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What determines the quality of carbon reporting? A system-oriented theories and corporate governance perspective

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Abstract

The study examines the determinants of the quality of carbon reporting (QCR) by top listed firms of a developed country. Using a sample of the top 50 listed firms of New Zealand (NZ) sampled over a period of 6 years (2015–2020), the study measured QCR index using 14-items and analysed the data using regression analysis. The study finds that external factors, namely, carbon regulation (Emission Trading Scheme—ETS law), use of a standardised reporting format for non-financial reporting (Global Reporting Initiative, GRI) template, and environmental and social (E&S) performance, all positively influence the QCR. The study also finds that corporate governance attributes namely board diversity (women's representation on the board) and board size positively influence the QCR. Lastly, the study finds that top firms in NZ have many areas of improvement in reporting quality carbon information. The study is the first empirical research on QCR from NZ firms that evidences multiple institutional factors and governance elements as key explanatory factors driving towards making carbon reporting credible and reliable.

KEYWORDS
board size, carbon regulation, E&S performance, New Zealand, quality of carbon reporting (QCR), reliability, women board members

1 | INTRODUCTION

The current study examines the determinants of quality of carbon reporting (QCR) by New Zealand (NZ) top listed firms. In recent years, in response to increasing climate risk concerns, an ever-increasing global momentum articulating various carbon issues such as carbon reporting, climate-related risk and other initiatives by firms have been evidenced. To illustrate, a recent report published by KPMG (2020) revealed that in 2020, the number of companies that reported carbon information has increased significantly compared with 2017. Specifically, in 2020 among the N100 group of companies, the number of firms that reported has increased to 43% from 28% in 2017 (KPMG, 2020). In its most recent report, the Carbon Disclosure Project (CDP) also documented a significant increase in the number of large companies disclosing their carbon emissions: response rates were up 10% to 82% in 2009 compared with 2008, and 500% in 2019 compared with 300% in 2018 (CDP, 2019). Likewise, national regulators in various countries undertook numerous initiatives for reducing climate change effect and global warming. For example, in 2021, the Central Bank of Brazil announced mandatory Taskforce on Climate-related Financial Disclosures (TCFD) aligned disclosure requirements to be implemented in two phases. In the first phase,

List of Abbreviations: CDP, carbon disclosure project; CO_2, carbon dioxide; CSR, corporate social responsibility; E&S, environmental and social; GRI, Global Reporting Initiatives; NZ ETS, New Zealand Emissions Trading Scheme; QCR, quality of carbon reporting; TCFD, Task Force on Climate-related Financial Disclosures.

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firms will disclose focusing on qualitative aspects related to governance, strategy and climate-related risk management and incorporate quantitative aspects in the second phase (TCFD, 2021).[1]

Against the above-mentioned progress, it is an undeniable reality that an increase in carbon reporting does not necessarily lead to an increase in the quality[2] of the reported carbon information (QCR hereafter). It has been evidenced that in practice, investors and other stakeholders are unable to rely on reported carbon information in their decision-making, owing to a lack of reliable, consistent and trustworthy carbon information. In their recent study, Ernst and Young (2021) reported that carbon disclosure by global firms remains the priority, rather than improving quality of carbon information, as only less than 4% of firms (out of over 1100 sample firms) have received full points of 100 in the quality index. The study by TCFD (2021) has revealed that while there has been a positive trend towards global firms adopting climate disclosures frameworks, nevertheless, firms are not prioritising improving the quality and comprehensiveness of carbon disclosures (see also Deloitte, 2021).

In parallel, academic researchers have argued that firms' carbon initiatives are built on impression management motives and the disclosure of carbon information is largely an exercise of green-washing (Andrew & Cortese, 2011, 2013; Cotter et al., 2011; Hrasky, 2012; Khan et al., 2022; Rankin et al., 2011). The underlying rationale for their arguments is that firms' carbon performance information is 'dubious' and very often, decision-makers opportunistically engage in such dubious reporting to impress external stakeholders and to retain their legitimacy (Cadez et al., 2019; Comyns & Figge, 2015). Additionally, in a voluntary carbon reporting era, it is not surprising to see that firms merely exhibit short-term positive carbon performance and disguise adverse carbon performance, resulting in a lack of 'balanced' reporting of carbon performance information. As a result, investors, customers and other stakeholders cannot fully trust the reported information (Cotter et al., 2011; Hrasky, 2012; Khan et al., 2022).

In the carbon literature, He et al. (2022) have raised the question of 'how good carbon disclosures' (p.19) are and have suggested future academic investigation in this regard taking a multi-dimensional perspective of a quality construct. The current study aims to address this call. Furthermore, to date, most of the carbon related research has focused on carbon disclosure, carbon performance and the impacts of voluntary carbon reporting in different contexts (see He et al., 2022, for details), with little focus on understanding credibility and reliability of reported carbon information. He et al. (2022) further suggested that future carbon accounting research should be conducted to detect the credibility of carbon information and examine the triggers and consequences of carbon reporting malpractice (p.19). A very recent study by Khan et al. (2022) added that future carbon research should investigate factors influencing the quality (credible and trustworthy carbon performance information) of carbon information (p.13). The current study also addresses this call. Overall, while the momentum, progress and doubts do exist regarding carbon disclosure, the factors driving firms to report quality carbon information are still unclear and under researched in the literature. Understanding determinants of QCR is crucial because the necessity of disclosing transparent and reliable carbon information represents a major task/milestone that should be achieved by firms. Our effort is also timely, given that there has been increasing public debate on climate change regulations, climate risks and global warming; all these call for exploring factors that are likely to influence firms' authentic carbon information reporting. Additionally, identifying these factors will likely assist governments, policymakers, and others to prioritise issues so that stakeholders' confidence in carbon information is restored.

Using the lens of system-oriented theories, specifically, institutional, stakeholders and legitimacy theories, (DiMaggio & Powell, 1983; Suchman, 1995), the current study explored potential factors that are likely to influence the QCR in the case of top firms of a developed country. The specific research question addressed in the study was as follows:

RQ-1. What external and corporate governance factors influence firms to report quality carbon information?

Taking a sample of 300 firm-year observations between 2015 and 2020 from the top 50 listed firms in NZ, the study used the 14 multi-dimensional item QCR index to assess the QCR. The study used regression analysis to test the research hypotheses. Our study found that firms in NZ need to improve both 'in-house' efforts as well as external reporting in many areas. The current study also found that many factors, namely, carbon regulation (ETS), use of a standardised reporting template (Global Reporting Initiative, GRI) for non-financial reporting, firms' environmental and social (E&S) performance and governance attributes, namely, women's representation on the board (FEMALE) and board size (B_SIZE), all influence the QCR positively. Our findings are robust as we employed battery of robustness tests.

The findings of the study make several contributions in the carbon accounting literature. First, we have provided empirical evidence and a detailed account of firms' commitment and progress towards QCR information. From the findings, it is also evident that carbon quality is not the same in each dimension/item with reporting quality higher in some dimensions than others. These findings enable identification of the indicators/items where carbon reporting quality needs to be improved by firms. Second, previous non-financial studies have provided empirical evidence on the quality of CSR, environmental and/or sustainability reporting (Khan, Bose, Mollik, & Harun, 2021; Michelon et al., 2015; Rahman et al., 2019); however, these findings cannot be necessarily generalised to the QCR as the carbon accounting/reporting is an independent and distinct field of study (He et al., 2022). To the best of our knowledge, our study is the first that has developed a theoretical underpinning for carbon quality information using a political economy theories lens and has provided empirical

[1]Similarly, the New Zealand Government passed the Climate Change Response Amendment Act in June 2020, also known as the Emissions Trading Reform, which put in place a wide range of reforms to the New Zealand emission trading schemes (NZ ETS) and decarbonisation initiatives (World Bank, 2021)

[2]For the current study, the term 'quality' refers to usefulness, trustworthiness, and reliability of reported carbon information; the detailed discussion is shown in Section 2.

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evidence in this respect. Third, our study has evidenced that external factors (e.g., carbon regulation, GRI template and E&S performance) are influential factors in improving QCR. Empirical evidence on this issue is also absent in the extant carbon literature. Fourth, since institutional investors demand board diversity and carbon disclosure (Reid & Toffel, 2009), we have provided new evidence that corporate governance attributes (specifically, women's representation on boards and board size) positively shape the corporate response and give rise to increased credibility and transparency in the reported carbon information. Our empirical evidence therefore establishes the functionalities of the corporate governance elements needed for improving QCR. Lastly, our study provides a key insight in that different explanatory factors improve not only overall QCR but also both the 'in-house' initiatives of management (relevance criteria of QCR) and the external reporting of carbon information (reliability aspect of QCR), this line of evidence is new in the context of NZ.

