

# Chapter 5

## Reporting

### Beata Iwasieczko

Wroclaw University of Economics and Business

e-mail: [beata.iwasieczko@ue.wroc.pl](mailto:beata.iwasieczko@ue.wroc.pl)

ORCID: [0000-0001-6104-7388](https://orcid.org/0000-0001-6104-7388)

### Katarzyna Piotrowska

Wroclaw University of Economics and Business

e-mail: [katarzyna.piotrowska@ue.wroc.pl](mailto:katarzyna.piotrowska@ue.wroc.pl)

ORCID: [0000-0002-5830-6526](https://orcid.org/0000-0002-5830-6526)

### Wioletta Turowska

Wroclaw University of Economics and Business

e-mail: [wioletta.turowska@ue.wroc.pl](mailto:wioletta.turowska@ue.wroc.pl)

ORCID: [0000-0002-6218-7822](https://orcid.org/0000-0002-6218-7822)

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Quote as: Iwasieczko, B., Piotrowska, K., & Turowska, W. (2025). Reporting. In B. Nita, P. Wanicki (Eds.), *Digital Transformation in Accounting: Modern Technologies and Ethical Dilemmas Reshaping Financial Management and Reporting* (pp. 74-103). Publishing House of Wroclaw University of Economics and Business.

DOI: [10.15611/2025.45.0.05](https://doi.org/10.15611/2025.45.0.05)

## 5.1. Financial and Non-Financial Reporting – Overview of Research

Financial and non-financial reporting play a key role in communication between organisations and their stakeholders, ensuring transparency and reliability of financial data. Against the backdrop of dynamic technological change, the traditional approach to reporting is evolving, by using tools such as big data analytics, blockchain, artificial intelligence and integrated ERP systems. Today's technologies not only enable the automation of reporting processes, but also provide new opportunities for data analysis and data quality improvement.

Table 5.1 provides a summary of key academic publications on the impact of digitalisation on financial and non-financial reporting. The cited studies illustrate the diversity of research methodologies and approaches, from empirical studies to theoretical analyses. The authors analysed both the benefits of digital technologies, such as increased accuracy and speed of reporting, and the challenges, including the need for regulatory alignment and data security risks.

This presentation of publications also takes into account global trends in financial and non-financial reporting, including the growing importance of ESG reporting and the need to harmonise international standards. The research highlighted the fact that technologies such as blockchain are helping to improve transparency and data verifiability, key to building trust among stakeholders. The table also stresses the importance of education and the development of digital competencies among professionals responsible for reporting processes.

In conclusion, Table 5.1 provides an overview of the current state of knowledge on the digitalisation of financial reporting and reporting, offering insights into the main research directions and practical implications of the application of modern technologies in this area. This is a valuable source of inspiration for both researchers and practitioners who want to better understand how digital technologies are transforming approaches to financial reporting globally.

**Table 5.1. Publications on financial and non-financial reporting**

Paper	Test sample	Research method	Results/conclusions	Citations
Z. Zhang & Wang, 2023	Companies with Class A shares listed on the Shanghai or Shenzhen Stock Exchange; study period: 2007-2020; sample: annual reports for 10,798 companies	Textual analysis with the assumption that narratives in MD&A contain information about the function generating numerical financial data.	Increased comparability of financial statements is only associated with improved analyst forecasts in industries that do not operate on a short-term basis. Businesses with more short-termism in management are more likely to have unusual corporate behaviour and thus have less comparable financial statements.	1
Wen et al., 2023	Small companies, companies with smaller physical assets and companies that have not been audited by the big four audit firms selected	Empirical methods – regression model	Fintech developments have been shown to reduce the management of real earnings of entities and determine the increase in the quality of financial information. The development of FinTech will play a greater role in reducing opaque companies in terms of real earnings management. The idea is that their information tends to be difficult to obtain by external investors, and their investors have a greater need for ex ante information production.	16
Kovach et al., 2023	No data	Linear degression	Researchers have demonstrated that a new one, based on readily available data from financial statements, can be used to measure and predict production outsourcing.	0
J. H. Choi et al., 2023	Public companies listed on US stock exchanges	Statistical analyses on comparative data for employers and employees in the United States	The low quality of financial reporting is linked to an offsetting pay gap i.e. a risk premium.	5

Paper	Test sample	Research method	Results/conclusions	Citations
Bini et al., 2023	Interviews conducted with 13 participants from different Western European countries. Interview time: 45-60 minutes; form: online video conference; period: 10/20-04/21	Theoretical model (data collection technique: questionnaires and interviews with purposive sampling strategy) – constructing an interview guide	The findings indicate a lack of general consensus around a specific definition of a business model, its constitutive elements and its reporting function. The importance of business model reporting for assessing information related to corporate sustainability is highlighted.	2
Lantto, 2022	Interviews conducted between November 2006 and May 2009 among accountants	Case study – observation	Areas explored: company mergers, goodwill, provision requiring new types of entity-specific information; impact of accounting changes – conversion from FAS to IFRS and the impact of this transition on the consolidated financial statements.	2
Ibrahim et al., 2021	No data	Literature review on theories: agency, stakeholders and legitimacy	There are points of convergence between big data and financial reporting, performance measurement, auditing, risk management, corporate budgeting, etc. There is a need for convergence between big data and the theories of agency, stakeholders and legitimacy. Big data sets and advanced analytics can overcome data limitations in accounting techniques that require estimates and forecasting.	31
Nguyen et al., 2021	No data	Survey research; adaptive structure theory	The results show that system strictness, professional IT support and the accountant's sense of self-efficacy influence the faithful use of the accounting information system. Information systems play an increasingly important role in the accounting process and influence its efficiency.	14
Rowbottom et al., 2021	No data	Case study – interviews; literature review	The study found that the IASB has sought to address the impact of digitisation on disclosures by including information provided by companies, not just that required by the IASB – Digitisation of Corporate Reporting – XBRL.	26
Shan & Troschani, 2021	US and Japanese companies	Share price and return value adequacy models – implementation	The study deepens the knowledge of the time on the implications of digital corporate solutions, accounting information reporting technology. It is shown that selected accounting measures will be more relevant once XBRL is mandatory. Evidence is presented to support the predictions for the US sample. It was confirmed that the contribution of XBRL to the relevance of selected accounting measures to value is greater in the US than in Japan.	19

Paper	Test sample	Research method	Results/conclusions	Citations
De Franco et al., 2020	No data	No data	The reports of companies with the same auditor are textually similar (more so than others). This suggests that there is an impact on the report, even though it is only reviewed, as it is not audited strictly. A positive relationship was identified between the aforementioned impact and the improved readability of the report, due to the fact that the textual similarity of the report may improve the quality of disclosure, as greater audit impact is a positive feature of financial reporting.	16
Omer et al., 2020	No data	Social network survey methodology – the network depicts the audit committees' linkages using four standardised measures of linkage (measures of centrality: degree centrality; eigenvector centrality; proximity centrality; linkage centrality)	Companies with well-connected audit committees are less likely to have distorted annual financial statements, as committee links through director networks mitigate the negative impact of board interlocks on errors in the quality of financial reporting.	50
Pei & Vasarhelyi, 2020	No data	XBRL taxonomy	The U-XBRL system has been shown to combine all types of information relevant to entities (internal data and data from external sources/ financial and non-financial data), then standardise the information according to guidelines and collect it in a repository for use as required.	15
Christensen et al., 2018	No data	No data	Differences in local gambling attitudes help explain the incidence of financial reporting errors – potentially increasing the likelihood that financial reporters will be willing to take gambling risk in company performance.	54
R. Gao & Sidhu, 2018	Entities from 22 countries applying IFRS on a voluntary basis	Investment efficiency/ optimality models; multivariate regression analysis; quartile model, binary models, multinomial logit models	On the basis of entities where IFRS has been adopted, it was found that investment efficiency has increased as a result of the change in standards. The probabilities of underinvestment and overinvestment have also decreased.	13
Amiram et al., 2018	No data	A review of the literature on financial reporting irregularities from a legal, accounting and financial perspective	Financial reporting fraud and other forms of financial misconduct are a significant threat to the existence and efficiency of capital markets. The aim was to develop a common language for researchers interested in this line of research and to identify directions for future research.	164

