Interrelation between the climate-related sustainability and the financial reporting disclosures of the European automotive industry

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Abstract

The financial reports of the automotive companies' are measured in a standardized manner; therefore, they are transparent and comparable to each other, but this is not valid for the sustainability reports and it is not possible to compare their sustainability performances. Standard-setting organizations are currently searching for better reporting procedures. This study aims to investigate the connection between sustainability and financial reports for the most dominant European car manufacturers. It reviews the traceability of the sustainability elements back to the financial statements, which helps transparency, comparability, and impact measurement of the disclosed items and issues. This investigation allowed us to additionally review whether these companies are targeting to disclose the most harmful pollution impacts, or only focus to disclose the required obligatory items. Given the financial and sustainability reports magnitude manual testing would not provide complete and proper coverage, therefore we utilized an automated and AI-assisted content analysis with natural language processing. In this new review method, the sustainable elements of the textual reports were automatically retrieved following the 5-stage model of Landrum & Ohsowski (2018). The study highlights the lack of true sustainability information content of reports and the potential discrepancies and connections between the financial and the sustainability reports. Findings concluded that sustainability disclosures at the reviewed companies from several aspects could be improved and quantified, traced back to the financial disclosures, and to be comparable to each other if they apply a similar review method.

Graphic abstract

Keywords Sustainability reporting · Global reporting initiative · Financial reporting · IFRS · Carbon emission · Automotive companies

Introduction

The connection and the potential reconciliation between sustainability and financial reporting are getting more and more attention. A quite heavy debate started in April 2019 based on a speech from the International Accounting Standard Board (IASB) chairman Mr. Hoogervorst and the most widely used Global Reporting Initiative (GRI) chief executive Mr. Mohin regarding the role of sustainability and financial reporting. Significant progress was made in July 2020 as the opposition between the GRI and the Sustainability Accounting Standards Board (SASB) eased, with the announcement of collaboration. Both institutions provide standards for sustainability reporting, but to fulfill different purposes: SASB focuses on sustainability-related risks on a company's financial conditions the GRI deals with issues that are of primary importance to stakeholders (SASB 2020). In September 2020, the European Commission recognized the importance of coordinating the development of EU standards with existing and emerging global initiatives (European Reporting Lab 2020), mandating the European Financial Reporting Advisory Group (EFRAG) to undertake preparatory work for possible EU non-financial reporting standards. The most recent regulatory results contain a state-of-the-art target sustainability architecture (EFRAG 2021).

International Financial Reporting Standards (IFRS) are applied in 144 different jurisdictions across the globe, and they represent a well-known global accounting standard, based on relevant and reliable financial information provided to investors. In comparison, sustainability reporting belongs to a so-called: Environmental, Social, and Governance (ESG) reporting. This new reporting is driven by investors' expectations related to corporate performance. Sustainability reporting is a good representation, where currently no global standard is agreed yet; as a result, it is not possible to give a universally accepted definition on this reporting. It is better to define the purposes of such reports, which is to inform readers about the material, resource, and service flow between entities, markets, or within the society. It assumes that the economy and the environment affect the ability of corporate, economic, social, and environmental systems to operate in the long term.

In the case of the automotive industry, companies' publicly expressed emphasis on operational sustainability puts an increased relevance on the question of reporting disclosure. Original equipment manufacturers (OEMs) bear the unethical possibility of using these sustainability elements (in the form of words, phrases) in their publications as key arguments to gain market share. This study analyses a

specific market on European-based car manufacturing companies, to map and traceback sustainability report information to their respective financial statements, where sustainability plays a vital role in the industry operation because investors are making primary decisions based on how those companies are operated according to sustainability standards. Using the mapping system of Guthrie et al. (2017), the reporting requirements and reporting contents are analysed for this industry. At the same time, corporate reporting's regulatory environment is shifting towards a standardized, electronic format, which makes it possible to apply certain new techniques for qualitative, text-based data analysis (Pejić Bach et al. 2019). This certain type of analysis will become more relevant to practice as the financial and non-financial reporting of European companies is approaching the goal of standardization and digitalization, with which textual information gains enhanced comparability (Busco et al. 2020).