The remainder of the paper is organised as follows. Section 2 briefly summarises the key literature and identify gaps in the literature. Section 3 discusses the theorical underpinning, develops the study's hypotheses, and provides an overview of the study's context. Section 4 discusses the research method. Section 5 reports the discussion of the results, including the robustness of findings. Section 6 concludes the paper.

2 | LITERATURE REVIEW AND CONCEPTUAL DISCUSSION OF THE KEY CONSTRUCT 'QCR'

2.1 | Prior studies on QCR and gaps in the literature

While carbon accounting literature is abundant in terms of numerous carbon-related issues (see He et al., 2022 for details of the latest developments),[3] there are few studies that have explored the QCR (Comyns & Figge, 2015; Cotter et al., 2011; Hrasky, 2012; Pitrakkos & Maroun, 2020). These previous studies reported many key insights, which include firms focused on reporting one sided carbon information - only positive information (Cotter et al., 2011); the extent of cosmetic vs authentic efforts in carbon footprint reporting vary based on industries and the later form of reporting is more intense in the carbon-intensive sectors than other sectors (Hrasky, 2012); the dominance of impression management by firms, and the necessities of regulation and independent assurance system for improving carbon reporting (Pitrakkos & Maroun, 2020). The study by Comyns and Figge (2015) measured greenhouse gas (GHG) reporting quality of 45 global firms using single industry's (gas and oil) longitudinal data and provided increased understanding of measuring a multi-dimensional perspective of carbon quality information. However, the current study is different from Comyns and Figge's (2015) study as they did not explore factors influencing QCR, whereas the current study has included five explanatory factors that are likely to affect QCR: carbon regulation, standardised reporting template, E&S performance, women's representation on the board and board size. Additionally, unlike focusing on a single industry (Comyns & Figge, 2015), our study considered multiple industries so there is broader generalisability of our findings.

The study by Rankin et al. (2011), probably the first of its kind, has provided useful insights into the role of numerous factors underlying the QCR in Australia. Collecting data from ASX-listed 187 firms, their study considered factors such as GRI template, environmental management, the presence of an environmental committee, corporate governance quality, EU emissions trading scheme (ETS), and firms' participation and response to the CDP (Rankin et al., 2011). Our study was primarily based on their study (Rankin et al., 2011); however, it differs in many respects. Specifically, Rankin et al. (2011) used only a single year of data compared with our carbon data for 6 years. Similarly, possible roles for other explanatory factors (e.g., carbon regulation, E&S performance and women's representation on boards), although pertinent, have been considered neither by their study nor in the carbon accounting literature. Lastly, an in-depth study of the quality of carbon information from multiple industries and factors influencing QCR are surprisingly neglected in the context of NZ. Recently, Khan et al. (2022) explored the nature of carbon reporting (organic vs. authentic) using top firms in NZ and market reaction for the QCR, however their study did not explore potential factors influencing QCR in this context. One of the motivations of current study was to fill this gap in the literature. (For why and how the NZ context is interesting, see Section 3.3).

2.2 | Conceptual discussion of the construct QCR

The term 'quality' is commonly used in both business and accounting disciplines to explain many key concepts, such as total quality management, quality of audit reporting or quality of financial reporting (Chauvey et al., 2015; Khan, Bose, Mollik, & Harun, 2021). In this study, we have used the conceptualisation of QCR from two broader aspects, namely, 'relevance' and 'reliability', as suggested by Khan et al. (2022), by focusing on a total of fourteen items (see Khan et al., 2022 for details). In explaining the attribute of 'relevance' to non-financial information, GRI (2002) defined 'relevance' as "… the significance/usefulness of non-financial information for stakeholders' decisions, having the key attributes of stakeholders' inclusion and stakeholder's engagement" (cited in Chauvey et al., 2015. p.739; see also Khan, Bose, Mollik, & Harun, 2021). Khan et al. (2022) explained the 'relevance' dimension of carbon information as reflecting multiple aspects of firms' internal initiatives for carbon information, namely engagement with key stakeholders; connecting the firm's carbon strategy with its business strategy; setting performance targets; use of performance indicators for carbon information; carbon reduction committee and governance; and integration of carbon mitigation programmes with business process/operations (p.6). It is argued that

[3]The detailed discussion of the study is not within the scope of the current study as their study has covered many carbon-related issues.

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firms' internal initiatives and their commitment to carbon reduction practices are also relevant for investors and other stakeholders' decision-making in many ways (Comyns & Figge, 2015; Rankin et al., 2011). For example, by understanding these internal initiatives, stakeholders can observe the internal changes initiated by firms for carbon reduction. If key initiatives (namely, carbon performance indicators, performance targets and comparisons) are adopted and practised internally, or if other 'in-house' initiatives for carbon reduction are implemented by firms (e.g., forming the carbon reduction committee, linking the carbon reduction plan across units or departments or other operational levels) and duly communicated, this information will be 'relevant' for stakeholders (Khan et al., 2022). Similarly, by engaging with key stakeholders, firms can better identify stakeholders demands and expectations for non-financial information and decide appropriate information to communicate, which are relevant for both parties (Chauvey et al., 2015; Khan, Bose, Mollik, & Harun, 2021). These will further indicate firms' authentic endeavours to reduce their carbon footprint. Overall, we argued that the greater the presence of relevance attributes within the carbon information, the better the quality of the reported carbon information.

Another key attribute of non-financial information is 'reliability'. In the financial accounting literature, it is argued that the 'reliability' of financial information enhances its credibility and trustworthiness (Financial Accounting Standards Board [FASB], 2010).[4] For the reliability of carbon information, the Taskforce on Climate-related Financial Disclosures (TCFD, 2017) recommended climate change-related disclosure in the light of four key elements, namely, governance, strategy, risk management and metrics and targets. TCFD (2017) have also recommended seven principles for reliable and trustworthy reporting on carbon information and climate risk issues. These include objective and verifiable information, completeness and specificity, clarity, balance (both positive and negative carbon information), comparability, consistency over time, and timeliness of carbon information (TCFD, 2017). The World Resources Institute-WRI (2004, p. 6) also prescribed that greenhouse gas (GHG) reporting should be based on the principles of relevance, completeness, consistency, transparency and accuracy.

Within the dimension of 'reliability' of QCR, the recent literature (e.g., Comyns & Figge, 2015; Khan et al., 2022) has also stressed the above aspects of TCFD (2017) as well as a few other issues such as materiality and risk assessment, and ongoing engagement with stakeholders (Comyns & Figge, 2015; Khan et al., 2022; TCFD, 2017). The existence of all these elements would increase the information's credibility and transparency for stakeholders (Comyns & Figge, 2015; Rankin et al., 2011). To illustrate, reported carbon information by firms will be reliable and trustworthy to stakeholders when it is externally assured, and developed through an ongoing stakeholder consultation process. Additionally, credible carbon information requires firms to identify materiality and assess risks and provide both timely and comparable information (Cotter et al., 2011; Rankin et al., 2011).

[4]The FASB (2010) defines key attributes of reliable accounting information as comparability (information can be compared across time, organisations, and divisions); verifiability (externally assured); clarity; and neutrality (providing both positive and negative information).

If the provided carbon information is complete (both positive and negative information is shared), free from bias, and communicates in a timely manner, it will be considered reliable by stakeholders (Comyns & Figge, 2015; Cotter et al., 2011; Rankin et al., 2011). Khan et al. (2022) argued that the more 'reliable' the carbon information, the better the quality of the carbon information and vice versa. In the absence of QCR or minimum efforts for QCR improvement, firms adopt a greenwashing/impression management strategy, intentionally mislead stakeholders' perceptions about corporate carbon actions and provide unreliable carbon performance information (termed as 'decoupled' practices in the carbon/sustainability studies) (Khan, Bose, Mollik, & Harun, 2021; Khan et al., 2022; Seele & Gatti, 2017). We continue this conversation below in the light of theories and describe its measurement in the research method Section 4.