Paper	Test sample	Research method	Results/conclusions	Citations
Hope & Vyas, 2017	No data	Data analysis; literature review	Sources of finance in private companies are heterogeneous. The usefulness of the financial reporting of these companies to capital donors was examined. There is considerable heterogeneity in the way private companies are financed, influenced by their specific business context.	51
Melloni et al., 2017	No data	Analysis of financial statements	It has been shown that increased disclosure does not mean better information in integrated reporting.	222
Appelbaum et al., 2017	No data	Review of the literature on the subject	The role of accounting is evolving from a traditional emphasis on financially-oriented decision analysis to a more strategic approach that emphasises identifying, measuring and managing key operational drivers of shareholder value. It is important to align the Managerial Accounting Data Analytics (MADA) framework based on balanced scorecards in the context of business analytics.	262
Black et al., 2017	No data	Multivariate regression analysis	It was found that many US companies continue to use exclusions in their financial statements that are not in line with GAAP standards.	43
Leuz & Wysocki, 2016	No data	A review of the empirical literature	Identification of disclosure information needs based on economic disclosure and financial reporting regulations, drawing on US and national evidence. The study looked at the costs and benefits of disclosure, the real effects of disclosure and regulatory developments.	698
Loureiro & Taboada, 2015	No data	Scenario analysis; difference-in-difference methodology	The ability of insiders (internal investors) to learn from outsiders (investors from foreign markets) improves after IFRS adoption, and this improved ability to learn from outsiders leads to real economic benefits. Conclusions: 1) price sensitivity of investments increases after IFRS adoption, 2) the relationship between market reaction to M&A announcements and the probability of completing a deal becomes stronger after IFRS adoption, 3) significant improvements in operating performance and stock returns after IFRS adoption, 4) feedback effect.	41

Paper	Test sample	Research method	Results/conclusions	Citations
Park & Jang, 2014	No data	Literature survey	The results indicate a lack of interdisciplinary research in hotel accounting. The authors propose new areas: behavioural accounting, human resource management, and indicate the usefulness of interdisciplinary research in this area with CSG reporting.	30
H. Zhu & Wu, 2014	No data	Regression method	The authors proposed a framework for assessing the quality of disclosures under XBRL: quality of information, XBRL versus GAAP taxonomy, XBRL versus GAAP standards; It was concluded that adding non-standard elements to the next version of the taxonomy could increase data interoperability with minimal adverse impact on the complexity and relevance of the taxonomy; industry specifications would increase both the completeness and relevance of the standard.	23
Cameran et al., 2014	No data	Literature review; lexical analysis of reports; statistical methods: correlation and regression; robustness tests as verification of results	The results show that the adoption of IFRS has not improved the quality of reporting among private companies; on the contrary, the quality has deteriorated because companies can use the level of flexibility contained in IFRS to pursue their own reporting interests.	41
Crawley & Wahlen, 2014	No data	No data	The study aims to: (1) inform business professionals about cutting-edge analysis in accounting research and (2) stimulate researchers to explore new and creative research opportunities.	9
Lantto, 2014	No data	Literature review; face-to-face interviews with professionals from New York Stock Exchange-listed companies	The results indicate the need to approximate and minimise the differences between IFRS and US GAAP. IFRS requires preparers to take more responsibility for reporting than domestic accounting standards (DAS) – which depends on the set of accounting standards.	17
J. J. Chen et al., 2014	No data	Descriptive statistics method	The results show a negative relationship between goodwill and voluntary disclosure for firms that rely heavily on guanxi for value creation (e.g. non-high-tech firms and firms located in regions with underdeveloped institutions). In contrast, a positive relationship between firm value and voluntary disclosure is found for firms that rely less on guanxi and more on other sources of core competencies (e.g. high-tech firms and firms in highly marketised regions).	30

Paper	Test sample	Research method	Results/conclusions	Citations
F. Lin et al., 2014	No data	Literature review; hypothesis testing based on Benford's law	The results indicate that companies with more conservative financial reporting are less likely to engage in earnings manipulation activities. A negative relationship was also found between earnings management and institutional investor holdings. However, if firms' financial statements tend to be conservative, institutional investor holdings may increase managers' incentives to manage earnings.	42
Debreceeny & Gray, 2001	No data	No data	Research indicates that a standard set of specifications for web-based financial and business reports is needed. One way to deal with the huge sources of information should be to automate web search through the development and use of intelligent agents. The 'eXtensible Business Reporting Language' (XBRL) is an initiative to develop specifications for web-based business reporting (taxonomies, database accounting, financial reporting, providing: intelligent agents, human/computer interfaces, standard development process and formal ontologies).	172
Baldwin & Williams, 1999	No data	No data	The financial reporting environment presents an opportunity for the development of intelligent agents to assist in financial reporting and analysis tasks.	6
Martinsons et al., 1999	No data	Developing a balanced scorecard concept for business functions, departments and even individual projects	The authors point out that the ability to mobilise and exploit softer and less tangible intellectual assets is becoming increasingly important. Information age companies need to focus on specific market segments or use technologically enhanced processes to efficiently produce and deliver their products and services.	356
Souza et al., 2024	Companies in the Brazilian electricity sector	Statistical methods. adapted Ohlson model (value relevance) and Hirschman-Hirfindahl Index (complexity of firms)	The impact of organisational complexity on value materiality under regulatory and financial accounting standards was analysed. The results contribute to demonstrating to policymakers that, depending on the level of organisational complexity, materiality from a financial perspective tends to decrease compared to the materiality of regulatory information.	0

Paper	Test sample	Research method	Results/conclusions	Citations
Elad et al., 2023	Sample: 245 African companies (214 were eventually surveyed)	Analysis	The study examined the accounting policy choices made by the largest non-financial companies from major jurisdictions in Africa when listed companies are required to adopt IFRS.	
Barker et al., 2013	No data	No data	Existing financial reporting until 2013 was characterised, on the one hand, by an excess of disclosures and, on the other hand, by a lack of a conceptual framework for organising and communicating disclosures. At the same time, there was a reported problem of better adapting the framework to the context in which financial statements are disclosed. This context has an important influence on the appropriate disclosure policy and practice in a given situation.	9
Murphy et al., 2018	No data	Experiment using a real case of fraud	Word choice and tone can help identify falsified financial statements. Through an experiment, it was found that people unconsciously show little suspicion.	5

Source: own elaboration on the basis of a review using the VOSviewer tool.

As a result of the literature review, publications on financial reporting and reporting were identified. A detailed summary of these, with indication of titles, authors, year of publication, methods and research samples, with conclusions and a number of citations is presented in Table 5.1. On this basis, it can be clearly stated that the largest amount of research in this period was directed towards the quality of reporting information, whereas a smaller number of publications concerned technology, single studies covering accounting regulations and competence issues.

Z. Zhang & Wang (2023) analysed the relationship between short-term planning and comparability of financial statement information. They used measures of short-termism in planning constructed using text analysis and machine learning based on Chinese language in management discussion and analysis (MD&A). The authors found that companies with a short-term approach produce financial statements with lower comparability (comparability is one of the qualitative characteristics of reporting information).

Wen et al. (2023) demonstrated in their research the role played by financial technology (fintech) in shaping information in the financial market in relation to the quality of corporate financial reporting. As fintech developments support credit finance in financial sectors through appropriate monitoring, this may further shape how firms report their activities in relation to disclosure costs and benefits. Using hand-collected data on fintech patents, the authors characterised regional fintech development and investigated its impact on firms' real earnings management. The results suggest that



fintech development improves the process of creating information and monitoring external financing.

J. H. Choi et al. (2023) posed the question of whether the quality of financial reporting affects employee compensation. Using employer-employee matched data in the United States, the authors verified employee characteristics by: regression of wages on firm-level reporting quality, documentation of wage changes, employee turnover and estimation of structural approach. They identified evidence consistent with two channels: pay for performance and turnover risk, where employees bear the risk of chaos in performance measurement. To mitigate endogeneity concerns, the authors pointed out that following the 2002 accounting scandals and the announcement of internal control weaknesses (ICW), former clients of Arthur Andersen and ICW firms pay bonuses to employees.

