and reliability of the company's ESG initiatives, promoting increased responsibility and confidence in the reported data.[212]

Double materiality assessment under the EU framework on sustainability reporting also requires extensive data collection, posing significant resource management challenges and administrative burdens. To properly assess both financial materiality and impact materiality, companies need accurate and vast amounts of data. The problem of extensive data collection for double materiality assessment presents issues in two main aspects: implementing effective data collection methods and ensuring the accuracy and reliability of the collected data.[213]

[211] Yusuf and others (n 17) p. 928.
[212] Leon and Tuffaha (n 192).
[213] European Commission, 'Study on Sustainability-Related Ratings, Data and Research' (European Commission 2020) <https://op.europa.eu/en/publication-detail/-/publication/d7d85036-509c-11eb-b59f-01aa75ed71a1>.

Ensuring data accuracy and reliability is particularly challenging for companies within complex value chains.[214] A company's evaluation of its own ESG performance may be distorted by inaccurate data from other value chain actors,[215] which might result in the withholding of important financial and non-financial information that is required under the present EU framework. For instance, without accurate data from stakeholders, it is impossible to appropriately identify and disclose environmental impact disclosures under the Taxonomy Regulation or ESG risks under the CRR II Pillar 3 disclosure obligations. As a result, failing to ensure data correctness across the value chain may result in negligent acts of breaches of the EU framework on sustainability reporting obligations. In these regards, blockchain technology can be deemed helpful in addressing these challenges. In particular, once this data is tracked, blockchain smart contracts can automate the process of collecting the relevant data from every node on the network. This implies that smart contracts can eliminate manual data collection and administrative hassles by automatically gathering all necessary data from stakeholders in accordance with predetermined circumstances.[216] Furthermore, data cannot be changed by any node within the blockchain after it has been recorded due to the tamper-proof nature of blockchain technology. This ensures the accuracy and reliability of the original data.

However, it is important to note that this only applies to data imported into the blockchain for transactions within the blockchain. Some data may not be imported if it is not needed for a transaction. In this context, blockchain oracles play a crucial role. Oracles ensure that all external data is taken into account within the blockchain by connecting it to external data sources.[217] This makes detailed data accessible to all participants, including those which must report under the CSRD.

Benefits for SMEs

All of the above-mentioned benefits are highly applicable to SMEs. However, beyond those, blockchain technology offers additional significant advantages to SMEs in their sustainability reporting efforts.

[214] S Asieh Hosseini Tabaghdehi and Hossein Kalatian, 'Trust in the Global Value Chain in the Digital Era' (2022) 31 Strategic Change 129, p. 130.
[215] ibid.
[216] Lafarre and Van der Elst (n 152) p. 8.
[217] Beniiche (n 134).

First off, by automating data verification and validation, blockchain may eliminate bureaucracy and expedite operations, saving SMEs time and resources. Additionally, by offering clear and dependable data on SMEs' sustainability performance, blockchain helps overcome information asymmetry and enhances SMEs' relationships with banks and potential investors.[218] This, in its turn, facilitates sustainability reporting within SMEs' value chains by enabling secure and transparent data sharing among stakeholders, which also enhances supply chain visibility and accountability.[219] Finally, blockchain can help SMEs by offering affordable and easily accessible ways to fulfill their sustainability reporting requirements. Since SMEs often lack the knowledge and resources to implement complex reporting frameworks, blockchain offers a user-friendly and efficient way to track, verify, and report sustainability data, empowering SMEs to demonstrate their commitment to overall ESG principles, and particularly regarding sustainability reporting obligations, effectively.

4.2 Drawbacks of blockchain application for corporate sustainability reporting.

Blockchain and corporate law

Utilizing blockchain technology for sustainability reporting offers numerous advantages, yet its implementation faces a significant challenge due to inadequate legislation regarding the legal status of blockchain in the EU. There is legal uncertainty as a result of this legislative gap in many areas of company operations. As detailed earlier in this thesis, blockchain facilitates enhanced communication among all stakeholders of a company, a crucial aspect for sustainability reporting, particularly through the establishment of DAOs on the blockchain. However, there is still uncertainty around the legal status of DAOs as an entity within the EU due to a lack of defined regulations.