3 | THEORY AND HYPOTHESES DEVELOPMENT

3.1 | Theoretical underpinning: System-oriented theories

In the study, we have considered three system-oriented theories (also known as political economy theories) to understand the QCR and develop our study's hypotheses. The system-oriented theories consider the socio-political aspect of organisational life (Bose et al., 2018; Deegan & Unerman, 2011). The underlying argument in the theories is that organisational practices and policies in any industries are not merely driven from a technical input–output model of organisations (technical rationale of an organisations' life), but broadly originate from the operating and social context where the organisations operate. The theory also assumes that the economic activities, as well as internal policies, procedures and practices of the business firms, cannot be understood without considering social, institutional, and political frameworks (Deegan, 2002) because there is an ongoing nexus between firms and different societal stakeholders/actors (e.g., regulators, media, customers, community and employees) (Deegan & Unerman, 2011). Avoidance of these stakeholders' expectations and demands are impossible for firms. Often reflected in three specific theories such as legitimacy, stakeholders, and the institutional theory, these system-oriented theories are a powerful way to predict firms' motives behind reporting non-financial performance (reporting of quality carbon information in the current case). Legitimacy theory argues that firms involve themselves in non-financial reporting (reporting of quality carbon information) to maintain their 'contract' (both formal and informal) within broader society and to receive ongoing social approval from society for survival (Cormier & Magnan, 2015; Deegan & Unerman, 2011; Khan, 2010; Suchman, 1995). Relying on a slightly different perspective from the legitimacy theory, the stakeholders' theory purports that firms have multiple 'social contracts' with different stakeholders (Freeman, 1984), and firms should be involved in non-financial reporting (in this case QCR) to manage all stakeholders' expectations (ethical

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stance of stakeholder theory) (Khan, Bose, Sheehy, & Quazi, 2021). In practice, however, being opportunistic, firms only look after powerful stakeholders' expectations and demands such as regulators, media or other powerful actors (a view echoed in the managerial branch of stakeholder theory) (Freeman, 1984; Freeman et al., 2010). Institutional theory depicts those organisational internal practices as homogeneous, principally driven due to three external forces: coercive (regulations/regulatory intervention or other means); normative (not from regulatory intervention, but industry best practices); or mimetic (rival firms copy competitors' practices to remain competitive in the market) (DiMaggio & Powell, 1983; Khan, Bose, Mollik, & Harun, 2021). This theory focuses on two key aspects namely *isomorphism* (homogeneity in the organisational practices) and *decoupling* (actual internal practices of organisations are in variant with what they exhibit externally) (Deegan & Unerman, 2011; Khan et al., 2020; Khan, Bose, Mollik, & Harun, 2021; Seele & Gatti, 2017). In this study, we argued that firm's decision-makers' intentions to improve the QCR can be explained in light of the themes of these three theories[5] and can be influenced by various external factors, the details of which are discussed in the following sub-section.

3.2 | Hypotheses development (RQ-1)

The study considered five key factors such as carbon regulation, standardised reporting template (GRI or others), E&S performance, diversity on the board (women's representation on the board) and board size for QCR. These factors were considered due to their potential influence on QCR, as argued in the carbon literature. We discuss the possible role of these factors by turn.

3.2.1 | Carbon regulations and the QCR

While the carbon reporting practice to date is largely voluntary in different jurisdictions, reporting of carbon emissions is mandatory in some countries such as the United Kingdom, Australia, France and NZ. Specifically, since 2013 the UK government introduced a mandatory carbon reporting requirement for all UK incorporated and publicly listed companies on the London Stock Exchange (Tauringana & Chithambo, 2015).[6] Studies have argued that firms display a better commitment to, and initiative for, implementation of non-financial reporting initiatives, when such practices are guided by powerful external actors (e.g., regulators and government agencies, powerful stakeholders and other interest groups) (Khan, Bose, Mollik, & Harun, 2021; Kumarasiri & Gunasekarage, 2017; Tauringana & Chithambo, 2015). In the light of New Institutional Sociology (NIS) theory (DiMaggio & Powell, 1983), scholars argued that national regulations or industry-specific regulatory guidelines serves as a coercive force (Hsueh, 2019; Tauringana & Chithambo, 2015), which are required for monitoring and improving quality of non-financial information. (Deephouse & Carter, 2005; Khan et al., 2020). Organisations follow regulatory rules to gain legitimacy and to avoid complex, inflexible, costly regulatory processes, and to circumvent possible legal liabilities (Horak et al., 2018; Khan, Bose, Mollik, & Harun, 2021; Wang et al., 2018). In the light of stakeholder theory, compliance with regulatory guidelines for carbon reduction by firms is a reflection of accommodating powerful stakeholders' demands and expectation.

In the case of carbon information, it has been argued that regulatory intervention is required for improving the QCR information to avoid inconsistency, and irrelevance, of reported carbon information (Andrew & Cortese, 2011, 2013; Comyns & Figge, 2015). Without regulatory intervention the industry lacks an ongoing monitoring mechanism and reported carbon information can become more superficial and untrustworthy (Andrew & Cortese, 2013; Ferguson et al., 2016). We argued that the presence of mandatory regulations relating to carbon information will encourage firms to develop carbon management and use carbon mitigation techniques internally more authentically as well as for external reporting. As a result, firms' quality of carbon information will be stronger because reported carbon information will be under the regular monitoring and scrutiny of regulators, and firms will be interested in maintaining good terms with regulators by providing reliable and credible carbon information. Empirically, Hsueh's (2019) study on Global 500 firms confirmed that, under stringent regulatory guidelines, firms adopt more pre-emptive moves to assess the impact of their operations on carbon emissions (see also Bui et al., 2020; Kumarasiri & Gunasekarage, 2017).

In the context of NZ, the government established the NZ ETS (New Zealand Emissions Trading Scheme) in 2008 and revised the ETS amendment Act, 2020, to combat increasing greenhouse gas (GHG) emissions (Diaz-Rainey & Tulloch, 2018; Khan et al., 2022) and include both forestry and agricultural sectors. In the 2008 Act, firms involved in this scheme were able to import carbon credits internationally and are eligible for receiving carbon credits when trading (Bullock, 2012; Carver et al., 2022). According to the Environmental Protection Authority (EPA) (2021), the Climate Change Response (Emissions Trading Reform) Amendment Act 2020 became law on 22 June 2020 and has enabled a variety of compliance tools to help manage and maintain the integrity of the ETS. Additionally, the other key changes in the revised Act-2020 included keeping the provision of monetary penalty for non-compliance or for incorrect emissions return information as well as provision of auctioning NZ units (EPA, 2021). In 2019, NZ became one of the first countries in the world to formally make a law to achieve zero net carbon dioxide emissions by 2050, and the first country in the world to introduce legislation. Such legislation requires the multiple financial service industries, namely, banks, insurers and investment managers, to report the impacts of climate change on their businesses, to the Minister for Climate Change (Khan et al., 2022). We argue that firm-level national

[5]At this stage, we clarify our position that the scope of the current study is not to empirically test each theme of these three theories, but to base our hypotheses' arguments in the light of the key ideas taken from these theories.

[6]Similarly, in Australia, an initiative was adopted by enacting Australia's National Greenhouse Energy Reporting Act of 2007 and established a National Greenhouse Energy Reporting (NGER) framework for firms to disclose how their work impacts the environment; firms that exceed certain emissions thresholds must register with the Department of Climate Change (DCC) and report their emissions annually by October 31 (CPA Australia, 2016).

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regulations for carbon emissions (regulation for the ETS) will have a key influence on the QCR of NZ firms, since it provides a context of holistic preparedness for a carbon agenda and for reporting quality carbon information. Formally, we state the following:

H1. The regulatory guideline on carbon (ETS) positively influences the QCR of firms.