Research was also carried out on non-financial reporting in a selected area, namely Bini et al. (2023) highlighted that recent regulatory initiatives such as the EU Non-Financial Instruments Directive, the Reporting Directive, and the UK Companies Act, encourage companies to use the business model concept as disclosure of non-financial information in the annual report. These regulatory initiatives are based on a reflexive approach that avoids specifying what should be disclosed or formulating minimum disclosure requirements, indicating whether and to what extent users of non-financial information have a common understanding of the business model concept and its role in reporting.

Lantto (2022) examined how accountants obtain entity-specific information, how they read their financial statements and how they deal with uncertainty in this regard. The paper addressed cases of implementation of International Financial Reporting that incorporate the new types of entity-specific information that the standards require. The most important issue in such implementation is that accountants are becoming increasingly dependent on the knowledge of business managers. The study found that the result (or possible results) in financial reporting played an important role in controlling production, accountants actively used this as a problem-solving tool when the business side was unable (or unwilling) to present a 'clear picture' of the business activity.

Ibrahim et al. (2021) aimed to develop accounting standards, curricula and research to support individuals in dealing with the rapid growth of big data. The study revealed several potential points of convergence between big data sets and various accounting data, and discussed how big data sets can overcome the limitations of accounting data. The findings indicated a significant convergence between big data and accounting. Advanced analytics can address accounting data constraints that require estimates and forecasts.

Nguyen et al. (2021) demonstrated that the newly issued International Financial Reporting Standards (IFRS) have significantly transformed the accounting process and accounting information system (AIS). With the changes in information technology (IT), the proper use of AIS is crucial in order to have accurate information on which to

process business transactions and reporting information in accordance with the new requirements (IFRS).

Rowbottom et al. (2021) pointed out that digital corporate reporting enables computers to 'read' accounting information. Relevant here, 'standard setters' must construct a taxonomy to assign contextual 'metadata' that codifies disclosures derived from accounting concepts, standards and practices. However, digitalisation poses a problem for corporate reporting as under internationally accepted accounting practice, 'principles-based' standards give companies considerable discretion in deciding what they disclose and how they present information in their financial statements.

In turn, the study by Shan & Troshani (2021) extended the current understanding of the implications of digital reporting technologies on accounting information. The authors analysed how XBRL, the benchmark for digital corporate financial reporting, affects the relevance of accounting information in the United States and Japan, two key jurisdictions where XBRL has become mandatory. The researchers predicted that selected accounting measures will be more valuable once XBRL is fully implemented. The evidence gathered confirms that digital corporate reporting technology improves relevance and information reliability (Shan & Troshani, 2021). A study on data quality, quality of schemas, ontologies and other forms of metadata, and the quality of XBRL taxonomy was also conducted by H. Zhu & Wu (2014), who proposed a framework to assess the quality of disclosures according to XBRL.

A similar body of research was provided by Pei & Vasarhelyi (2020), who proposed the use of a new accounting system called User XBRL (U-XBRL) to address issues related to slow information dissemination, outdated accounting systems and high levels of data aggregation. U-XBRL collects, analyses and displays information in a way that meets the requirements of today's stakeholders. The article also discusses the measurement and corporate assurance ecosystem, highlighting the role of automation and machine analytics in data processing and evaluation (Pei & Vasarhelyi, 2020).

Omer et al. (2020) examined the impact of linkages between audit committees through directors' networks and the quality of financial reporting, particularly as it is related to misstatements in annual financial statements. They studied multiple dimensions of the linkage and found, after accounting for performance and corporate governance characteristics, that firms with well-functioning audit committees were less likely to misrepresent annual financial statements.

Christensen et al. (2018) analysed whether attitudes towards gambling help explain the occurrence of intentional misreporting, and showed that, similarly to gambling, some financial reporting choices are associated with deliberate, speculative risk taking. It is suggested that in places where gambling is more socially acceptable, managers are more likely to take financial reporting risks that increase the likelihood of having to restate financial statements. The study considered geographical variation in local attitudes towards gambling and finds that restatements due to deliberate misreporting are more common in areas where gambling is more socially acceptable (Christensen et al., 2018).

The research goal of R. Gao & Sidhu (2018) was to assess how IFRS adoption affects investment decisions and reporting performance in different countries. The study focused on the impact of mandatory IFRS adoption on externalities reporting and investment performance, analysing various variables such as operating cycle, leverage, dividend policy and financial performance indicators including CFO, sales and investments.

The fraud aspect was addressed in a review study by Amiram et al. (2018). The researchers highlighted that financial reporting fraud and other forms of financial misreporting pose a significant threat to the existence and efficiency of capital markets. This is a form of literature review on financial reporting fraud conducted from the perspectives of law, accounting and finance.

Hope & Vyas (2017) provided a comprehensive assessment of the sources of financing of private firms and their relationship with financial reporting practices. The study covered debt financing (bank financing, leasing and government guarantees), equity financing (family ownership, government ownership, employee ownership and private equity financing) and trade credit (supplier credit and factoring). It was pointed out that there is considerable heterogeneity in the way private firms are financed, influenced by their specific business contexts, and that this heterogeneity in financing is associated with differential demand and supply of financial reporting (Hope & Vyas, 2017).

Melloni et al. (2017) conducted research with reference to the Integrated Reporting Framework developed in 2013, stressing that they represent the most recent international attempt to combine a company's financial and sustainability performance (i.e. environmental, social and corporate governance) in a single report. It was pointed out that an integrated report (IR) should 'succinctly' communicate how a company's strategy, governance, performance and prospects, in the context of its external environment, lead to sustainable value creation. At the same time, the internal report must be 'complete and balanced', i.e. cover all the relevant issues, both positive and negative, in a balanced way. Drawing on research on impression management, selected performance determinants were investigated to gain insights into factors related to conciseness, completeness and balance in IR. The results from a sample of early adopter companies show that when a company's financial performance is poor, the IR is significantly longer and less clear (i.e. less concise) and more optimistic (i.e. less balanced). Moreover, it was found that companies with poorer social performance provide reports that are more vague (i.e. less concise) and contain less information on their sustainability performance (i.e. are less complete). The evidence gathered suggests that early adopters of IR use manipulation of quantity and syntax, as well as manipulation of thematic content and verbal tone as impression management strategies (Melloni et al., 2017). The results also indicated that such strategies depend not only on the level of firm performance, but also on the type of performance (financial or non-financial/sustainability).

Appelbaum et al. (2017) addressed the nature of the responsibility of management accounting which is evolving from simply reporting aggregate historical values to

measuring organisational performance and providing management with information related to decision-making. Corporate information systems such as enterprise resource planning (ERP) systems, provided management accountants with both expanded data storage power and increased computing power. It has been pointed out that with large data sets from both internal and external data sources, management accountants can now use data analysis techniques to answer questions such as what happened (descriptive analysis), what will happen (predictive analysis) and what is the optimised solution (prescriptive analysis). However, research showed that the nature and scope of management accounting has hardly changed, with management accountants using mainly descriptive analytics, some predictive analytics and an absolute minimum of prescriptive analytics (Appelbaum et al., 2017). The authors proposed a framework for management accounting data analysis (MADA) based on balanced scorecard theory in the context of business intelligence.

Black et al. (2017) addressed the frequency of non-GAAP (or 'pro forma') data reporting, which has steadily increased in the United States over the past decade, despite preliminary evidence that regulatory intervention has led to a decline in non-GAAP disclosures (cf. Almulla et al., 2024). In particular, the Sarbanes-Oxley Act of 2002 (SOX) and Regulation (2003) imposed strict reporting requirements for non-GAAP figures. Overall, the results suggest that although regulation has generally reduced aggressive non-GAAP reporting, some companies continue to disclose non-GAAP earnings figures that may be misleading in the post-SOX regulatory environment.

Leuz & Wysocki (2016) reviewed the literature on the economic consequences of disclosure and financial reporting regulation, drawing on US and international evidence. Given the policy relevance of regulatory research, they highlighted the challenges of: quantifying regulatory costs and benefits, measuring disclosure and reporting outcomes, and drawing causal inferences from regulatory research. They pointed out that understanding these linkages is important in evaluating the introduced regulations. The study synthesised empirical evidence on the economic effects of disclosure regulation and reporting standards, including evidence on the adoption of International Financial Reporting Standards (IFRS).