Examining the practices of different countries reveals diverse treatments of DAOs in blockchain. The most common way that DAOs are treated is treating them like general partnerships.[220] For example, a Federal Court decision in the United States decided that members of DAOs can be

[218] Hengxi Chen, 'Blockchain Technology and Small and Medium Enterprises Access to Finance' (2023) 8 Advances in Economics, Management and Political Sciences 139, p. 142.
[219] ibid.
[220] Lafarre and Van der Elst (n 152) p.10.

regarded as general partners and so be liable jointly and severally.[221] In a general partnership, partners collectively conduct a trade based on a partnership agreement, with personal liability for the partnership's debts and obligations.[222] Reviewing EU case law concerning the liability of general partners, it becomes evident from rulings such as *Finanzamt Saarlouis v. Heinz Malburg*[223] and *Kopalnia Odkrywkowa*[224], that the European Court of Justice has explicitly stated that general partners may bear personal responsibility for a partnership's obligations (value added tax debts specifically in these cases).

The combination of interpreting DAOs as partnerships and the European Court of Justice's approach on the liability of general partners presents a significant challenge concerning the sustainability reporting obligations of companies. The interpretation presents difficulties for reporting on sustainability, particularly in relation to non-compliance to the CSRD. Member states are required under the CSRD to impose sanctions for non-compliance, such as administrative fines, cease-and-desist orders, and public announcements of violations.[225] Interpreting DAOs as general partnerships similar to the US model could lead to varying liability for CSRD non-compliance compared to traditional hierarchical corporate structures. The question arises whether the DAO itself or its management bodies, together with certain stakeholders acting as general partners, would be liable for CSRD-related penalties.

As an alternative, DAOs are acknowledged as distinct legal entities in several jurisdictions. For example, Switzerland has established a legal framework that permits the establishment and operation of Decentralized Autonomous Associations, which are nonprofit DAOs under Swiss law.[226] The State of Wyoming also approved a statute providing limited liability status to DAOs.[227]

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[221] 'Federal Court Holds DAO Members Can Be Treated as Ge...' <https://www.dechert.com/knowledge/onpoint/2023/4/federal-court-holds-dao-members-can-be-treated-as-general-partne.html/1715864781970> accessed 16 May 2024.
[222] 'What's the Difference Between a General Partner and a Limited Partner?' <https://www.roundtable.eu/learn/whats-the-difference-between-a-general-partner-and-a-limited-partner> accessed 16 May 2024.
[223] Case C-204/13 *Finanzamt Saarlouis v Heinz Malburg* [2014] ECJ.
[224] Case C-280/10 *Kopalnia Odkrywkowa Polski Trawertyn P Granatowicz, M Wąsiewicz spółka jawna v Dyrektor Izby Skarbowej w Poznaniu* [2012] ECJ.
[225] 'The Impact of CSRD on Your Organisation' <https://www.apiday.com/blog-posts/corporate-sustainability-reporting-directive-all-you-need-to-know> accessed 16 May 2024.
[226] 'Legal Aspects of Decentralized Autonomous Organisations (DAOs)' (*No More Tax*, 26 April 2022) <https://nomoretax.eu/legal-aspects-of-decentralized-autonomous-organisations-daos/> accessed 16 May 2024.
[227] ibid.

Such an approach of interpretating DAOs as separate legal entities distinct from traditional structures may also introduce uncertainties regarding a company's liability for failing to comply with sustainability regulations.

In both scenarios, the corporate structure of companies using blockchain may be affected and misinterpreted. Additionally, these interpretations, as well as any other taken by ECJ, may potentially impact liability of stakeholders in cases of regulatory non-compliance. Therefore, when considering blockchain for sustainability reporting practices, companies must also anticipate the potential approaches of EU legislators and courts regarding the legal status of blockchain to mitigate uncertainty regarding liability for non-compliance with sustainability reporting frameworks.

Blockchain and data protection

The liability of companies regarding personal data emerges as the most critical concern within the context of utilizing blockchain for sustainability reporting. With the increasing digitalization of corporate activities facilitated by blockchain technology, along with the corresponding expansion of data collection, management, and reporting, certain characteristics of blockchain introduce complexities that must be navigated to ensure compliance with data protection regulations and the safeguarding of sensitive information.[228]

One of the primary challenges encountered by companies utilizing blockchain for sustainability reporting lies in reconciling blockchain's transparency and immutability with data protection requirements.[229] Blockchain's transparent nature permits anyone to access transaction history, potentially exposing sensitive data related to individuals or communities affected by a company's operations. Furthermore, the immutability of blockchain presents difficulties for the right to be forgotten and data deletion. Right to be forgotten is provided by GDPR[230] and was acknowledged by ECJ was an individual human right in *Google v. Costeja case*[231] and was further developed in

[228] '(25) The Role of GDPR in the Corporate Sustainability Reporting Directive (CSRD) | LinkedIn' <https://www.linkedin.com/pulse/role-gdpr-corporate-sustainability-reporting-directive-csrd-oagnf/> accessed 16 May 2024.
[229] Michele Finck, 'Blockchains and Data Protection in the European Union' (*EDPL*, January 2018).
[230] REGULATION (EU) on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation) 2016 [216/679] (GDPR 2016), Art. 17(1).
[231] Case C-131/12*Google Spain SL and Google Inc v Agencia Española de Protección de Datos (AEPD) and Mario Costeja González* [2014] ECJ.