3.2.2 | Standardised reporting templates for non-financial reporting (GRI guidelines) and the QCR

Previous studies have argued that the content of non-financial reports and templates used for reporting non-financial information, are the key to ensuring credibility and reliability of reported information (Aureli et al., 2020; Khan, Bose, Mollik, & Harun, 2021; Marimon et al., 2012). Firms' use of the GRI template for reporting non-financial information has considerably increased as the standard and credible reporting template during the last two decades (Fernandez-Feijoo et al., 2014; Marimon et al., 2012). The prominence of the GRI template is further enhanced globally because of their recent partnership with the United Nations (UN) to promote sustainable development goals (SDGs) and sustainability reporting (GRI, 2021). In the light of stakeholder theory, the use of the GRI template by firms will be positively appreciated by different stakeholders owing to GRI's credibility and reputation as a standard/coherent reporting template for the sustainability performance information. In the light of institutional theory, it is argued that, in the institutional environment, following the GRI template has become the 'norm' and accepted guidelines for many industries globally (Fifka, 2013; Khan, Bose, Mollik, & Harun, 2021). In other words, in an institutional setting, following the GRI guidelines for reporting sustainability performance information may not be driven merely due to regulatory guidelines (e.g., ETS or other non-financial regulations), but the practice may already be widely adopted in similar industries and settings. Consequently, the GRI adoption turns into an established 'norm' and the 'industry best practice' in an industry.

In the study, we argued that firms following GRI guidelines for their non-financial reporting would have a positive impact on enhancing QCR. Specifically, firms that used the GRI guidelines for non-financial information (sustainability and other activities) would provide a greater level of credible and reliable carbon emissions information (Rankin et al., 2011). The reason is that firms that utilise the GRI guidelines to produce sustainability information are likely to be pro-active in embracing climate change issues/carbon reduction initiatives within their organisation (Rankin et al., 2011). Additionally, GRI reporting templates require firms to focus on and improve 'in-house' preparation for non-financial performance information in many ways, namely, setting performance targets, performance indicators, performance over time, maintaining stakeholder dialogues and linkingenvironmental/carbon initiatives across organisational operational levels as well as on external verification (GRI, 2021; Khan, Bose, Mollik, & Harun, 2021; Rankin et al., 2011). Indeed, firms who already use GRI guidelines for their non-financial reporting, will have pre-existing, in-built 'structure' and 'readiness' for producing quality (relevant and reliable) carbon information. Likewise, firms following GRI guidelines in general, will have a greater level of consensus on their quality criteria and standard of carbon information. Empirically, Rankin et al. (2011) have evidenced that use of GRI for sustainability reporting affects the quality of carbon information positively. Yet, the potential role of GRI guidelines in improving the QCR is to be examined empirically in the NZ context. Based on the above discussion, we hypothesise:

H2. The use of GRI guidelines by firms for non-financial reporting positively influences the QCR.

3.2.3 | Environmental and social (E&S) performance and the QCR

The E&S performance of firms conveys a key message to stakeholders that firms care not only for shareholder value but also for social well-being and environmental protection (Clarkson et al., 2019; Schaltegger & Hörisch, 2017). By displaying E&S performance, firms receive both financial (increasing market value) and non-financial benefits from the market (such as market reputation, social acceptance and others) (Clarkson et al., 2019; Schaltegger & Hörisch, 2017). From the legitimacy theory perspective, it is argued that firms commit to improving E&S performance in line with social expectations to gain social legitimacy (Deegan, 2002) and to reduce the credibility gap in the society/market (Cappucci, 2018; Wang et al., 2018). Legitimacy theory argued that since social expectations are not static, but rather changes constantly, it is the firms' responsibility to reduce the gap by providing ongoing carbon performance information (Deegan & Unerman, 2011). It is therfore necessary for firms to provide not only carbon performance information but also, to ensure that reported carbon information is relevant, credible and trustworthy. Given that firms' E&S performance reflects firms' commitment to society and the natural environment (Capelle-Blancard & Petit, 2017; Clarkson et al., 2019; Schaltegger & Hörisch, 2017), firms with better E&S performance are likely to be motivated to strengthen their internal endeavours for carbon reduction activities, avoid reporting superficial carbon performance to maintain their reputation in the market, and to sincerely take internal initiatives for improving the quality of carbon information. From the stakeholder theory perspective (Freeman et al., 2010), disclosing credible and trustworthy information on carbon emissions will be a vital mechanism for generating positive impressions and a positive reputation from the market in the long term (Khan et al., 2022; Slager et al., 2012). Such activities will be better sensed and be more smoothly carried by those firms with better E&S performance.

From the above discussion, we argued that when firms have track records of E&S performance, they would take holistic initiatives for improving QCR. Surprisingly, in the literature and in the context of NZ, the relationship between E&S performance and QCR has not yet

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been tested empirically. However, based on the previous discussion, we have a priori expectation that firms in NZ with a better E&S performance score, will produce better QCR information. Formally, we express the following:

H3. The environment and social (E&S) performance of firms positively influences the QCR.

3.2.4 | The effect of corporate governance attributes on the QCR

We have considered two key corporate governance attributes (e.g., women's representation on boards and board size) that are likely to influence the QCR. The possible role of these factors in improving QCR is discussed below.

Women's representation on boards and the QCR

Rankin et al. (2011) argued that specific internal governance systems and effective board structure should be in place to monitor, measure, and record carbon emissions levels, and to mitigate any risk associated with future regulatory requirements and changing societal expectations (p.1045). Recent carbon studies have advocated the necessity of board diversity for fostering carbon-related disclosure (Ben-Amar et al., 2017; Gerged, 2020; Hollindale et al., 2019; Liao et al., 2014; Nielsen & Huse, 2010). These studies have argued that different stakeholders strongly favour diversity of board members for dealing with carbon and climate change-related risks. The underlying rationale in this regard is that women on the board bring effectiveness in non-financial performance agenda, specifically, for environmental protection, carbon issues and social caring. Females have been portrayed as being more compassionate, fostering, cooperative, caring and sensitive to the natural environment and climate change risks (Ben-Amar et al., 2017; Gerged et al., 2018; Liao et al., 2014; Nielsen & Huse, 2010). With these different attributes of women, a more consultative, democratic, and proactive governance exists in the firms, which results in more participative leadership and engagement in the board, and informed decision making (Hollindale et al., 2019; Khan, 2010). In the presence of women on the board, the board engages in improved discussion, negotiation, supervision and monitoring of the firms' various non-financial initiatives and sustainability activities (Khan, 2010; Zhang et al., 2013). Empirically, Ben-Amar et al. (2017), using data from Canadian firms, reported that women's representation on boards positively affected carbon disclosure. Hollindale et al. (2019) showed that the percentage of female directors on the board positively influenced the disclosure of carbon information (see also Liao et al., 2014 in the UK context).

In the case of QCR, we argued that women's representation on the board is important for quality enhancement of carbon information and is likely to increase the quality of carbon information, because women directors will actively monitor firms 'in-house' carbon reduction initiatives. Additionally, they will work for reporting credible and transparent carbon information externally (Liao et al., 2014; Reid & Toffel, 2009). Formally stated:

H4. Female representation on the board positively influences the QCR.

Board size and the QCR

Previous carbon studies have advocated the importance of board structures and carbon disclosures (Daily et al., 2003; Rankin et al., 2011; Yunus et al., 2016). It is undeniable that board size is an important determinant of effective corporate governance, as the presence of more directors tends to increase the capacity of boards to monitor the different activities of executive management, which results in strengthening the quality of corporate governance (Daily et al., 2003; Yunus et al., 2016). Empirically, some studies (e.g., Rankin et al., 2011; Yunus et al., 2016), found a positive association between the overall quality of corporate governance and the extensiveness of carbon reporting. Specific to the board size and carbon issue, Yunus et al.'s (2016) study reported a positive relationship between the board size and firms' adoption of a carbon management strategy as well as their carbon performance. Based on the above-mentioned discussion, we argued that firms with a larger number of board members would have better opportunities to concentrate on issues relating to improving carbon quality, adopting in-house internal practices for carbon reduction and monitoring improvements, to optimise the credibility of their carbon information. Formally stated:

H5. The size of the board positively influences the QCR.

3.3 | The research context of New Zealand: A short background

The above-mentioned research hypotheses were tested in the context of NZ firms. We have selected NZ firms for numerous reasons. First, recently, the country has included a wide-ranging industry representation (both the forestry and agriculture sectors) in its ETS and ETS regulations (Carver et al., 2022; Diaz-Rainey & Tulloch, 2018) with some observable benefits for NZ firms. These include, allowing unlimited importation of overseas carbon credits, linking local firms into other international carbon markets, coupled with market liquidity due to the availability of multiple buyers and sellers (Bullock, 2012; MfET, 2007; Ranson & Stavins, 2016). Second, notwithstanding its ambitions, the efficacy of the country's ETS has been doubted, particularly following the collapse of NZ units (NZU) prices after 2010. A recent report published by the Ministry for the Environment projected that net emissions in the context would reach 90 million tonnes of carbon dioxide (CO_2) by 2040 from 1990 levels (Diaz-Rainey & Tulloch, 2018).[7] The significant rise in emissions has posed a new challenge for the government's ambitious

[7]The country experienced challenges to reduce greenhouse gas (GHG) emissions owing to its heavy dependence on the agricultural sector, which alone is responsible for around half of NZ's total GHG emissions This percentage is very high compared with other developed countries (12%) (see Khan et al., 2022; Treasury, 2007).