A study by Loureiro & Taboada (2015) enabled answering whether and how an exogenous shock in the information environment changes the ability of insiders to learn from outsiders. The authors found an increase in the price sensitivity of investments after the adoption of International Financial Reporting Standards (IFRS), additionally indicating that the relationship between market reaction to M&A announcements and the probability of completing a deal becomes stronger after IFRS adoption. They also found a significant improvement in operating performance and stock returns after IFRS adoption.

Park & Jang (2014) examined the intersection of finance and accounting in the hospitality industry from a global perspective. The paper stressed the need for research in hospitality finance/accounting (HFA) to not only understand past trends, but also identify future directions, whilst Crawley & Wahlen (2014) presented various analyses

in empirical/archival financial accounting research, and focused on research questions that are central to accounting, on analyses used to test hypotheses, and evidence. They described voice and text analysis that generates interesting new datasets and hypothesis testing, offering promising potential for future research. Their study aimed to inform business professionals about cutting-edge analytical methods in accounting research, and also encourage researchers to explore creative new research opportunities.

Debreceeny & Gray (2001) indicated that a standard set of specifications for web-based financial and business reports is required, as one of the ways to deal with huge sources of information should be to automate an Internet search through the development and use of intelligent agents. They identified three factors that are prerequisites for the effective use of the web, namely there should be adequate representation of metadata of financial reporting information, the ability to reliably analyse (recognition problem) on web pages, and that standard mechanisms are required to encourage or require corporations in reporting to be consistent.

Baldwin & Williams (1999) highlighted two factors that positively influence the likelihood of intelligent agents for financial analysis becoming a viable option for Europe in the future. Firstly, the science of intelligent agents is developing rapidly, with huge advances in the design and operation of the underlying agents being reported each year. Secondly, the European financial community is moving towards a better relationship between financial markets and accounting standards.

Souza et al. (2024) analysed the impact of organisational complexity on value materiality according to regulatory and financial accounting standards in the Brazilian electricity sector. Performing the analysis by business segment of companies in the electricity sector, differences in the materiality of financial and regulatory information were noted. In the transmission segment, data refer to equity, while in the distribution segment, profit information is more relevant. For both segments, complexity has negatively affected the materiality of their information, thus reducing it. The results contribute to demonstrating to policymakers that, depending on the level of organisational complexity, materiality from a financial perspective tends to decrease compared to the materiality of regulatory information.

Murphy et al. (2018) investigated whether and how linguistic indicators of fraud find their way into the management discussion and analysis (MD&A) section of financial reports. While research has shown that word choice and tone can help identify fraudulent financial reports, it is not yet clear how this happens when these reports are written by multiple individuals, some of whom are unaware that financial fraud is occurring. By examining industry recommendations and interviewing people experienced in writing MD&A sections, the authors confirmed that many a hand are involved in writing this part of financial reports.

To sum up, it can be concluded that the main stream of research in the area of financial reporting and (non-financial) reporting in the period under review addressed the qualitative aspect of reporting information, the technological aspect (the use of new technologies in the process of developing reporting information), the regulatory aspect

(the impact of balance sheet law standards on the scope and type of disclosures) and competence issues were also distinguished, with two involving single publications.

## 5.2. Impact of Digitalisation on Financial and Non-Financial Reporting

Among the technological solutions related to digitalisation, it is important to highlight the tools that have a significant impact on accounting processes, facilitating their automation, efficient data analysis and reporting of reporting information, and ultimately improving the decision-making process. In this aspect, the following areas can be highlighted.

### Cloud Computing

Cloud Computing is one of the main innovative AI tools used in accounting because of its ability to store data in the so-called cloud which users can access simultaneously and edit information from anywhere. This allows flexibility, increased scalability and speed of data processing and contributes to the effective modernisation of accounting policies. The advantages of cloud technology include:

- the speed with which cloud technology can be introduced into the operations of any organisation,
- real-time data analysis,
- filtering out irrelevant information,
- automation of calculations,
- the ability to store large amounts of data (Khomiak et al., 2022).

### Blockchain

Blockchain technology ensures the security of records due to the fact that they cannot be altered or duplicated, which helps to ensure a high level of trust and transparency in accounting policies (Blessing, 2024). In addition to reliability, blockchain ensures integrity of records and the use of big data allows analysis and identification of relationships and trends, which supports strategic decision-making, etc. (Khomiak et al., 2022). With blockchain technology it is possible to store structured and easily accessible data in real time. Such a solution determines an increase in accuracy, speed and interoperability in routine accounting processes and in the reporting of their results.

### Machine Learning (ML)

Machine Learning algorithms allow the rapid processing of large financial data sets, identifying trends, patterns and anomalies that would be difficult or impossible to detect without digital technology, also because they are constantly evolving as new data is provided, and this makes them highly adaptive to the changing financial environment. This ability to continuously learn makes the technology essential to improving the efficiency of both financial reporting and audit processes, thus real-time reporting results in increased confidence in the organisation and its accountability

(Blessing, 2024). Using ML algorithms, organisations can identify patterns of, for example, environmental behaviour, predict trends and assess the environmental impact of their activities with unprecedented precision. One of the key advantages of artificial intelligence, relevant to the concept of sustainable accounting is its ability to enhance the accuracy and reliability of data (Adelakun et al., 2024).

### **Internet of Things (IoT)**

The Internet of Things refers to a network of physical devices (sensors, sensors, etc.) that exchange data with each other via the Internet. The implementation of the Internet of Things allows the collection of large amounts of data in real time, which helps to streamline accounting processes and ensures the accuracy and speed of information exchange. IoT devices equipped with environmental sensors can stream data to AI systems that immediately process and analyse the information, which is crucial for timely reporting and its compliance with e.g. environmental standards (Adelakun et al., 2024).

### **Big Data**

Big data technology can improve the quality of financial reporting by increasing the transparency of accounting information, since by combining different data sources into an integrated system, it can improve the quality of reporting information, e.g. by transforming narrative information into numerical values, images and other forms of visualisation in non-financial, narrative reporting. Large data sets are also important for building continuous and two-way communication with all users of information from each organisation's accounting systems, and this determines the consideration of the diverse information needs of all stakeholders. With the use of this tool, the role of accountants is evolving as specialists with the right information processing skills are becoming increasingly necessary. The main disadvantages of big data include privacy issues and those related to the risk of cyberattacks – resulting in the loss or adverse use of information (Bonsón et al., 2021; Khomiak et al., 2022; Shapovalova et al., 2023).

### **Artificial Intelligence**

The use of artificial intelligence tools simplifies complex financial reporting by generating personalised financial statements in real time, essential for stakeholders of business entities who demand increasingly transparent and timely data (Almulla et al., 2024). AI-based systems can generate real-time financial reports, enabling organisations to access up-to-date financial and non-financial information, which allows for faster decision-making and more responsive business strategies. Hence, AI-based reporting tools can be configured to comply with multiple reporting standards simultaneously.

### **Visualisation of Data and Information**

The use of digital technology for the visualisation of data and information makes it possible to present them in graphical or visual forms that are easier to interpret for the audience. Thus the use of tools of this type enables creating dynamic, interactive



financial and non-financial reports that can be adapted to the information needs of report users, e.g. through different levels of detail, making it easier to understand financial results, trends, etc. With the use of dashboards, key performance measurement indicators can be monitored in real time by adapting to their specific reporting framework, which ensures that stakeholder requirements are met and, at the same time, determines the regulatory compliance of the reports (Blessing, 2024).

### **eXtensible Business Reporting Language (XBRL)**

XBRL allows for structuring and labelling of data in financial reports, ensuring standardisation and automated processing of data and information. Through automated analysis and data processing, this standard facilitates the efficient exchange of data and information, ensuring greater accuracy, accessibility and transparency (Shapovalova et al., 2023). As a machine-readable format for electronic transfer of business and financial data, XBRL allows organisations to communicate seamlessly and accurately (Nofel et al., 2024).