Literature review and the importance of the mapping between sustainability and financial reporting standards

There are several studies in different fields dealing with the mapping of corporate and sustainability reporting, such as Kannenberg and Schreck (2019), or Guthrie et al. (2017). Others review the entities' sustainable operations as Geissinger et al. (2019), who questioned how sustainable a particular market is. According to Hoogervorst (2019), IASB chairman, a need for change is assessed as "sustainability issues can already have an impact that needs to be reflected in financial reporting". Mohin (2019), GRI key executive commented as "Mr. Hoogervorst's arguments misrepresent the role of standard-setters such as GRI, and indeed his own organization, the IASB. Standard-setters—GRI, IASB, or others—cannot be responsible for the disclosures made by companies. Our role is to establish the best practice for such disclosure". These were one of the first published documents, which initiated an international debate among the financial and sustainability standard setters. Since 2019 significant efforts taken to standardize and harmonize sustainability reporting. The key milestones of these ongoing changes were highlighted in the next section. From the literature review perspective, the primary importance is on the fact that the mapping of financial statements to sustainability reports exists; however voluntary disclosure of companies might not provide sufficient information for stakeholders.

According to empirical results of Kannenberg and Schreck (2019) on sustainability reporting, disclosure, and corporate decisions, some positive implications can be made, but overall, the two reporting systems' integration shows yet inconclusive results. From an accounting aspect, a clear connection exists between GRI and the IFRS disclosure requirements. With the use of the IFRS standards, at least seven areas can be identified where concrete reconciliation should be available, as presented in Table 1.

The abovementioned seven areas in Table 1 are representing financial accounting areas, where the sustainability-related impacts if relevant and material should be quantified and reported in the financial reports. It was initially reported in 2019 and later updated in 2020. Any of these categories can be disclosed, however, in relation to climate-related effect within the automotive industry in the European Union, there is the carbon-emission specific topic, which must be addressed. It relates to the last category of the table, IAS37

(provisions, contingent liabilities). It does mean in case if an automotive company is knowingly above the CO₂ emission limits already in their 2020 financial statement the material and relevant provision should be recognized. A detailed review of this area is reported in the result section.

Standardization of financial and sustainability reporting and developments in the EU

Within this research topic, there are two relevant areas connected to EU implementation, the first being a common format of electronic reporting, and the second being the standardization of the content of reports, both sustainability and financial. Regarding sustainability: cooperation between the biggest standard-setting organizations, namely GRI, the Sustainability Accounting Standards Board (SASB), and

Table 1 IFRS' connection to sustainability reporting Source: Own editing based on Anderson (2019)

IFRS reference	Topic	Content and connection to GRI standards
Conceptual framework	Materiality	The document makes materiality judgements to climate-related and other emerging risks, much like the GRI 101 standard: Foundation (reporting principles)
IAS 1	Relevant notes from the appendix	Information is considered to be relevant if it could reasonably be expected to influence decisions made by investors, which links to GRI 102's (General disclosures) definition of relevance (and materiality)
IAS 36	Impairment of assets	IAS 36 defines the carrying amount of Property, Plant and Equipment, related to mineral resources, intangible assets, and goodwill. It also sets disclosure requirements that address the company's exposure to climate-related risks, and their key assumptions on cash flow projections (discounted CF – Net Present Value presentation), as seen in the GRI 201 (Economic Performance) standard
IAS 16/IAS 38	Expenses related to assets	These standards require to recognize expenses related to tangible and intangible items, of which the GRI 201 and 207 standards also make a differentiation
IFRS 13	Fair value measurement	In IFRS 13, key assumptions are used, incorporating the possible scenarios when an asset is affected by climate-related risks, including potential changes (laws, regulations) to managing risks. Companies should disclose how it factors climate-related risk in fair value measurement. Sectors particularly affected may need to consider disclosing their assumptions regarding such risks, even if they cannot quantify any effects on the financial statements. Fair value measurement is also a key concept in general disclosures of GRI 102
IFRS 7/IFRS 9	Financial instruments	These standards view forward-looking statements on Expected Credit Losses (ECLs). Mainly financial institutions are required to evaluate investments in projects in this manner. However, exposure to climate-related risk affects loans and investments in more industries, for instance in the case of fossil-fuel-intensive, or automotive investments. These are a part of the GRI 101–1 disclosure on direct economic value generated and distributed
IAS 37	Provisions, contingent liabilities (contingent assets)	By the standard, it is required to provide a brief description of the nature of any contingent liability, estimate the financial effect, and an indication of the uncertainties about the outflow of resources for obligation settlement Provisions appear in several GRI standards including the more traditional tax provisions of GRI 207, to addressing climate-related effects (as seen in GRI 303). These can be categorized in three key sections in line with accounting regulation: (a) <i>Recognition of an onerous contract provision (climate-related risks)</i> (b) <i>Increase of provisions recognized for decommissioning a plant or rehabilitating environmental damage</i> (c) <i>disclosure of a contingent liability for potential litigation and fines or penalties. (For instance: CO₂ emission fine)</i>