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2050 target of a 50% emission reduction (Diaz-Rainey & Tulloch, 2018; Khan et al., 2022). As a result, NZ firms and the economy are experiencing difficulties combating the carbon impact. Third, as mentioned earlier, in 2019, the country passed formal legislation, the first of its kind in the world, in order to achieve zero net carbon dioxide emissions by 2050 through enacting legislation for the multiple financial services industry, including industries' reporting requirements to the Minister for Climate Change; the first related reports will be published by companies in 2023 (Reuters, 2021). Against this backdrop, it is essential to understand NZ firms' efforts towards improving QCR and factors influencing QCR. QCR may be shaped and reshaped owing to multiple factors in the context and, thus, understanding the factors affecting the QCR of listed firms is also a matter of timely academic investigation.

4 | RESEARCH DESIGN

4.1 | Sample and data

The data collected for testing research hypotheses of the study involved the top 50 firms[8] listed on the NZ stock exchange for the years 2015–2020. The total sample consisted of 300 firm-year observations, representing over 80% of the total market capitalisation as of 26 July 2021. The period 2015 was selected because the NZ companies' climate related disclosures have been available on a comprehensive basis since 2015. Year 2020 was selected as the year was the latest year with available sustainability reports at the time of conducting the study. Information on the QCR was hand-collected from the sustainability reporting of firms. Following others (e.g., Khan et al., 2022), when separate standalone sustainability reporting was not published by sample firms, various sections of companies' annual reports were used, such as the chairman's statement, directors' report and other reports such as corporate governance disclosures, corporate social responsibility disclosures, and notes to the financial statement. Data for other variables such as ETS, GRI, and governance elements (women's representation on the board, board size) were also hand-collected from annual reports or other published reports. Finally, data relating to E&S performance and some control variables were collected from the Bloomberg database.

4.2 | Measures of the quality of carbon reporting (QCR)

To measure the QCR construct, we relied on the scale developed by Khan et al. (2022). Like previous studies, we employed a content analysis technique to quantify the quality of climate reporting (e.g. Khan, Bose, Mollik, & Harun, 2021; Khan et al., 2022). As mentioned earlier, relying on a total of fourteen (14) items, Khan et al. (2022) developed the construct 'quality' of carbon reporting using relevance (six items) and reliability (eight items) dimensions of carbon quality (CQ) information ranging from CQ1–CQ14 coded items (see Table 2 for details; see also Khan et al., 2022 for all coding procedures). Their study considered appropriate variables of interests reflecting QCR argued in the carbon literature (see Comyns & Figge, 2015; Rankin et al., 2011; TCFD, 2017; WRI, 2004). For the CQ1 item, an example of the exact wordings was '*Carbon emission reduction strategies are clearly connected with the business strategy/objectives of the firm'. Assign '1' if this information is presented; otherwise, '0*'. Or for the item CQ13 (materiality and risk assessments), the exact wording was '*The report contains information on firms' initiatives to identify all "material" information about key business operation; information that might affect firms achieving carbon emission reduction agenda; assessing threats/risks for implementation of carbon emission reduction and scanning of external market. Assign 1 if this information is presented; otherwise, 0*'. Similarly, for the CQ14 item, (Completeness), the wording for coding included, '*The report contains both positive and negative types (say, accident rates, number of injuries for carbon emission, accidents (fires, smokes) from electricity and other energies) of carbon emission reduction initiatives information. Assign 1 if this information is presented; otherwise, 0*'.[9] The majority of the QCR items were quantified with the indicator variable coded as (0,1) (exceptions included two sub-indicators namely CQ3 and CQ4, which were measured on 0–5 points scale). QCR was calculated as the arithmetic average of the weighted scores on all QCR 14 items. The total QCR scores were calculated as a ratio of the sum of the scores of each sub-indicator, scaled by the maximum possible score for the firm, a procedure followed by others (Khan, Bose, Mollik, & Harun, 2021; Michelon et al., 2015). Following prior studies (Chauvey et al., 2015), we used presence or absence of quality items to assess the reporting adequacy of our QCR index, rather than relying on other units of analysis, such as sentences or paragraphs. Following prior studies (Khan, Bose, Mollik, & Harun, 2021; Michelon et al., 2015), we used Cronbach's alpha coefficient to assess the internal consistency of our QCR index. The alpha coefficient of our QCR index was 0.845, indicating that the items included in the QCR index captured the same underlying constructs. To ensure reliability in the data collection and coding, three independently involved coders completed the content analysis of the annual reports/sustainability reports at different times. The first coder reviewed the entire sample of a firm's annual reports and performed the coding process. The second and third coders then compared and verified the coded data. All disagreements between coders were then addressed through consultation, and by revisiting the reports when required, an approach suggested by others such as Krippendorff (2018, p.128).

[8]List of sample companies are available in Appendix A. Sample firms % of GHG contributions are not reported as this type of inquiry is not within the scope of the current study. The anonymous reviewer 2 is thanked for this line of direction.

[9]The wordings used for the entire QCR items and coding procedure have not been reported in the table but for details, see Khan et al. (2022).

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4.3 | Measures of the regulatory guidelines, standardised reporting guidelines for non-financial reporting (GRI reporting templates) and E&S performance

The regulatory influence (ETS regulation) variable is the regulatory guidelines issued by the NZ regulators for ETS regulation. As mentioned earlier, the NZ ETS was enacted in September 2008 after more than a decade of consideration of emissions pricing by successive Governments and with amendment in 2020. This was measured as an indicator variable, which takes the value of '1' for industries (Agriculture, Energy, Industrial processes and Product use and Waste) covered by the Climate Change Response (Emissions Trading Reform) Amendment Act 2020, and '0' otherwise. The standardised reporting templates for non-financial reporting measured whether firms use the GRI reporting template for reporting non-financial information. The GRI reporting template was measured as a dummy variable that equalled '1' if a firm followed the GRI reporting framework as a standardised template for non-financial information, and '0' otherwise. To measure the variable E&S performance, we relied on the environment and social reporting score from Bloomberg, in each year, for each company. Bloomberg scores firms' E&S performance range from 0.1 for companies that disclose a minimum amount of E&S data, to 100 for those firms that disclose every data point collected by them. This approach to calculating E&S performance is widely used in the literature (e.g., Cheng et al., 2014, 2015). For other variables measurements, please see Table 1 for details.

4.4 | Control variables

We followed prior literature (Bose et al., 2018; Khan, Bose, Mollik, & Harun, 2021) and included several control variables. These included profitability (ROA), firm age (Age), leverage (Lev), firms' dual listing (DUAL-LIST), company size (SIZE) and cash flow from operations (CFO) (Ben-Amar et al., 2017; Bui et al., 2020). We also controlled for the year fixed effects.

4.5 | Models and estimation

We ran the following model to test our hypotheses.