### **Natural Language Processing (NLP)**

In financial reporting, NLP plays a key role in processing unstructured data and information from contracts, emails, legal documents, reports, etc., which helps to ensure that financial statements comply with complex regulatory frameworks. By automating the extraction and interpretation of textual data, NLP increases the efficiency of accounting processes (Blessing, 2024). The use of the NLP technique leads to the transformation of financial reporting by automating the generation of reports, using linguistic analysis tools resulting in the presentation of data and information in a consistent and structured manner. NLP algorithms can also process large data sets, identify key trends, generate text summaries, etc. This speeds up not only the report generation process itself, but also ensures, in addition to consistency, the accuracy of the presentation (Jejenywa et al., 2024).

### **Robotisation of Business Processes (RPA)**

RPA technology in accounting is particularly effective in automating routine, repetitive tasks, reducing the likelihood of human error and the labour intensity of these processes. The technology – through its ability to collect data from multiple sources, financial systems, databases and external documents and incorporate them into financial statements – ensures their consistency (Blessing, 2024). Hence, the integration of artificial intelligence (AI), machine learning (ML) and RPA technology is revolutionising the accounting sector by improving the efficiency and accuracy of various accounting processes (Samson Ayinla et al., 2024).

### **Digitalisation in Management Accounting**

Technologies such as artificial intelligence – expert systems, machine learning, natural language processing (NLP), robotics – are transforming traditional management



accounting practices. Key areas where the development of new technologies adds value are in efficient data analysis and decision-making, automation of routine tasks, real-time monitoring and reporting, and predictive analytics for risk management. Thus, the accuracy and timeliness of financial forecasts and budgeting processes can be significantly improved, while the implementation of, for example, RPA technology can allow operational costs to be reduced. Real-time reporting, facilitated by artificial intelligence, increases the transparency of data and information on an organisation's financial and asset position and enables proactive management, while predictive models help managers make decisions to mitigate risk. Expert systems that mimic the capabilities of a human expert can support complex decision-making processes and the use of machine learning and business intelligence systems by analysing large data sets to discover patterns, trends, etc., determine the increase in accuracy and timeliness of financial forecasts as well as budgeting processes (Almulla et al., 2024). This enables proactive risk mitigation, thereby increasing competitiveness in an increasingly dynamic market, whilst the data and information generated is generally very complex and requires specialist skills to interpret it accurately (Hamidah, 2024).

### Technology in Sustainable Development

The implementation of digital technologies plays a key role in sustainability, with specific social and ethical implications for organisations and their stakeholders (Bonsón et al., 2021). Big data tools enable the collection, analysis and reporting of ESG data in a more streamlined and accurate way, helping organisations meet regulatory requirements, and demonstrates their commitment to sustainable and ethical practices; large data sets also support more effective communication with all stakeholders (Faccia & Petratos, 2024). A significant contribution of artificial intelligence is to increase transparency and accountability in environmental reporting. Through the use of NLP algorithms one can analyse and interpret regulatory texts, corporate reports, etc., confirming that organisations are complying with sustainability standards and guidelines (Adelakun et al., 2024).

Based on contemporary research, the relevant aspects of the impact of digital technologies on financial and non-financial reporting can be summarised as follows.

1. Implementation: artificial intelligence (AI) solutions are revolutionising real-time financial reporting by increasing accuracy, efficiency in decision-making processes and reducing the risk of human error. This enables regulatory compliance, improving operational transparency and resulting in a reduction in operating costs at the same time (Sanjiwani et al., 2024).
2. The use of modern IT tools such as big data technology, XBRL language, machine learning, cloud computing can lead to improvements in reporting quality, as the financial reporting process relies heavily on the verifiability and transparency of transactional data (Autore et al., 2024).
3. Digital transformation tools enable flexible, secure, efficient processing of large volumes of data, with automation of routine accounting processes, increasing

the accuracy and transparency of reporting from the accounting system. However, there are risks associated with errors in digital technologies and the threat of losing confidential data, which implies the need to establish ethical standards related to the implementation of artificial intelligence (Shapovalova et al., 2023).

4. The integration of artificial intelligence with accounting information systems offers significant potential to improve the quality of decision-making, which may ultimately lead to changes in accounting procedures and financial reporting standards (Sanjiwani et al., 2024).
5. Big data in financial and non-financial reporting facilitates the processing of large amounts of data from a variety of sources, improving predictive accuracy and enhancing the quality of decision-making processes. The technology addresses the challenges of complexity and high data velocity using advanced analytical tools (Indrayani et al., 2024).
6. Thanks to modern technologies, various methods and techniques can be used at the stage of data entry, processing, and analysis of reporting information, namely voice recognition, natural language, images, automatic document scanning, and visualisation of information. This leads to a reduction in the level of distortion of accounting information and helps to ensure its authenticity and accuracy (Khomiak et al., 2022).
7. Automating routine tasks in reporting and reporting reduces the need for human resources, allowing accounting teams to focus on strategic analysis and decision making (Maksymov et al., 2023).
8. Artificial intelligence technologies such as optical character recognition (OCR) and natural language processing (NLP) have revolutionised data entry, enabling machines to read and interpret text from images and documents. This leads to more reliable and accurate data reconciliation processes, reducing the risk of errors and ensuring compliance with regulatory requirements.
9. A configurable reporting framework enabled by artificial intelligence tools determines organisations to align their sustainability reports with international standards and guidelines, providing a comprehensive set of indicators for reporting environmental, social and governance (ESG) performance, which ensures transparency, comparability and credibility of reports.
10. Dashboards, based on artificial intelligence technology, enable an organisation's stakeholders to analyse data, tracking progress towards sustainability goals, with access to detailed reports and analysis (e.g. through dynamic and interactive visualisations of environmental data). This real-time transparency fosters a culture of accountability by reinforcing stakeholders' confidence in the organisation's commitments in this regard.
11. Technologies enable organisations to meet and even exceed stakeholder expectations by providing timely, accurate and relevant information on their environmental performance. This proactive approach to stakeholder engagement

enhances an organisation's reputation and fosters positive relationships with key audiences for reporting information (Jejenywa et al., 2024).

12. In the field of accounting, the impact of artificial intelligence goes beyond the mere implementation of technology, as it marks a paradigm shift in the way financial processes are conceived, executed and evaluated. The combination of technological agility and financial insight – in effect, the integration of modern digital technologies into accounting practices – not only increases the efficiency of routine tasks, but also enables accountants to take on more strategic roles in organisations (Jejenywa et al., 2024).
13. The convergence of AI and accounting requires interdisciplinary collaboration with data analysts, AI specialists and IT professionals (Jejenywa et al., 2024). In fact, artificial intelligence has become an ally of accountants, changing accounting practices and redefining the accounting profession.
14. The effect of integrating artificial intelligence with accounting practices was to create a balance between the benefits of increased quality in decision-making and the challenges of ethical considerations, data security and workforce dynamics (de Villiers et al., 2024).
15. The capability of generative artificial intelligence tools such as ChatGPT has serious implications for the future of corporate reporting, including sustainability reporting. This implies the threat posed by greenwashing in terms of reporting credibility, creating a gap between an organisation's disclosure to stakeholders and the organisation's actions (Moodaley & Telukdarie, 2023).
16. AI technology can make non-financial information more accessible to stakeholders by providing easy-to-understand and interactive information. This can help organisations to better communicate the impact of their sustainability initiatives and thereby ensure increased trust in their operations (Arkhipova et al., 2024).
17. Business Intelligence Systems which include a variety of support systems for reporting and data analysis, offer timely, relevant and easy-to-use information for strategic, tactical and operational levels of decision-making within an organisation. These systems are increasingly being used to provide management reporting capabilities and to enable deeper analysis of data obtained through advanced analytical techniques (Martins et al., 2024).
18. The use of natural language processing (NLP) in financial reporting represents a transformative step forward in the way organisations communicate their financial performance. As technology continues to evolve, the use of artificial intelligence tools, and NLP in particular, has the potential to redefine standards of financial transparency, accessibility and communication, ushering in a new era of informed and engaged stakeholders (Jejenywa et al., 2024).
19. RPA enables organisations to scale their operations by automating repetitive tasks with large amounts of data, thereby increasing operational efficiency without increasing human resources (Blessing, 2024).