GC et al v. CNIL[232] and *CNIL v. Google*[233] cases. On the other hand, once data is recorded on a blockchain, it becomes practically impossible to modify or erase, potentially violating individuals' rights to control their personal information. The identification of data controllers and processors, as required by GDPR, in blockchain networks presents additional difficulties. In traditional centralized systems, organizations typically act as data controllers responsible for complying with data protection regulations. However, in blockchain networks, multiple participants collectively validate and maintain data, blurring the lines of accountability. Determining who bears responsibility as data controllers or processors becomes challenging, particularly in public blockchain networks where anyone can join and participate.[234]

In light of sustainability reporting obligations of the companies, all of the mentioned implications can adversely affect the assessment of a company's impact materiality. Thus, the exposure of the sensitive data of individuals, as well as violating the individual's rights for their data to be deleted or be forgotten may be regarded as a factor by which companies affect society. This, in its turn, may raise concerns about the role of this factor in impact materiality assessment. It is worth noting that the protection of sensitive personal data is a core principle of the GDPR[235], also aligning with the core objective of the social aspect of ESG rules.[236] Therefore, improper handling of sensitive data as well as violating individuals' rights under GDPR may not only affect the company's overall ESG performance, but also impose additional burdens on companies under the current reporting framework.

Smart contracts and conventional contract law

The incorporation of blockchain technology into traditional contract law, namely through smart contracts, poses many obstacles for businesses regarding sustainability reporting. One key issue is the ambiguous legal status of smart contracts in the EU due to insufficient legislation. While the Data Act offers some guidance on the essential functions of smart contracts, it fails to clearly

[232] Case C-136/17 *GC and Others v Commission nationale de l'informatique et des libertés (CNIL)* [2019] ECJ.
[233] Joined Cases C-682/18 and C-683/18 *Frank Peterson v Google LLC and Others and Elsevier Incv Cyando AG* [2021] An Chúirt Bhreithiúnais.
[234] Finck (n 229).
[235] GDPR 2016, Art. 1.
[236] Amira Nabila Budiyano and Johnatan Kao, 'DATA PROTECTION AS PART OF AN ENVIRONMENTAL, SOCIAL AND GOVERNANCE FRAMEWORK' [2021] Personal Data Protection Digest.

define their legal standing and role within traditional contract law. When using smart contracts in a corporate setting, this uncertainty might raise important questions and challenges.

A primary concern is the potential conflict of smart contracts with the principle of freedom of contract, which is vital for ESG performance, especially in terms of reporting obligations. In many cases, such as *Automec Srl*[237]*, Sky Österreich GmbH*[238]*, and Mark Alemo-Herron*[239], the European Court of Justice and General Court have acknowledged contract freedom as a component of freedom to conduct business. At the same time, to comply with the existing framework, companies must ensure that ESG reporting requirements are incorporated as contractual rights and obligations among various parties.[240] Companies should incorporate contractual provisions to guarantee compliance with reporting obligations, whether they are directly affected by sustainability standards or not, for both them and their value chain partners. In this context, freedom of contract is crucial as it allows companies to align their business goals with regulatory requirements, avoiding non-compliance and ensuring necessary ESG clauses are included in contracts.[241] Nevertheless, smart contracts, which are self-executing based on predefined conditions, pose a challenge to this freedom. Unlike conventional contracts, which can be amended or renegotiated by the parties involved, smart contracts lack the flexibility for post-execution changes, executing only based on the initial terms set.[242]

This issue is particularly relevant as sustainability reporting frameworks are dynamic and evolving. Because of their inherent flexibility, conventional contracts make it simpler to amend them in response to new laws. On the other hand, the inflexibility of smart contracts makes it harder to adjust to changes in regulations. This rigidity is especially problematic for SMEs, which often have less negotiating power in setting the conditions of smart contracts.[243] The inability to modify smart contracts post-execution can hinder SMEs in implementing new sustainability reporting