the IFRS Foundation was seen in 2020. This way a joint pursuit of quality information can be assumed, as GRI is known as the provider of the most widely used framework, while SASB focuses on material sustainability factors affecting financial performance (SASB 2017). Besides, the IFRS Foundation, which designs IFRS standards used by over 29 thousand public listed companies (roughly 60% of its total population), calls for standardization and comparability of reporting. These institutions declare that sustainability and climate change issues are becoming increasingly important to capital markets (IFRS Foundation 2020). In Fig. 1, out of the mentioned sustainability frameworks in all regions, GRI was the leading establisher, in the case of Europe followed by the International Integrated Reporting Council (IIRC)—recently conducting a merger with SASB (Deloitte 2020).

To review the status of reporting standardization in automotive, we used the database of Statista (2018). As seen in Table 2, from the top 200 automotive companies (based on aggregate revenue) the top 10 were selected, where three automotive groups are registered and located from financial reporting perspectives in the EU. All three

key companies—Volkswagen AG, Daimler AG, and the Bayerische Motoren Werke AG (BMW)—applied the same financial and sustainability reporting standards. From an accounting perspective, all three European manufacturers use IFRS. Regarding sustainability standards, the Global Reporting Initiative (GRI) standards are a commonality of all ten car manufacturing companies (except for the Chinese-based SAIC), which demonstrated the significance of these standards. Therefore, European car manufacturers, despite the locations of their administrative and production sites, are fully comparable in the question of information disclosure.

Despite 2020's exceptional global progress in sustainability framework propositions by organizations, a regulatory implementation is also in progress regarding the accounting obligations of EU companies. It is important to highlight that corporate reporting is greatly affected by technological change since it is a data processing procedure, a form of supplementing and automating human interpretation. Each stakeholder is affected by the fact that previously hectic and unstructured data become structured and machine-readable (Radzimski et al. 2014).

Fig. 1 Global coverage of the sustainability standards (2015)
Source: Calace (2016) based on the database of datamaran.com

Table 2 Top 10 global automotive companies based on annual revenue Source: Statista (2018)

Rank	Company name	Exchange	Listing ID	Location Country	Financial reporting	Sustainability Reporting Standard
1	Volkswagen AG	Frankfurt	VOW	Germany	IFRS	GRI
2	Toyota Motor Corp	Tokyo	7203	Japan	Japanese GAAP	GRI
3	Daimler AG	Frankfurt	DAI	Germany	IFRS	GRI
4	Ford Motor Co Corp	New York	F	United States	US GAAP	GRI
5	General Motors Co Corp	New York	GM	United States	US GAAP	GRI
6	SAIC Motor Co Ltd	Shanghai	600,104	China	IFRS	Non-GRI
7	Honda Motor Co Ltd	Tokyo	7267	Japan	Japanese GAAP	GRI
8	Fiat Chrysler Automobiles N.V	NYSE	FCAU	US	US GAAP	GRI
9	Bayerische Motoren Werke AG	Frankfurt	BMW	Germany	IFRS	GRI
10	Nissan Motor Co Ltd	Tokyo	7201	Japan	Japanese GAAP	GRI