TABLE 1 Variable definitions

Variable	Variable name	Definition and measurement	Sources
QCR	Quality of carbon reporting	The arithmetic mean of the weighted scores of all relevance and reliability items stated in Table 2	Sustainability/annual report (2015–2020)
RELV	Relevance	The arithmetic mean of the weighted scores of all relevance items stated in Table 2	Sustainability/annual report (2015–2020)
RELI	Reliability	The arithmetic mean of the weighted scores of all reliability items stated in Table 2	Sustainability/annual report (2015–2020)
ETS	Emissions trading scheme regulation	Dummy variable takes the value of 1 for industries (Agriculture, Energy, Industrial processes and Product use and Waste) covered by the Climate Change Response (Emissions Trading Reform) Amendment Act 2020, otherwise 0.	International carbon action partnership
GRI	GRI reporting guidelines	Dummy variable coded 1 if the firm follows the GRI guideline format for reporting sustainability/non-financial information, and 0 otherwise	Sustainability/annual report (2015–2020)
E&S	Environmental and social performance	Environmental and social scores calculated by Bloomberg	Bloomberg
FEMALE	Percentage of female directors in the board	Number of female directors divided by total number of directors in the board	Annual report (2015–2020)
B_SIZE	Board size	The total number of directors in the board	Annual report (2015–2020)
AGE	Company age	Date of listing in the New Zealand stock exchange	Annual report (2015–2020)
DUAL_LIST	Dual listing	Dummy variable takes the value of 1 if the company traded more than one stock exchange, otherwise 0.	Annual report (2015–2020)
SIZE	Firm size	The natural logarithm of firms' total assets	Annual report (2015–2020)
LEV	Leverage	The ratio of firms' total liabilities to total assets	Annual report (2015–2020)
ROA	Profitability	Earnings before interest and tax divided by total assets	Annual report (2015–2020)
CFO	Cash flow from operations	Cash flow from operations divided by total assets.	Annual report (2015–2020)

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TABLE 2 Quality of carbon reporting by year

Year	Relevance (RELV)							Reliability (RELI)	
	CQ1 Mean (SD)	CQ2 Mean (SD)	CQ3 Mean (SD)	CQ4 Mean (SD)	CQ5 Mean (SD)	CQ6 Mean (SD)	RELV[b] Mean (SD)	CQ7 Mean (SD)	CQ8 Mean (SD)
2020 ($n = 50$)	0.58 (0.49)	0.80 (0.73)	2.00 (1.64)	1.96 (1.42)	0.32 (0.47)	0.04 (0.19)	0.95 (0.59)	0.02 (0.14)	0.52 (0.50)
2019 ($n = 50$)	0.56 (0.50)	0.86 (0.35)	2.08 (1.71)	1.84 (1.29)	0.30 (0.46)	0.02 (0.14)	0.94 (0.57)	0.02 (0.14)	0.52 (0.50)
2018 ($n = 50$)	0.50 (0.50)	0.76 (0.43)	1.62 (1.70)	1.74 (1.30)	0.22 (0.42)	0.00 (0.00)	0.81 (0.57)	0.02 (0.14)	0.44 (0.50)
2017 ($n = 50$)	0.46 (0.50)	0.70 (0.46)	1.26 (1.54)	1.60 (1.19)	0.16 (0.37)	0.00 (0.00)	0.70 (0.53)	0.00 (0.00)	0.34 (0.47)
2016 ($n = 50$)	0.42 (0.49)	0.66 (0.47)	1.12 (1.43)	1.50 (1.18)	0.14 (0.35)	0.00 (0.02)	0.64 (0.51)	0.00 (0.00)	0.30 (0.46)
2015 ($n = 50$)	0.42 (0.49)	0.62 (0.49)	1.1 (1.56)	1.52 (1.28)	0.12 (0.38)	0.00 (0.00)	0.63 (0.55)	0.00 (0.00)	0.28 (0.45)

Note: All variables are defined in Table 1. CQ1 = carbon emission reduction strategies link with business strategy/objectives; CQ2 = Engagement with key stakeholders; CQ3 = Carbon performance targets; CQ4 = Carbon performance indicators (PIs); CQ5 = Integration with business processes/operations; CQ6 = carbon emission reduction committee and governance; CQ7 = Ongoing feedback and stakeholder dialogue; CQ8 = Trends over time; CQ9 = Readability & Clarity; CQ10 = Verifiability; CQ11 = Accuracy; CQ12 = Value and timeliness of data; CQ13 = Materiality and risks assessments; CQ14 = Completeness; QCR = the arithmetic mean of the scores on all CQs items.
[a]QCR (0–2.63)
[b]RELV(0–2.17)
[c]RELI (0–0.88)

TABLE 2 (Continued)

Year	Reliability (RELI)							QCR[a]
	CQ9 Mean (SD)	CQ10 Mean (SD)	CQ11 Mean (SD)	CQ12 Mean (SD)	CQ13 Mean (SD)	CQ14 Mean (SD)	RELI[c] Mean (SD)	Mean (SD)
2020 ($n = 50$)	0.24 (0.43)	0.24 (0.43)	0.58 (0.67)	0.06 (0.24)	0.08 (0.27)	0.08 (0.27)	0.23 (0.22)	1.18 (0.78)
2019 ($n = 50$)	0.22 (0.41)	0.24 (0.43)	0.50 (0.64)	0.04 (0.19)	0.04 (0.19)	0.04 (0.19)	0.20 (0.20)	1.15 (0.74)
2018 ($n = 50$)	0.16 (0.37)	0.20 (0.40)	0.34 (0.51)	0.04 (0.19)	0.02 (0.14)	0.02 (0.14)	0.16 (0.17)	0.96 (0.72)
2017 ($n = 50$)	0.16 (0.37)	0.16 (0.37)	0.32 (0.55)	0.04 (0.19)	0.02 (0.14)	0.04 (0.19)	0.14 (0.18)	0.83 (0.68)
2016 ($n = 50$)	0.10 (0.30)	0.16 (0.37)	0.28 (0.53)	0.04 (0.19)	0.00 (0.00)	0.02 (0.14)	0.11 (0.17)	0.75 (0.65)
2015 ($n = 50$)	0.10 (0.30)	0.16 (0.37)	0.24 (0.51)	0.06 (0.24)	0.00 (0.00)	0.02 (0.14)	0.10 (0.17)	0.74 (0.70)

Note: All variables are defined in Table 1. CQ1 = carbon emission reduction strategies link with business strategy/objectives; CQ2 = Engagement with key stakeholders; CQ3 = Carbon performance targets; CQ4 = Carbon performance indicators (PIs); CQ5 = Integration with business processes/operations; CQ6 = carbon emission reduction committee and governance; CQ7 = Ongoing feedback and stakeholder dialogue; CQ8 = Trends over time; CQ9 = Readability & Clarity; CQ10 = Verifiability; CQ11 = Accuracy; CQ12 = Value and timeliness of data; CQ13 = Materiality and risks assessments; CQ14 = Completeness; QCR = the arithmetic mean of the scores on all CQs items.
[a]QCR (0–2.63)
[b]RELV(0–2.17)
[c]RELI (0–0.88)

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$$QCR_{i,t} = \alpha_0 ETS_{i,t} + \alpha_1 GRI_{i,t} + \alpha_2 E\&S_{i,t} + \alpha_3 FEMALE_{i,t} + \alpha_4 B\_SIZE_{i,t} + \alpha_5 AGE_{i,t} + \alpha_6 DUAL\_LIST_{i,t} + \alpha_7 SIZE_{i,t} + \alpha_8 LEV_{i,t} + \alpha_9 ROA_{i,t} + \alpha_{10} CFO_{i.t} + YEAR\_FE + €_{i,t} \quad (i)$$

$$RELV_{i,t} = \alpha_0 ETS_{i,t} + \alpha_1 GRI_{i,t} + \alpha_2 E\&S_{i,t} + \alpha_3 FEMALE_{i,t} + \alpha_4 B\_SIZE_{i,t} + \alpha_5 AGE_{i,t} + \alpha_6 DUAL\_LIST_{i,t} + \alpha_7 SIZE_{i,t} + \alpha_8 LEV_{i,t} + \alpha_9 ROA_{i,t} + \alpha_{10} CFO_{i.t} + YEAR\_FE + €_{i,t} \quad (ii)$$

$$RELI_{i,t} = \alpha_0 ETS_{i,t} + \alpha_1 GRI_{i,t} + \alpha_2 E\&S_{i,t} + \alpha_3 FEMALE_{i,t} + \alpha_4 B\_SIZE_{i,t} + \alpha_5 AGE_{i,t} + \alpha_6 DUAL\_LIST_{i,t} + \alpha_7 SIZE_{i,t} + \alpha_8 LEV_{i,t} + \alpha_9 ROA_{i,t} + \alpha_{10} CFO_{i.t} + YEAR\_FE + €_{i,t} \quad (iii)$$

All variables are defined in Table 1.