[237] Case T-24/90 *Automec Srl v Commission of the European Communities* [1992] GC.
[238] Case C-283/11 *Sky Österreich GmbH v Österreichischer Rundfunk* [2013] ECJ.
[239]Case C-426/11 *Mark Alemo-Herron and Others v Parkwood Leisure Ltd* [2013] ECJ.
[240] Netta Skön and Emma Mäkelä, 'Supplier Agreements – Updates Are Needed for ESG Readiness' (15 May 2024) <https://fondia.com/en/en/insights/articles/supplier-agreements-updates-are-needed-for-esg-readiness> accessed 16 May 2024.
[241] ibid.
[242] Kristin Cornelius, 'Smart Contracts and the Freedom of Contract Doctrine.' (2018) 2 Journal of Internet Law.
[243] Carlo Pietrobelli, 'Cross-Border Innovation and Global Value Chains: The Role of Public Policies' in Davide Castellani and others (eds), *Cross-Border Innovation in a Changing World: Players, Places, and Policies* (Oxford University Press 2022), p. 258 <https://doi.org/10.1093/oso/9780198870067.003.0014> accessed 25 October 2023.

obligations mandated by EU legislators. Therefore, the use of smart contracts can create significant challenges for companies' sustainability reporting obligations, as it restricts the ability of contracting parties to navigate evolving needs and obligations through the essential freedom of contract.

Another complicating factor is the Data Act's requirement for smart contract vendors to include a kill-switch function. As it was described earlier, in the event of a serious threat to data privacy, this function enables the termination of all transactions as well as the smart contract itself. The legal implications of such a function, which is similar to unilateral termination of a conventional contract, remain unclear.[244] The uncertainties include questions about remedies and liabilities for the contracting parties, particularly regarding obligations to provide information on sustainability performance. One problematic aspect of this function is that a kill-switch could be interpreted as falling under the scope of a force majeure clause. Notably, the ECJ in the *European Commission v Slovak Republic* case defined a force majeure event as one arising from circumstances beyond the control of the contracting party, and which are abnormal and unforeseeable.[245] Given that data privacy threats are often unforeseen and external, they might fit this definition of force majeure. With such understanding, contracting companies could be exempted from their obligations under contract, including those on sustainability reporting requirements. This might cause errors or delays in the data that smart contracts are supposed to automatically gather for sustainability reporting.

Even if the kill-switch function is not seen as a force majeure event, the uncertain status of contractual obligations, including those related to sustainability performance, places companies using smart contracts in a difficult position. They face potential delays and disruptions in data collection and reporting, which are crucial for meeting regulatory requirements.

Conclusion

Like any new technology, blockchain has the potential to revolutionize corporate sustainability reporting. However, its legal status in the corporate world remains uncertain and challenging. Blockchain could address problematic aspects of the EU sustainability reporting framework by

[244] 'The New Rules on Data – Is the EU Data Act a Threat or an Opportunity?' (*Roschier*, 27 June 2023) <https://www.roschier.com/newsroom/the-new-rules-on-data-is-the-eu-data-act-a-threat-or-an-opportunity/?post_date=20230628164535> accessed 30 October 2023.

[245] Case C-540/21 *European Commission v Slovak Republic* [2023] ECJ.

harmonizing rules and identifying applicable standards through smart contracts, detecting compliance issues, and facilitating real-time reconciliation among market participants. Despite its theoretical benefits, practical implementation faces challenges related to scalability and interoperability.

Blockchain can significantly aid companies in double materiality assessments through the implementation of DAOs and improving direct communication with stakeholders. It ensures data accuracy and helps companies collect extensive data, reducing the risk of unintentional breaches of reporting standards. However, data collection presents complexities, particularly in identifying the data controller and managing the right to be forgotten and sensitive information, complicating compliance with EU data protection rules. This in turn may have an influence on impact materiality and the efficacy of ESG performance.

In addition, while DAOs enhance stakeholder engagement, their ambiguous legal status and place in corporate structures can lead to uncertainty in liability issues in cases of non-compliance with sustainability rules.

Furthermore, blockchain can empower SMEs with knowledge and resources but may reduce their negotiating power in value chain contracts due to the rigidity of smart contracts, which can conflict with freedom of contract principles. The "kill-switch" function of smart contracts and the status of sustainability reporting obligations post-implementation also pose challenges from both contract law and sustainability law perspectives.