Hence the technology-reliant process, adaptation for bureaucratic organizations such as governments, faces implementational difficulties. At the same time, XBRL gained traction with regulators because the format supports the analysis and dissemination of large amounts of information. In business uses, it is widely accepted as a reporting alternative (Wenger et al. 2013). In the USA, it is also obligatory for public listed companies (XBRL International 2020). In the service sector, XBRL content analysis is used by audit and consulting firms, but these methods remain hidden business practices. On the supplier side, there is a wide range of software vendors offering solutions for qualitative analysis. These are also commonly used by academics in data-heavy researches. Generally, nowadays there is much bigger ground for exploratory data analysis such as text mining for this cause (Debreceeny 2007). After successful first-time adoption of electronic financial reporting, it can make external and internal processes more transparent. Implementation reduces financial data collection, processing, and analysis time in both the business and academic sectors. In the past years, the European Securities and Markets Authority which supervises European stock markets has advocated the implementation of the *European Single Electronic Format (ESEF)*—which is an inline XBRL format of financial statements. There was a successful pilot project carried out in 2017 with 25 participants (ESMA 2020), and the financial statements published next year will arrive in this standardized format as an obligation for European listed companies. The ESEF format in the first period only contains financial statements, but in the following years, the format will expand on the notes to financial statements and possibly non-financial information as well. Currently, there are ongoing consultations on the details of this introduction, such as a common platform to present information for all companies under the definition of the European Single Access Point (ESAP) (European Commission 2020).

Methodology

Since the application of the ESEF format in European sustainability and financial reports, two research questions arise, as follows: Due to the unavailability of a standardized reporting system, are sustainability reports unable to be automatically reviewed? What are the true information content and the perceived reason for publishing sustainability reports? As a test for the potential of automation and thus creating the methodological foundations for the automated qualitative review of upcoming ESEF reports, a pilot analysis was carried out using the most recent sustainability reports (as unstructured pdf files) of the three leading car manufacturers (BMW, Daimler, and Volkswagen, business year 2019) as the sample. More studies exist in the literature in which topics that appear in sustainability reports are reviewed and evaluated with modern, text-mining-based methods (Rivera et al. 2014; Te Liew et al. 2014). We adopted a framework introducing a sustainability spectrum with 5 stages following the work of Landrum and Ohsowski (2018). The study also supported automated content analysis by linking keywords (as in Table 3) to each stage, which is ideal in the algorithm of natural language processing (NLP).

The stages differ greatly in terms of reporting elements and the reasoning behind sustainability activities. Stage one represents activities that are externally enforced (therefore require compliance), while stage two is internally focused, yet motivated by the result in benefits. Stage three shows an intermediate level, that indicates some form of cooperation between stakeholders in true environmental/economic or social activities to address systemic change. The fourth and fifth stages represent the regenerative and coevolutionary activities that are closed to understanding sustainability science and seeking to maintain balance with other systems (humans, corporations, societies, and the natural world). For the analytical NLP tasks, we used the Provalis WordStat 8.0.33 software (Provalis Research, 2020) and as methodological guidelines the prior works of Shin et al. (2018) and Valverde-Berrocoso et al. (2020). The content analysis steps included (1) textual data retrieval from reports, (2) exploratory quantitative analysis (word and phrase frequency

Table 3 Keywords for content analysis Source: Own editing based on Landrum & Ohsowski (2018)

Stage	Level of sustainability	Keywords (indicative examples)
1. Compliance	Very low	compliant*, legal*, regulat*, risk*
2. Business-centered	Low	competitive advantag*, cost–benefit*, demand*, efficienc*, public relations, ROI, value chain*
3. Systemic	Medium	collaborat*, ecoefficienc*, humanity, industry, integrat*, partnership*, system*, transform*
4. Regenerative	High	consumption, planetary boundar*, redistribution, repair*, restor*, science*, steady state*
5. Coevolutionary	Very high	circular, coevol*, ecocentri*, ecoethic*, ecolog*, ecosystem*, flourish*, no growth, resilien*

(1) the asterisks indicate arbitrary characters, (2) in column three examples are shown from the total 63 keywords

calculation; topic formation with factor analysis; segmentation by paragraph), (3) categorization of keywords by the five sustainability stages, and (4) stage categorization of companies by the disclosed sustainability elements.

Results

Although there are no standardized reporting requirements of sustainability reports, and there is no obligation to prepare these reports in a machine-readable format, NLP has reached a technological level where automated topic evaluation on unstructured datasets becomes possible. Based on the automated content analysis of the main 3 automotive reports, we concluded that the higher the stage of sustainability, the lower the frequency of keywords. In Fig. 2, the pre-coded corporate sustainability stages showed different results between the analysed three reports. Significant independence was determined using Chi-square testing between the three companies in disclosed information. Keywords from the first three stages were the most frequently used, while keywords from stage five were hardly even mentioned.