5 | FINDINGS: DISCUSSION REGARDING QCR

As Table 2 shows, the QCR score has improved from 2015 to 2020 (0.74 to 1.18). However, the overall QCR score is very low. For example, of the 14 points for QCR items, NZ firms achieved only 1.18 points (8.43%) in 2020, although their QCR point score had increased from 2015 and 2016 (0.74 and 0.75 respectively). NZ firms need to improve their carbon quality reporting information in many areas; the formation of a carbon emission reduction committee and governance (CQ6), ongoing feedback and stakeholder dialogue (CQ1), value and timeliness of information (CQ6), materiality and risk assessments (CQ7) and completeness (CQ8), were almost entirely absent from the reported information over our period of investigation (Table 2). From Table 2, in terms of accuracy (CQ11), readability and clarity (CQ9), although the mean scores have increased over the years, the overall mean value was low (0.13 and 0.16, respectively). In other words, in 2020 more than 75% firms' reporting of carbon information did not reach the readability and clarity criteria. However, the sample firms have displayed noticeable progress in other areas, such as carbon emission reduction strategies that link with business strategy/objectives (CQ1), engagement with key stakeholders (CQ2), carbon performance targets (CQ3), carbon performance indicators (CQ4) and trends over time (CQ8) over the years under investigation. [Correction added on 18 January 2023, after first online publication: In section 5, 'QSR' has been corrected to 'QCR' in this version.]

As Table 3 shows, the mean (median) of QCR is 0.94 (0.75). In our study sample, 38% of firms were in ETS industries and 24% of firms used the GRI format for sustainability reporting. Moreover, firms in ETS industries had higher QCR scores (1.16 vs. 0.79) and higher compliance with GRI reporting format (1.39 vs. 0.78). The mean (median) of E&S was 36.31 (33.96). This result is similar to the previous studies such as Zuraida et al. (2017). The mean of FEMALE is 0.25, suggesting that on average one of four members on the board was female. The mean (median) board size was 6.67 (7.00), which is consistent with Chapple and Truong (2015). Among the other control variables, we found that on average 55% firms were a dual listing.

In terms of industry-wide quality information, as shown in Table 4, the consumer staples industry secured the top position (QCR mean of 1.39). This was then followed by consumer discretionary (QCR mean of 1.30), utilities (QCR mean 1.21), the energy sector (QCR mean 1.20), industrial sector (QCR mean 1.12) and technology industry (QCR mean of 0.17). Table 5 reports the correlation among the 13 variables. This result is consistent with our expectations and provides initial support of our hypotheses. To address multicollinearity, we calculated the Variance Inflation Factor (VIF). The VIF was well below 10 (3.59), and thus, collinearity is not a problem in this study.

TABLE 3 Descriptive statistics of all variables of interest

	Full sample ($n = 300$)					ETS = 1 ($n = 114$)		ETS = 0 ($n = 186$)		GRI = 1 ($n = 72$)		GRI = 0 ($n = 228$)	
Variable(s)	Mean	Median	SD	Q1	Q3	Mean	Median	Mean	Median	Mean	Median	Mean	Median
QCR	0.94	0.75	0.73	0.17	1.65	**1.16**	**1.20**	**0.79**	**0.56**	**1.39**	**1.58**	**0.78**	**0.50**
RELV	0.78	0.67	0.57	0.17	1.33	**0.94**	**1.00**	**0.67**	**0.50**	**1.10**	**1.16**	**0.67**	**0.50**
RELI	0.16	0.13	0.19	0.00	0.25	**0.22**	**0.13**	**0.12**	**0.00**	**0.29**	**0.25**	**0.11**	**0.00**
ETS	0.38	0.00	0.49	0.00	1.00					0.42	0.00	0.36	0.00
GRI	0.24	0.00	0.42	0.00	0.00	0.26	0.00	0.22	0.00				
E&S	36.31	33.96	18.21	21.01	48.04	**37.95**	29.26	**33.65**	35.67	**49.61**	**45.99**	**32.19**	**28.63**
FEMALE	0.25	0.25	0.13	0.17	0.33	0.26	0.25	0.24	0.25	**0.30**	**0.28**	**0.23**	**0.25**
B_SIZE	6.67	7.00	1.41	6.00	8.00	**7.11**	**7.00**	**6.24**	**6.00**	7.09	7.00	6.71	7.00
AGE	18.62	17.00	16.29	6.75	24.00	17.28	16.00	19.43	18.00	**24.98**	**20.00**	**16.44**	**16.50**
DUAL_LIST	0.55	1.00	0.49	0.00	1.00	0.59	1.00	0.52	1.00	**0.71**	**1.00**	**0.50**	**1.00**
SIZE	9.30	9.25	0.74	8.90	9.64	9.35	**9.45**	9.26	**9.19**	**9.59**	**9.45**	**9.21**	**9.19**
LEV	0.49	0.47	0.19	0.35	0.60	0.49	0.47	0.49	0.45	0.49	0.45	0.49	0.48
ROA	0.06	0.07	0.15	0.04	0.11	0.08	0.06	0.05	0.07	0.07	0.06	0.06	0.07
CFO	0.09	0.06	0.20	0.04	0.11	**0.09**	**0.08**	**0.06**	**0.05**	0.08	0.07	0.07	0.06

Note: All variables are defined in Table 1. Means and medians in bold are significantly different at $p < .05$.

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TABLE 4 Descriptive statistic of quality of carbon reporting by industry

Industry	*n*	QCR Mean (SD)	RELV Mean (SD)	RELI Mean (SD)
Communication services	18	0.74 (0.54)	0.56 (0.38)	0.18 (0.17)
Consumer discretionary	24	1.30 (0.84)	1.15 (0.72)	0.16 (0.12)
Consumer Staples	30	1.39 (0.69)	1.17 (0.57)	0.22 (0.15)
Energy	12	1.20 (0.57)	1.06 (0.48)	0.15 (0.08)
Financials	18	1.00 (0.55)	0.81 (0.38)	0.19 (0.19)
Health care	42	0.79 (0.68)	0.67 (0.48)	0.13 (0.23)
Industrials	42	1.12 (0.74)	0.95 (0.56)	0.17 (0.18)
Information technology	12	0.31 (0.26)	0.25 (0.15)	0.06 (0.11)
Materials	06	1.03 (1.17)	0.81 (0.86)	0.23 (0.31)
Real estate	48	0.41 (0.31)	0.35 (0.22)	0.05 (0.09)
Technology	06	0.17 (0.00)	0.17 (0.00)	0.00 (0.00)
Utilities	42	1.21 (0.78)	0.94 (0.54)	0.26 (0.26)
Total	300	0.93 (0.73)	0.78 (0.57)	0.16 (0.19)

Note: All variables are defined in the Table 1.

5.1 | Factors influencing the quality of carbon reporting: Results of hypotheses (H1–H5)

5.1.1 | Regression results

The regression results for factors that influence the QCR model are reported in Table 6. Column (1) presents the regression results of the overall reporting quality (QCR), while Columns (2) and (3) report regression results for the two dimensions of overall reporting quality, that is, relevance (RELV) and reliability (RELI). The adjusted R^2 values for the models range from 32.05% to 34.65%.

Hypothesis H1 assumes that the regulatory guidelines for carbon (e.g., ETS) are positively associated with the *QCR*. The coefficient of ETS was positive and statistically significant *(Coff = 0.3354, p < .01)*, as shown in Column (1), suggesting that the issuance of the regulatory directive (ETS regulation) has increased the QCR, thus, supporting H1. Furthermore, we documented the positive association of the ETS regulation with our two dimensions of overall reporting quality, that is, RELV *(Coff = 0.2540, p < .01)* and RELI *(Coff = 0.0815, p < .01)*. This indicated that the issuance of the regulatory guidance for ETS also improved both the 'in-house' efforts of firms and their external communications for QCR. The findings are in line with arguments in previous studies that regulatory intervention is essential to improve the trustworthiness and credibility of carbon reporting.

Hypothesis H2 predicts that the use of the GRI framework for non-financial reporting is positively associated with the *QCR*. The GRI coefficient was positive and statistically significant *(Coff = 0.2340, p < .01)*, as shown in Column (1), supporting a positive relationship between the use of the GRI framework and overall QCR. This result suggests that firms that have adopted the GRI reporting framework for sustainability reporting have a higher QCR, thus, supporting H2. Furthermore, when we split the QCR into two components, we found the carbon reporting quality was positively associated with both RELV (*Coff* = 0.1547, $p < .05$) and RELI (*Coff* = 0.0793, $p < .01$). This finding suggests that the adoption of a standardised reporting framework, such as GRI, for sustainability and other non-financial reporting initiatives, increases the relevance and reliability of carbon reporting.