20. The implementation of artificial intelligence requires responsible governance and the existence of ethical standards, as it raises concerns about data security, privacy and the ethical use of the technology (F. Zhang et al., 2024).

Contemporary research clearly indicates that digital technologies are having a revolutionary impact on financial reporting and reporting. The implementation of artificial intelligence enables the generation of real-time reports, which significantly improves accuracy, efficiency and regulatory compliance. AI eliminates many human errors, reduces operational costs and at the same time increases the transparency of decision-making processes. These developments contribute to improving the quality of reporting and building stakeholder confidence.

Modern IT tools such as big data, XBRL language, machine learning and cloud computing are revolutionising the way financial data is processed and presented. These technologies support the verifiability and transparency of transactional data, leading to more reliable and accurate reports, whilst the automation of routine accounting processes allows finance teams to focus on strategic activities, increasing the value of their work in organisations.

At the same time, the development of technology brings with it challenges related to data security and ethical standards. The implementation of AI and digital tools requires careful governance and the development of regulations to ensure data protection and information confidentiality. There is also a need to educate and develop digital competencies among professionals so that they can realise the full potential of modern technologies in reporting and reporting.

The role of technology in sustainability reporting (ESG) is also significant. AI and other digital tools enable reports to be aligned with international standards, ensuring transparency and comparability. Interactive dashboards allow stakeholders to monitor an organisation's progress in real time, reinforcing a culture of accountability and trust.

In conclusion, digital technologies are transforming financial reporting, increasing its transparency, efficiency and strategic relevance for organisations, while their development requires continuous regulatory adaptation, addressing ethical challenges and building interdisciplinary competencies, which are key to maximising their potential in the future.

### 5.3. Diagnosis and Directions for Further Research

The development of reporting is leading to a combination of financial and non-financial reports towards presenting a holistic view of the entity. A review of the literature on financial and non-financial reporting in modern companies identified four main sub-areas: quality of reporting, technological aspect in reporting, regulation, and competence. The review showed that the articles in this area were mainly concerned with the quality of the financial statements presented, and addressed the technological aspect to a lesser extent. Section 5.2 extended the research to recent publications on

the impact of digitalisation on reporting. Technological tools were presented that have a significant impact on accounting processes, facilitating their automation, effective data analysis and reporting of reporting information.

The third section identified key areas indicating how digitisation affects the process of reporting information. In particular, the analysis addressed:

- automation in the reporting process,
- the use of technology for ESG reporting,
- the quality of the reports prepared,
- the development of technological competence in the area of reporting.

Table 5.2 highlights the transformative potential of automation in impacting the quality and presentation of financial and non-financial reports. Digital technologies like Blockchain, Big Data, Artificial Intelligence (AI), Machine Learning (ML) and the Internet of Things (IoT) are providing individuals with big data processing, process automation, greater accuracy and transparency in reporting. The strength of digital technologies is the speed and efficiency of the reports generated. A breakthrough in financial reporting was the use of **natural language (NLP)**, enabling entities to extract important information from unstructured sources. Traditional reporting processes were both labour intensive and time consuming. NLP, using linguistic analysis, speeds up the process of generating reports and ensures consistency and accuracy in the presentation of financial information, and plays a key role in the speed of reporting. With NLP technology, individuals have access to up-to-date information and can use it for reports. The ability to process data in real time increases the timeliness and relevance of reporting. With NLP, the financial reports presented are enriched by the interpretation of factors affecting financial performance, as NLP allows financial reports to be customised based on the preferences of different stakeholders. The use of **cloud computing** providing real-time data reporting is also becoming commonplace. Real-time transaction reporting is also enabled by **blockchain** technology.

**Table 5.2. Areas of influence of modern technology on the reporting process**

Key research areas	Description	Exemplary publications
Automation in the reporting process	Automation of repetitive operations such as data entry, reconciliation and reporting has streamlined the work of finance and accounting services. Units have reduced the time it takes to produce both financial and non-financial reports. Automation has also ensured consistency in accounting records. NLP algorithms can process huge data sets, identify trends and generate text summaries. The widespread use of cloud computing has enabled real-time data processing and reporting.	Azaan & Elsa, 2024; Adeyelu et al., 2024; Jejenywa et al., 2024
Improving the quality of reports	Digital technologies favour efficiency, accuracy and speed of reporting. AI-based systems can process huge amounts of data with high precision. The use of data analytics and blockchain technology increases the transparency and overall quality of reports.	Islam Priom et al., 2024; Jejenywa et al., 2024; Yarmoliuk et al., 2024

Key research areas	Description	Exemplary publications
Use of technology for environmental reporting	Digitalisation is essential for environmental aspects. Through AI tools, ESG assessment is more accurate, which in turn enhances accountability and stakeholder engagement. Using ML algorithms, individuals can identify patterns, predict trends and assess the environmental impact of their actions with unprecedented precision. IoT devices equipped with environmental sensors can stream data to AI systems that immediately process and analyse it.	Abhishek et al., 2024
Development of competence	There is a need to intensify the use of technological and analytical tools in curricula, and to invest education and training in different AI models.	Azaan & Elsa, 2024; Pargmann et al., 2023; Rabbani, 2024

Source: own elaboration based on the literature review.

There is a growing body of research dedicated to the use of AI in environmental reporting. When creating an ESG report, it is important for entities to provide a comprehensive picture of activities in key environmental, social and governance areas. For many entities, however, the accuracy of reported ESG data is a major stumbling block. An analysis of articles in this area indicated that digitalisation enabled entities to analyse environmental variables, allowing them to anticipate emerging risks and develop strategies.

Current global trends emphasise the relevant competence requirements for accounting graduates (Table 5.3). Concepts of understanding the challenges and opportunities created by digitalisation need to be introduced into curricula, whilst companies also need to invest in training programmes to help employees adapt to technological advances.

**Table 5.3. Planned research directions on the impact of digitalisation on reporting**

Key areas	Description	Suggested testing methodology
Automation in the reporting process	What digital techniques are used in the reporting process?	A case study of companies with high levels of integration with blockchain and cloud technologies
	What is the impact of AI on reporting in different industries and regions?	Analysis of regulatory documents and industry reports to determine the current state
	What are the determinants of the use/choice of digital techniques?	Interviews with financial managers
	What units perceive problems when implementing AI?	Case study of companies using AI, interviews with financial managers
	What are the challenges of integrating AI with existing F-K systems?	Case study of companies using AI
Improving the quality of reports	Can artificial intelligence be detected in reports? Does it make a difference?	Case study of companies using AI
	Is there a framework for collaboration between the technology industry and the accounting industry?	Case study of companies using AI in reporting

Key areas	Description	Suggested testing methodology
Use of technology for environmental reporting	How can digitalisation improve the monitoring and reporting of ESG indicators?	Analysis of national and international literature, analysis of regulations and, in particular, analysis of sustainability standards
	How to explore the most effective ways to incorporate ESG indicators into financial reports?	Quantitative and qualitative research
Development of competence	Are curricula aligned to a hybrid skill set that combines specialist knowledge with technological proficiency?	Quantitative and qualitative research
	Are there innovative solutions that integrate AI with accounting education?	Quantitative and qualitative research
	Are employees willing to learn new skills to adapt to changing expectations on the job?	Quantitative and qualitative research

Source: own elaboration based on survey.

The future of accounting is the convergence of automation and artificial intelligence. It is important to emphasise that they provide unprecedented opportunities in terms of efficiency and quality of prepared reports, but their implementation requires a considered approach to ensure ethical conduct and take into account the evolving role of accountants in this transformation.

The implementation of modern technology in reporting, while addressing data security, ethics and regulatory compliance issues, will be crucial in an era of digital transformation. Blockchain is now emerging as a technology that has the potential to transform traditional double-entry accounting to a novel so-called triple-entry accounting (Yadav et al., 2024), and this system may be a more reliable way to secure financial information. Triple-entry accounting increases transparency by providing a more comprehensive and accurate representation of financial transactions, achieved by incorporating a third entry that serves to confirm and validate the traditional double-entry accounting system. At the same time, it reduces the time gap between the occurrence of a financial event and its subsequent recording.