At the same time, the analysed automotive companies addressed relatively similar frequencies on the first three stages. This predicts a positive trend where companies not only focus on compliance with regulations and achieving internal benefits, but work with other stakeholders on sustainability activities, to address environmental, economic, and social systemic change. On a note, out of the 3 companies, Daimler disclosed the biggest volume of information on all stages other than stage five. With the given results on sustainability information disclosure, a further quality check is needed to determine whether keywords on stage three and above (including the real endeavours towards environmental sustainability, e.g. self-regulation of carbon emission) are connected to any measurable financial data. The identified disclosure constraints for the reviewed automotive companies are the following.

There is no clear reported connection between sustainability and their financial reporting, and it was not possible to reconcile the sustainability reports to the financial statements, despite the representation of the word CO2 several, as quantified, 54 (Volkswagen), 169 (BMW), and 297 (Daimler) times. The CO2 emission regulation within the

Fig. 2 Corporate stages of sustainability elements Source: Own editing based on sustainability reports

EU provided a solid reference point, where we could validate, whether the reviewed companies should or should not report climate-related financial and sustainability elements. Based on publicly available studies and statistical reports, according to 2020 effective 2019/631 defined emission performance standards (European Commission 2019) the produced companies' CO₂ limits should not exceed the 95 g of CO₂ per km for passenger cars and 147 g of CO₂ per km for light commercial vehicles registered in the Union as an average in 2020 and individually from 2021. Car manufacturers should calculate and present their assumptions in their financial/sustainability reports. In Table 4, based on public information these deviations and penalties were estimated.

Of the three European car manufacturer groups, Volkswagen bears an especially high penalty percentage in comparison to its earnings. Long-term perspectives within 5 years these emission requirements are going to be even stricter, and therefore, financial impacts are expected to be more significant.

Conclusion and discussion

Based on the reviewed financial and sustainability reports, the following conclusion can be made. European automotive car manufacturers do have dominant financial and sustainability reporting standards. From a financial perspective, it is the International Financial Reporting Standard (IFRS) and from a sustainability standard perspective, it is the Global Reporting Initiative (GRI) standard. According to the comparison between the dominant IFRS and GRI standards, it was possible to establish a clear mapping from disclosure perspectives. In other words, it does mean that in theory financial and sustainability reports should be able to be reconciled to one another. From financial reporting perspectives, an environmental fine (CO₂ emission penalty) related provision disclosure is identified as an area, where all the reviewed companies should report on their status. For the

selected samples in the reviewed past year, these provisions were not disclosed in either report.

Based on international cooperation, a new approach is coming between regulating bodies of GRI, SASB, and the IFRS Foundation. It should build on the existing initiatives with a climate-first approach and build on existing standard works. To achieve higher effectiveness of sustainability reports, a requirement that is not yet fulfilled is a standardized categorization of the reported information, with which all essential sustainability issues would be addressed. A formal requirement of these disclosure categories should ensure that financial information is assigned to each item. For the quantification of this financial information, we recommend using scales instead of including specific financial data. This way, unfavourable judgement against the company, and possible negative impact on share prices could be avoided, while companies could maintain correspondence with information obligations.

The third conclusion involves the future direction in the reported data structure, as during our content analysis, natural language processing (NLP) was possible to be used on unstructured datasets of sustainability reports. With the expected arrival of structured ESEF financial datasets in 2021 and notes to financial statements in 2022, this technology will provide ground for an even higher quality of automated analysis in many fields, including the increasingly corporate value-shaping sustainability (EFRAG 2021). This design of standardized sustainability reports with high-quality (and not just compliance- or business-centered) information also benefits further research using tools of text-mining in content analysis. As an ultimate goal of standard-setting organizations, integrated reports, linking interrelations between financial and sustainability data will be able to be achieved.

This study aimed to provide evidence of the determinants of corporate non-financial reporting as an implementation of the 5-stage sustainability model of Landrum and Ohsowski (2018). It is apparent that as part of non-financial reports, sustainability information content and also context

Table 4 Overview of potential CO₂ penalties per car manufacturer Source: PA Consulting, 2020