5. CONCLUSION

5.1. Key Findings

In conclusion, the research has identified key findings to address the research questions. Firstly, the primary challenges posed by the European Union framework on sustainability reporting include: i) lack of harmonization and uniformity in legislation. The existing sustainability reporting regulations in the EU, such as the Corporate Sustainability Reporting Directive, Sustainable Finance Disclosure Regulation, Taxonomy Regulation, and CRR II, are not harmonized. This lack of consistency creates confusion among companies regarding the content and scope of reporting applicable to them, resulting in legal, economic, and data-related challenges; ii) broad scope of double materiality assessment. There is uncertainty about whether negligence or intention should be considered in assessments, which arises from difficulties in correctly identifying stakeholders for the reporting process and the extensive data collection required; iii) impact on SMEs. SMEs face significant challenges in meeting sustainability reporting obligations due to their limited resources and expertise.

Secondly, the research has identified transparency and security, decentralized nature, smart contracts, blockchain oracles and DAOs as key characteristics of blockchain that are useful in a corporate environment.

Thirdly, regarding possible relationship of blockchain with sustainability reporting rules, the research has demonstrated that blockchain can support the comprehensive ESG reporting obligations and KPIs defined under the CSRD by ensuring accurate and transparent data reporting. Blockchain can also facilitate real-time reconciliation and compliance detection, aiding companies in meeting specific sectoral ESG performance requirements under SFDR and Taxonomy Regulation. Finally, in the financial sector, blockchain’s robust data validation and transparency can help institutions comply with CRR II requirements.

Research question 2

When addressing the research questions, it's appropriate to start with the second question, as the answer to the first is dependent on it. The primary legal implications for companies aiming to utilize blockchain to enhance sustainability reporting are related to the uncertainties surrounding blockchain technology.

However, one significant implication, not merely uncertain but embedded in the EU legislative framework, is the adverse impact of blockchain on data protection and related individual rights. Blockchain introduces complexities in identifying data controllers, especially in public blockchains where anyone can join the network. Such implications directly affect sustainability reporting obligations. Violating data protection rules essentially impacts society, which is critical for impact materiality assessment under the EU framework. Ignoring this fact can lead to non-compliance with sustainability reporting requirements. Furthermore, data protection issues can reduce companies' overall ESG performance and harm their sustainability reputation. Notably, the CSRD is highlighted by legal practitioners as challenging for data security and GDPR compliance.[246] Adding blockchain to sustainability reporting can further complicate data privacy, placing an additional burden on companies.

Regarding the legal uncertainties around blockchain, the thesis showed that, although smart contracts are effective for process automation, they pose challenges to contract negotiation. Contractual freedom is vital for compliance with sustainability reporting requirements since contracts define company needs, including EU-imposed reporting obligations in their value chains. The thesis emphasizes that smart contracts challenge this freedom due to their self-executing nature. Parties can only negotiate during the predefined conditions of the smart contracts. They can include conditions related to data gathering for reporting obligations, but the evolving nature of sustainability reporting requirements can put companies in a difficult position for renegotiating contracts and updating reporting obligations. Additionally, the legal implications regarding contractual liabilities and remedies for reporting obligations under smart contracts are uncertain, especially concerning the kill-switch function imposed by the Data Act. The primary concern is the fate of reporting obligations upon contract termination and the cancellation of all associated transactions. This situation imposes a significant legal implication for using smart contracts in sustainability reporting, as it can lead to nullification of reporting obligations mentioned predefined into smart contracts.

Moreover, uncertainties around the legal status of DAOs as corporate structures present another legal implication of blockchain for sustainability reporting. This issue is particularly relevant in

[246] 'The EU's Green Deal Is an Opportunity to Improve Data Governance' <https://www.thebanker.com/The-EU-s-Green-Deal-is-an-opportunity-to-improve-data-governance-1677744754> accessed 18 May 2024.

cases of non-compliance with sustainability reporting requirements. Determining liability for non-compliance is highly dependent on the status of DAOs within the EU's corporate structure legislation.

In summary, the thesis highlights several key legal implications of blockchain for sustainability reporting. The adverse impact on data protection and individual rights, complexities in data controller identification, and challenges posed by smart contracts to contractual freedom and compliance all present significant concerns. The evolving nature of sustainability reporting requirements, the uncertain legal status of DAOs, and potential non-compliance issues further complicate the landscape.