However, the widespread implementation of blockchain faces some problems that need to be addressed. Limitations in this context include lack of standardisation, scalability issues and privacy. Therefore future research on the convergence of accounting systems with blockchain technology and triple-entry accounting should address the following aspects (Yadav et al., 2024): exploring the dynamics of inter-organisational collaboration in the context of triple-entry accounting, formulating and implementing a formal legal framework for triple-entry accounting, and assessing the opportunities, challenges and best practices in implementing blockchain and triple-entry accounting. Studying triple-entry accounting not only promises to redefine the organisation of accounting in business entities, but also implies reshaping audit processes, increasing the accuracy of financial reporting and reducing the risk of fraud.

As the future of reporting is non-financial reporting, it is necessary to highlight research directions in this area using artificial intelligence techniques presented in Table 5.4.



**Table 5.4. Research on ESG reporting using artificial intelligence techniques**

Key ESG research areas	Typical problems	Typical ESG areas	Typical AI techniques	Research in this area
ESG disclosures	Analysis of ESG disclosure data and identification of trends	Assessment of ESG disclosures and investor sentiment towards organisations in ESG reports and their categorisation	Event analysis, interaction modelling, learning, modal analysis, prediction techniques, etc.	(Briere et al., 2022; Chang & Lee, 2022; A. H. Huang et al., 2023; Reig-Mullor et al., 2022)
ESG measurement	Measuring the social and financial impact of climate change	Develop predictive models to help investors and other organisation intersectors anticipate changes in an organization's ESG performance	Time series analysis, sequence analysis, pattern mining, dynamic processes and programming, machine learning and deep learning models, etc.	Briere et al., 2022; Chang & Lee, 2022; A. H. Huang et al., 2023; Reig-Mullor et al., 2022)
ESG management	Identifying and assessing potential ESG risks, as well as monitoring and ensuring compliance with relevant regulations	Monitor and enforce ESG compliance by automating the tracking and analysis of ESG data	Probabilistic modelling, classification, clustering, learning, behaviour modelling, sequential modelling, novelty/exception/change detection, pattern mining, event modelling, etc.	M. Chen et al., 2021, 2022; Fan & Wu, 2022; Lim, 2024
ESG data analysis	Identify and extract ESG-related information from large amounts of unstructured data, such as newspaper articles, social media posts, company reports, etc. for assessing environmental factors	Access textual data from corporate sustainability reports to extract ESG-related information, using natural language processing techniques, etc.	Text analysis, pattern mining, classification, generative adversarial network, prediction, evolutionary computing	Gupta et al., 2021; Lopez et al., 2020; Rizzato et al., 2022; Sokolov et al., 2020

Source: own compilation based on (Lim, 2024).

In the area of ESG reporting practitioners can use artificial intelligence tools to analyse data on ESG disclosure, develop ESG measurement tools and improve ESG management practices. Future research directions could focus on the following areas: exploring the potential of emerging artificial intelligence techniques such as graph neural networks, learning models, etc. to improve ESG-related financial applications and address the responsible use of artificial intelligence; assessing the impact of regulatory frameworks, industry standards and stakeholder expectations on the adoption and integration of ESG and AI.

Directions for further research in the aspect of technology and ESG integration are determined by the following research questions (Lim, 2024):

- How will technology applications facilitate better quality ESG reporting?
- Will ESG disclosures based on the application of modern technology improve ESG reporting performance?



- How will disclosed ESG information further facilitate investors' and organisations' decisions to achieve sustainability goals?

The research directions presented, together with the research questions, provide direction for the area related to financial and non-financial reporting.

#### **5.4. Ethical Dilemmas of Financial and Non-financial Reporting in the Context of Modern Technology**

Accounting ethics is commonly defined as the totality of principles, the norms of behaviour in force in a given collective, era and environment, and is identified with morality, i.e. the rules of conduct considered appropriate. This includes societal standards of behaviour, including those related specifically to the accounting profession. Since ethical decision-making is more than just making a choice, it involves critical thinking that accepts the existence of multiple viewpoints and values that are sometimes in conflict with each other. The hierarchy of ethical decision-making includes acting in accordance with the law, with the rules of the profession and/or code of conduct, and on the basis of moral values and philosophical reasoning from the area of right and wrong (Cieślak, 2011). There are ethical dilemmas associated with accounting ethics – relating to financial and non-financial reporting in the context of modern technology – such as artificial intelligence and blockchain, which can affect many areas, hence this monograph highlights only the most important ones.

##### **Transparency and Honesty**

One of the main challenges is to ensure transparency in the use of artificial intelligence, which includes understanding the basis of decisions made by algorithms and the implications of their use in financial reports. The inappropriate use of AI can lead to reporting errors, affecting the credibility of financial information, and thus leading to a lack of transparency in decision-making processes and in the financial reports themselves. The use of algorithms in financial analysis may increase the risk in terms of distortions or simplifications that could falsify the presented financial position of the audited entity, undoubtedly affecting the fairness of the analyst's assessment and accountability (Groşanu et al., 2024).

##### **Responsibility**

In the context of the use of AI, an important issue is the problem of accountability for decisions made by automated systems. Attributing responsibility for erroneous decisions or fraud that may result from the use of technology is becoming a key challenge for companies, and this can lead to ethical concerns regarding the professional responsibility of accountants (Groşanu et al., 2024). The balance sheet legislation indicates the scope and type of responsibility in this aspect, however there is a doubt whether this will be a barrier when implementing new technologies in reporting practices, as the responsibility for interpreting and presenting financial statements using AI software will also fall on accountants (P. H. Rana, 2024).

### **Security and Data Protection**

Another key area is information security. The increased digitalisation of financial data raises new data protection and privacy challenges. Potential security breaches can lead to unethical practices such as the leak of confidential information (P. H. Rana, 2024). In the context of non-financial reporting, adequate protection of personal data and sensitive information is a significant challenge. The increased processing of data by AI raises concerns about privacy breaches and regulatory needs for data protection (Groşanu et al., 2024), which also needs to be taken into account in business practice. Implementing monitoring systems that can identify and assess AI risks, including potential algorithmic bias, is undoubtedly an important step in maintaining security and ensuring the right conditions are in place to accept responsibility for AI activities.

### **Objectivity and Impartiality**

Artificial intelligence can also be susceptible to biases, which can lead to unfair practices in the reporting of financial results. Automated systems can reproduce existing biases in the data, requiring special attention from accountants to ensure equality and fairness in reports (Groşanu et al., 2024). Technology can affect the objectivity of accountants, whereas the use of AI can introduce bias in decision making if algorithms are not designed to be neutral (W. Zhang, 2024) also in the context of the quality of reporting information.

### **Ethical Use of Algorithms**

Accountants are responsible for the ethical use of technology, which includes the responsibility to verify the reliability of AI algorithms. The inappropriate use of technology can lead to the manipulation of financial data and fraud, therefore it is important for accountants to understand AI algorithms and be able to assess their implicit risks (W. Zhang, 2024). Accountants should ensure that AI-based decision-making processes are clear and understandable. It is vital that information stakeholders have access to knowledge of the methods and models used to prepare and analyse financial data (Groşanu et al., 2024). In view of the above, accountants need to be familiar with the basic algorithms and models behind AI systems to be able to assess their reliability and make ethical decisions when using and sharing data generated with support from new technologies (W. Zhang, 2024).

### **Compliance with Professional Ethics**

Technological change introduces new challenges in complying with existing ethical standards. Accountants must adapt their practices to the new realities, which implies the need for training in the ethical use of new technologies (Groşanu et al., 2024). This suggests the need to adapt ethical standards and ensure that accounting professionals are adequately trained to effectively identify and manage risks in the face of the challenges involved.