Rank	Company name	Deviation (grams of CO ₂ per km)	Penalty (in million €)	Penalty (in % of EBIT 2018)
1	Mazda	28.7	877	115.7%
2	Flat-Chrysler (FCA)	27.0	2461	49.5%
3	Honda	25.2	322	5.5%
4	Ford	16.2	1456	39.0%
5	Volkswagen	12.7	4504	32.4%
6	Volvo	12.5	382	27.6%
7	Daimler	11.0	997	9.0%
8	Hyundai-Kia	7.7	797	28.9%
9	BMW	7.6	754	8.3%

are capable of affecting investor decisions (Striukova et al. 2008). Beretta et al. (2021) concluded that in the automotive industry positive and negative toning differences occur even between pillars of the ESG (Environmental, Governance, and Social) reporting framework. Therefore, even with assumed regulatory advances (EFRAG 2021) companies can exploit certain practices to falsify, for instance, an automated sentiment analysis (Hajek and Henriques 2017). The possible tightening of future sustainability disclosure requirements could further increase skewness in the direction of the compliance sustainability stage represented in the current study; however, it is questionable how stakeholder decision-making is affected by such information. In terms of the ability of quantification, indicators included in sustainability stages 1 and 2 contribute the most to traditional firm performance measures such as the economic value added (Shad et al. 2019). To be able to provide so, it also needs to be taken into consideration the need for a specific sustainability enterprise resource planning (S-ERP) system in order to make the process of tracking business resources, operations, and status feasible (Chofreh et al. 2020).

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Availability of data and material Official annual and sustainability reports of company groups.

Code availability Software used for natural language processing (NLP) algorithm: Provalis WordStat 8.0.33.

Declarations

Conflict of interest Not applicable.

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References

- Anderson N (2019) IFRS® Standards and climate-related disclosures. IFRS Foundation educational material. <https://cdn.ifrs.org/-/media/feature/news/2019/november/in-brief-climate-change-nick-anderson.pdf?la=en>, Accessed 25 Nov 2020
- Beretta V, Demartini MC, Lico L, Trucco S (2021) A Tone analysis of the non-financial disclosure in the automotive industry. *Sustainability* 13(4):2132
- Busco C, Consolandi C, Eccles RG, Sofra E (2020) A preliminary analysis of SASB reporting: Disclosure topics, financial relevance, and the financial intensity of ESG materiality. *J Appl Corp Financ* 32(2):117–125. <https://doi.org/10.1111/jacf.12411>
- Calace D (2016) Battle of giants: GRI vs SASB vs IR. <https://www.greenbiz.com/article/battle-giants-gri-vs-sasb-vs-ir>, Accessed 18 Oct 2020
- Chofreh AG, Goni FA, Klemeš JJ, Malik MN, Khan HH (2020) Development of guidelines for the implementation of sustainable enterprise resource planning systems. *J Clean Prod* 244:118655
- Debreceňy R (2007) Research into XBRL—old and new challenges. In *New dimensions of business reporting and XBRL* (pp. 3–15). DUV
- Deloitte (2020) IIRC and SASB intend to merge. <https://www.iasplus.com/en/news/2020/11/iirc-and-sasb-intend-to-merge>, Accessed 10 Dec 2020
- EFRAG (2021). Proposals for a relevant and dynamic EU sustainability reporting standard setting. https://ec.europa.eu/info/publications/210308-efrag-reports_en Accessed 12 March 2021
- ESMA (2020). Field test of ESEF. <https://www.esma.europa.eu/field-test-esef>. Accessed 04 Dec 2020
- Commission E (2019) Regulation (EU) 2019/631 of the European Parliament and of the Council. Office for Official Publications of the European Communities, Luxembourg
- European Commission (2020). Capital markets union: Final report by the High-Level Forum. *Luxembourg*, Office for Official Publications of the European Communities.
- European Reporting Lab (2020). Press Release – Appointed Members and Chair of the European Lab Project Task Force on Preparatory Work for the Elaboration of Possible Eu Non-financial Reporting Standards. European Commission. *Brussels*, 04
- Geissinger A, Laurell C, Öberg C, Sandström C (2019) How sustainable is the sharing economy? On the sustainability connotations of sharing economy platforms. *J Clean Prod* 206:419–429
- Guthrie J, Manes-Rossi F, Orelli RL (2017) Integrated reporting and integrated thinking in Italian public sector organisations. *Meditari Account Res.* <https://doi.org/10.1108/MEDAR-06-2017-0155>
- Hajek P, Henriques R (2017) Mining corporate annual reports for intelligent detection of financial statement fraud—A comparative study of machine learning methods. *Knowl-Based Syst* 128:139–152
- Hoogervorst H (2019) Speech: IASB Chair on what sustainability reporting can and cannot achieve. Climate-Related Financial Reporting Conference. Cambridge University: UK
- IFRS Foundation (2020). Consultation Paper on Sustainability Reporting. <https://cdn.ifrs.org/-/media/project/sustainability-reporting/consultation-paper-on-sustainability-reporting.pdf?la=en>. Accessed 04 Dec 2020
- Kannenberg L, Schreck P (2019) Integrated reporting: boon or bane? A review of empirical research on its determinants and