Research question 1

Having addressed the potential legal implications of blockchain for sustainability reporting, we can now turn to the first research question. Blockchain technology indeed offers several advantages for companies with regards to complying with the EU framework. Firstly, blockchain can assist in navigating various regulations and requirements, helping companies identify which specific regulations apply to them. Smart contracts can identify the most relevant requirements based on predefined criteria and detect suspicious activities or compliance issues through the analysis of transactions and data recorded on the blockchain. Additionally, blockchain facilitates real-time reconciliation among market participants by enabling shared access to common datasets, which aids in the harmonization of rules. However, the legal implications of smart contracts, such as potential limitations on contractual negotiation and uncertainties around the kill-switch function, could potentially reduce the effectiveness of blockchain in this regard.

In terms of substantial law, blockchain plays a crucial role in the double materiality assessment. By enabling direct communication among stakeholders and automatically identifying the appropriate stakeholders for assessment, blockchain helps companies conduct both financial materiality and impact materiality assessments. Moreover, blockchain enhances data collection capabilities by automatically gathering data from contracting partners which is also important for proper double materiality assessment. Despite these benefits, the legal uncertainties surrounding the interpretation of DAOs and the adverse effects on data protection rules can reduce the effectiveness of blockchain.

For SMEs, the thesis demonstrates that blockchain not only provides the aforementioned benefits but also reduces the bureaucratic burden by automating processes, thereby eliminating the need for specific knowledge, skills, and resources. However, the limitation of contractual freedom is particularly disadvantageous for SMEs, given their typically weaker bargaining power.

Overall, it is important to note that most of the adverse effects of blockchain are theoretical, with the exception of data protection implications, while most of the benefits are practical, aside from the harmonization of rules. Moreover, the supportive stance of the EU towards blockchain, evident through official publications[247] and exemptions from specific financial regulations[248], gives optimism that blockchain applications for sustainability will similarly be met with a favorable approach. Therefore, provided that companies implement robust data protection policies and monitor the evolving legal status of blockchain within the EU, blockchain technology can be regarded as an effective tool for compliance with the EU's sustainability reporting legislative framework.

5.2. Contribution of the Research

The thesis significantly contributes to various aspects of the topic:

1. Knowledge: This thesis contributes to academic and practical knowledge by systematically analyzing the legal implications of integrating blockchain with sustainability reporting. It bridges the gap between theoretical potential and practical application, offering a comprehensive understanding of blockchain's capabilities and limitations in this context.
2. Companies: For large companies, the thesis demonstrates how blockchain can streamline compliance with complex ESG reporting requirements, enhancing transparency, accuracy, and stakeholder engagement, also showing possible drawback of blockchain in practice. For SMEs, it highlights how blockchain can reduce bureaucratic burdens and resource constraints through process automation. However, it also warns about the challenges posed by the rigidity of smart contracts and the complexities of data protection, urging companies to implement robust data protection policies.

[247] 'Blockchain Strategy | Shaping Europe's Digital Future' (8 February 2024) <https://digital-strategy.ec.europa.eu/en/policies/blockchain-strategy> accessed 18 May 2024.
[248] 'Blockchain Regulation in the Spotlight: Key Takeaways from the EU DLT Pilot Regime' (*Setterwalls*) <https://setterwalls.se/en/article/blockchain-regulation-in-the-spotlight-key-takeaways-from-the-eu-dlt-pilot-regime/> accessed 8 May 2024.

3. Legal practitioners: Legal practitioners benefit from a detailed exploration of the legal uncertainties surrounding blockchain, such as the implications of smart contracts and DAOs. The thesis provides valuable guidance on navigating these complexities, helping lawyers advise their clients on compliance strategies and risk management in sustainability reporting.
4. Policy: For policy, the thesis offers critical insights into the current regulatory landscape's shortcomings from companies' perspective, particularly the lack of harmonization and the challenges posed by data protection regulations.

5.3. Suggestions for Further Research

The potential legal implications outlined in the thesis are largely theoretical. Further investigation of each implication within the context of sustainability reporting is necessary. This includes investigating the legal status of DAOs, the extent of freedom of contract in smart contracts, and the remedies available under the kill-switch function.

Additionally, given the rapidly evolving legislative landscape surrounding sustainability reporting, it's imperative to explore potential future legislation. This involves examining proposed regulations in the EU regarding the automation of sustainability reporting processes and the advancement of blockchain technology in sustainability initiatives. Furthermore, research into forthcoming reporting standards for SMEs and the role of blockchain in these standards is also important.

Finally, given the scope of the thesis within the EU jurisdiction, it's essential to analyze the potential interconnection between jurisdictions concerning blockchain in sustainability reporting. This includes understanding how regulations and standards in one jurisdiction may influence or intersect with those in others.

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