Note that many countries and regions have become aware of the ethical risks posed by AI and introduced a number of ethical principles for the areas in question. In March 2018, the EGE announced a Statement on Artificial Intelligence, Robotics and Autonomous Systems, comprising seven ethical principles, namely (C. Zhang et al., 2023):

- human dignity – artificial intelligence algorithms should not be used in a discriminatory manner;
- autonomy – whether, how and when to use AI systems are determined by humans, and that systems should be transparent and predictable;
- responsibility – the design, development and use of artificial intelligence systems should not introduce an unacceptable risk of harm to humans;
- justice, equity and solidarity – related to the prevention and detection of discriminatory biases and deviations in the AI system and the establishment of a mechanism for equitable distribution and benefit sharing;
- rule of law and accountability – governments and organisations should clarify with whom the responsibility lies if undesirable AI behaviour causes harm;
- safety, security and bodily and mental integrity – referring to the reliability of artificial intelligence in relation to human-machine interaction;
- data protection and privacy.

To sum up, the ethical challenges associated with the use of AI in financial and non-financial reporting include the need for ongoing education and adaptation to changing technologies (Table 5.5). Accountants are forced to reliably assess the impact of modern technologies on ethical standards and take steps to protect the quality of financial reports. Through these actions, they can strengthen stakeholder confidence and enhance the overall quality of practice in their profession.

**Table 5.5. Basic ethical dilemmas of financial managers related to technological advances**

Key ethical dilemmas	Description	Ethical question/problem	Examples of solutions
Transparency and reliability of financial data	Modern technology enables more sophisticated data analysis, but there is a risk of manipulation of financial results or forecasting models. Ethical concerns arise when automation and artificial intelligence affect the transparency and reliability of financial data. Financial managers must therefore ensure that automated processes do not compromise the quality of financial data.	How to ensure the transparency and reliability of the financial data presented, while protecting trade secrets and competitive advantage?	<ul style="list-style-type: none"> <li>• Implement standardised reporting methods to ensure uniformity and facilitate comparison of financial data.</li> <li>• Identify the scope of confidential information that does not need to be disclosed in reports.</li> <li>• Implementing blockchain technology to verify the authenticity and integrity of data, which increases its credibility.</li> <li>• Defining levels of access to information – e.g. detailed data for regulators and auditors, aggregated information for investors.</li> <li>• Regular audits by recognised auditing firms to increase confidence in the data presented.</li> </ul>

Key ethical dilemmas	Description	Ethical question/problem	Examples of solutions
Accountability for decisions taken by AI	Automating financial decisions with AI can lead to situations where it is difficult to determine who is responsible for mistakes or unethical actions. With automation and artificial intelligence taking over routine tasks, accountants need to protect their professional judgement. Ethical issues arise when they rely solely on automated processes, potentially reducing the importance of human expertise.	How to address the accountability of financial managers for AI decisions?	<ul style="list-style-type: none"> <li>• Striking a balance between technology and human judgement, based on expertise, and applying professional scepticism to the results generated by AI.</li> <li>• Introduce detailed frameworks and regulations defining responsibilities at different levels of the company.</li> <li>• Training financial managers in AI operations and high-tech risk management.</li> <li>• Implement independent audits of the algorithms to assess their compliance with company objectives and regulations.</li> <li>• Application of human-in-the-loop principles, stating that key decisions made by AI must be approved by a human.</li> </ul>
Data privacy and security	Financial managers need to advocate for privacy policies, ensuring the security of customer and company data. The integration of automation and artificial intelligence introduces new risk areas for cybersecurity. Financial managers are therefore responsible for securing systems against breaches, protecting financial data from unauthorised access.	How to ensure data privacy and security?	<ul style="list-style-type: none"> <li>• Transparent communication with customers about data use and protection.</li> <li>• Implement appropriate data protection and cybersecurity measures, adhering to ethical standards and the legal framework governing customer data.</li> <li>• Use of data anonymisation tools to protect confidential information during analysis.</li> <li>• Implement a Federated Learning method to test AI models on local data without the need to send it to central servers.</li> </ul>
Algorithmic discrimination	Ethical concerns stem from the opacity of artificial intelligence algorithms and arise when AI systems exhibit biases, leading to unfair results. Finance managers must advocate for transparent AI systems, providing insight into how algorithms arrive at conclusions. This is because transparent algorithms increase accountability by allowing the results generated by AI systems to be understood, interpreted and validated.	How do we ensure that artificial intelligence algorithms are fair and inclusive?	<ul style="list-style-type: none"> <li>• Implement guidelines and measures to identify and mitigate biases in AI algorithms.</li> <li>• Proactively engage with finance managers to address bias, ensuring that automated processes treat all stakeholders fairly.</li> <li>• Introducing simulation tests and independent reviews of AI algorithms.</li> <li>• Use data anonymisation techniques to eliminate information that may lead to discrimination.</li> <li>• Introduce mechanisms to optimise results towards greater equality (e.g. 'fairness-aware' algorithms).</li> </ul>

Source: own elaboration based on the literature review.

Based on a study of the ethical implications of the use of AI in the accounting systems of multinational corporations, the introduction of ethical review committees (councils) has been proposed to analyse and assess the ethical implications of solutions proposed by artificial intelligence before they are applied, as well as the implementation of training programmes on the responsible use of AI (Bani Ahmad, 2024).

However, the use of AI to analyse data to make work easier and quicker seems to struggle with concerns about security, privacy and misuse of data, whereas accountants' negative attitudes towards AI may result in incomplete information being passed on to programmers, resulting in erroneous results. The researchers also found, based on interviews, that after using AI some people lower their expectations of AI and that human intervention and professional judgement are still necessary to use the new technology. Over-reliance on AI may weaken the professional judgement of accountants.

Moreover, users doubt the capabilities of artificial intelligence and fear that theoretical AI models may encounter problems when analysing real data and dealing with complex scenarios. Due to inaccurate input of data or models, or misinterpretation of results by accountants for their own benefit, results may be distorted. Another problem is the reluctance to use artificial intelligence due to outdated knowledge and education difficulties in understanding advanced algorithms and unfamiliarity with basic IT functions. Some employees are also not well prepared to use artificial intelligence from a psychological point of view. In fact, artificial intelligence poses new demands and challenges for accountants (for example, in relation to completing knowledge and acquiring new, necessary competences). The inaccessibility of AI systems and data makes it difficult for users to have the autonomy to choose whether, when and how to use artificial intelligence.

The indicated ethical dilemmas that arise today in the work of financial managers and accountants are not a 'closed list'. The current codes of ethics and the so-called ethical dilemma banks should be expanded in the future with descriptions of further cases (situations) so that it is possible to educate staff by analysing cases from professional practice. Therefore, it appears that it is a priority to support financial managers and other professional groups in the accounting area in solving ethical dilemmas related to the use of modern technology.

This section discussed in detail the ethical challenges of integrating modern technologies, particularly artificial intelligence (AI), into the field of accounting and financial management. These considerations were based on the analysis of the impact of technology on fundamental principles of professional ethics, including data transparency, accountability for decisions, privacy and the potential risk of algorithmic discrimination.

The identified dilemmas point to the need to balance technological advances with maintaining high ethical standards in accounting. Technologies such as AI enable significant improvements in the efficiency of financial processes, but they raise a number of issues related to the transparency of algorithms, accountability for automated decisions and data protection.

Research indicates that technology cannot completely replace human judgement, and that the professionalism of financial managers requires their active involvement in overseeing the results generated by AI. It is also important to stress that AI is not neutral as algorithms can introduce biases that negatively impact the fairness of decisions, hence it is crucial to put in place systems that ensure transparency and fairness in algorithmic decision-making processes.

A further challenge is the accountability of decisions made by autonomous systems, particularly in the context of the opacity of AI algorithms, which can generate results that are difficult to verify. In order to minimise the risk, it is essential to create clear regulations and auditing mechanisms to reliably assess the results produced by AI systems.

Data privacy and security in the context of data processing by AI systems is another aspect that requires special attention. Financial managers must strive to ensure the full protection of their customers' and organisations' data, which can be achieved through advanced data protection methods such as anonymisation and Federated Learning technologies.

These issues are a rapidly developing area of research that requires ongoing updates to codes of ethics and industry regulations, particularly in the context of the increasing role of technology in accounting and financial management. It is necessary not only to regulate legal liability, but also to undertake educational activities that will prepare professionals for the responsible use of AI.

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