- implications. *J Bus Econ* 89(5):515–567. <https://doi.org/10.1007/s11573-018-0922-8>
- Landrum NE, Ohsowski B (2018) Identifying worldviews on corporate sustainability: A content analysis of corporate sustainability reports. *Bus Strateg Environ* 27(1):128–151. <https://doi.org/10.1002/bse.1989>
- Mohin T (2019). ESG information is now critical for investors. *Financial Times*. <https://www.ft.com/content/368be44a-5704-11e9-a3db-1fe89bedc16e>. Accessed 03 Jan 2021
- PA Consulting (2020). How European automotive industry can meet tough CO2 emissions targets. https://www2.paconsulting.com/rs/526-HZE-833/images/PA-CO2-Report-2019_2020.pdf, Accessed 12 Sept 2020
- Pejić Bach M, Krstić Ž, Seljan S, Turulja L (2019) Text mining for big data analysis in financial sector: A literature review. *Sustainability* 11(5):1277. <https://doi.org/10.3390/su11051277>
- Provalis Research (2020). [Software] WordStat 8.0.33. <https://provalisresearch.com/products/content-analysis-software/>, Accessed 12 Sept 2020
- Radzinski M, Sanchez-Cervantes JL, Garcia-Crespo A, Temiño-Aguirre I (2014) Intelligent architecture for comparative analysis of public companies using semantics and XBRL data. *Int J Software Eng Knowl Eng* 24(05):801–823. <https://doi.org/10.1142/S0218194014500314>
- Rivera SJ, Minsker BS, Work DB, Roth D (2014) A text mining framework for advancing sustainability indicators. *Environ Model Softw* 62:128–138
- SASB (2017). SASB and GRI Pen Joint Op-Ed on Sustainability Reporting Synchronicity. <https://www.sasb.org/blog/blog-sasb-gri-pen-joint-op-ed-sustainability-reporting-synchronicity/>. Accessed 05 Dec 2020
- SASB (2020). GRI and SASB announce collaboration. <https://www.sasb.org/blog/gri-and-sasb-announce-collaboration-sustainability-reporting/> Accessed 10 March 2021
- Shad MK, Lai FW, Fatt CL, Klemeš JJ, Bokhari A (2019) Integrating sustainability reporting into enterprise risk management and its relationship with business performance: A conceptual framework. *J Clean Prod* 208:415–425
- Shin SH, Kwon OK, Ruan X, Chhetri P, Lee PTW, Shahparvari S (2018) Analyzing sustainability literature in maritime studies with text mining. *Sustainability* 10(10):3522. <https://doi.org/10.3390/su10103522>
- Statista (2018). Leading global automotive companies based on revenue in 2017 (in million U.S. dollars) [Graph]. In *Statista*. <https://www.statista.com/statistics/504032/global-leading-automotive-companies-by-revenue/>. Accessed 10 Nov 2020
- Striukova L, Unerman J, Guthrie J (2008) Corporate reporting of intellectual capital: Evidence from UK companies. *Br Account Rev* 40(4):297–313
- Te Liew W, Adhitya A, Srinivasan R (2014) Sustainability trends in the process industries: A text mining-based analysis. *Comput Ind* 65(3):393–400
- Valverde-Berrococo J, Garrido-Arroyo MDC, Burgos-Videla C, Morales-Cevallos MB (2020) Trends in educational research about e-Learning: A systematic literature review (2009–2018). *Sustainability* 12(12):5153
- Wenger MR, Elam R, Williams KL (2013) A tour of five XBRL tools: Products that help make tagged data work for you and your clients. *J Account* 215(4):48–55
- XBRL International (2020). XBRL for Securities Filing. <https://www.xbrl.org/the-standard/why/xbrl-for-securities-filing/>. Accessed 24 Sept 2020

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