Hypothesis H3 predicts that E&S performance is positively associated with the *QCR*. The coefficient of E&S was positive and statistically significant *(Coff = 0.0119, p < .01)*, as shown in Column (1), suggesting that improved E&S performance is positively associated with higher quality carbon reporting, thus, supporting H3. Furthermore, we documented that carbon reporting quality is positively associated with both RELV *(Coff = 0.0095, p < .01)* and RELI *(Coff = 0.0023, p < .01)*. This finding suggests that firms' efforts in improving E&S performance increases the relevance and credibility of their carbon reporting.

For Hypothesis H4, the coefficient of FEMALE was positive and statistically significant (*Coff* = 0.8234, $p < .01$), as shown in Column (1), supporting a positive relationship between the presence of women directors on the board and the overall QCR. This result suggests that firms where women are represented on board have a higher QCR, thus, supporting H4. Furthermore, when we split the QCR into two components, we found the carbon reporting quality was positively associated with the RELV component (*Coff* = 0.7233, $p < .01$) but not with RELI (*Coff* = 0.1001, $p > .10$). This finding suggests that women's representation on boards increases the relevance component of carbon quality reporting. Lastly, for Hypothesis H5, the B_*SIZE* coefficient was positive and statistically significant (*Coff* = 0.1149, $p < .01$), as shown in Column (1), supporting a positive relationship between board size and the overall QCR. This result suggests that firms with larger board sizes have a higher QCR, thus, supporting H5. Furthermore, when we split the QCR into two components, we found that carbon reporting quality was positively associated with both RELV (*Coff* = 0.0917, $p < .01$) and RELI (*Coff* = 0.231, $p > .10$). This finding suggests that larger board size increases both the relevance and reliability of carbon reporting.

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TABLE 5 Correlation matrix ($n = 300$)

	QCR	RELV	RELI	ETS	GRI	E&S	FEMALE	B_SIZE	AGE	DUAL_LIST	SIZE	LEV	ROA	CFO
QCR	1													
RELV	0.99*** (0.00)	1												
RELI	0.87*** (0.00)	0.78*** (0.00)	1											
ETS	0.25*** (0.00)	0.23*** (0.00)	0.23*** (0.00)	1										
GRI	0.35*** (0.00)	0.32*** (0.00)	0.38*** (0.00)	0.05 (0.37)	1									
E&S	0.43*** (0.00)	0.40*** (0.00)	0.42*** (0.00)	−0.12** (0.04)	0.40*** (0.00)	1								
FEMALE	0.32*** (0.00)	0.32*** (0.00)	0.28*** (0.00)	0.05 (0.32)	0.21*** (0.00)	0.32*** (0.00)	1							
B_SIZE	0.36*** (0.00)	0.36*** (0.00)	0.31*** (0.00)	0.17*** (0.00)	0.18*** (0.00)	0.26*** (0.00)	0.21*** (0.00)	1						
AGE	0.17*** (0.00)	0.16*** (0.00)	0.15*** (0.00)	−0.06 (0.26)	0.22*** (0.00)	0.14*** (0.00)	0.05 (0.31)	0.07 (0.22)	1					
DUAL_LIST	0.16*** (0.00)	0.12** (0.02)	0.24*** (0.00)	0.06 (0.24)	0.18*** (0.00)	0.28*** (0.00)	0.29*** (0.00)	0.27*** (0.00)	−0.14** (0.02)	1				
SIZE	0.23*** (0.00)	0.19*** (0.00)	0.29*** (0.00)	0.07 (0.22)	0.22*** (0.00)	0.45*** (0.00)	0.34*** (0.00)	0.45*** (0.00)	0.15*** (0.00)	0.27** (0.00)	1			
LEV	0.03 (0.58)	0.03 (0.58)	0.03 (0.64)	−0.01 (0.97)	0.02 (0.71)	0.16*** (0.01)	0.23*** (0.00)	0.13** (0.02)	0.04 (0.40)	0.16*** (0.00)	0.60*** (0.00)	1		
ROA	0.12** (0.04)	0.10* (0.06)	0.12** (0.03)	0.09 (0.11)	0.03 (0.62)	0.15*** (0.01)	0.09* (0.08)	−0.04 (0.45)	0.14** (0.02)	0.00 (0.99)	0.18*** (0.00)	−0.01 (0.92)	1	
CFO	0.24*** (0.00)	0.25*** (0.00)	0.13** (0.02)	0.02 (0.73)	0.04 (0.48)	0.09* (0.09)	0.19*** (0.00)	0.24*** (0.00)	0.09 (0.12)	0.10** (0.06)	−0.01 (0.84)	−0.18*** (0.00)	0.37*** (0.00)	1

Note: All variables are defined in the Table 1. Variance Inflation Factor (VIF) 3.59.
***$p < .01$.**$p < .05$.*$p < .10$.

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TABLE 6 Determinants of quality of carbon reporting: Baseline results

Variable(s)	Model 1 QCR Coefficient (*t*-value)	Model 2 RELV Coefficient (*t*-value)	Model3 RELI Coefficient (*t*-value)
ETS	0.3354*** (4.42)	0.2540*** (4.22)	0.0815*** (4.00)
GRI	0.2340*** (2.46)	0.1547** (2.05)	0.0793*** (3.11)
E&S	0.0119*** (4.81)	0.0095*** (4.84)	0.0023*** (3.57)
FEMALE	0.8234*** (2.70)	0.7233*** (2.98)	0.1001 (1.22)
B_SIZE	0.1149*** (3.79)	0.0917*** (3.81)	0.2310*** (2.85)
AGE	0.0036 (1.58)	0.0029 (1.57)	0.0007 (1.24)
DUAL_LIST	−0.0380 (−0.47)	−0.0598 (−0.93)	0.0219 (1.00)
SIZE	0.0416 (1.26)	0.0528** (2.01)	0.1115 (1.26)
LEV	−0.1585 (−0.67)	−0.0219 (−0.12)	−0.1365**(−2.16)
ROA	0.0575 (0.33)	0.0731 (0.53)	0.0155 (0.34)
CFO	0.7247* (1.80)	0.5351* (1.67)	0.1895* (1.76)
Constant	0.1982 (0.35)	0.5753 (1.28)	−0.3771** (−2.48)
YEAR_FE	Yes	Yes	Yes
Adj. R^2	0.3465	0.3205	0.3304

Note: Table 5 reports the OLS regressions results of testing the determinants of quality of carbon reporting. All variable definitions are in Table 1. Heteroscedasticity-robust standard errors clustered at firm-level are shown in parentheses.
***Statistical significance at the 1% level.
**Statistical significance at the 5% level.
*Statistical significance at the 10% level.

TABLE 7 Determinants of quality of carbon reporting: Lagged effects

Variable(s)	Model 1 QCR Coefficient (*t*-value)	Model 2 RELV Coefficient (*t*-value)	Model3 RELI Coefficient (*t*-value)
ETS_{t-1}	0.3651*** (4.12)	0.2714*** (4.21)	0.0821*** (3.98)
GRI_{t-1}	0.2334*** (2.27)	0.1545** (2.01)	0.0789*** (3.10)
$E\&S_{t-1}$	0.0117*** (4.77)	0.0092*** (4.71)	0.0021*** (3.59)
$FEMALE_{t-1}$	0.8211*** (2.62)	0.7229*** (2.86)	0.0910 (1.11)
B_SIZE_{t-1}	0.1143*** (3.62)	0.0911*** (3.38)	0.2611*** (2.72)
AGE_{t-1}	0.0031(1.52)	0.0014 (1.51)	0.0008 (1.12)
$DUAL\_LIST_{t-1}$	−0.0341(−0.42)	−0.0562 (−0.94)	0.0258 (1.12)
$SIZE_{t-1}$	0.0411 (1.24)	0.0521** (2.09)	0.1117 (1.37)
LEV_{t-1}	−0.1581 (−0.61)	−0.0214 (−0.21)	−0.1355** (−2.10)
ROA_{t-1}	0.0551 (0.29)	0.0742 (0.55)	0.0167 (0.38)
CFO_{t-1}	0.7250* (1.76)	0.5341* (1.68)	0.1874* (1.72)
Constant	0.1992 (0.45)	0.5755 (1.34)	−0.3798**(−2.41)
YEAR_FE	Yes	Yes	Yes
Adj. R^2	0.3289	0.3184	0.3109

Note: Table 6 reports the OLS regressions results of testing the determinants of quality of carbon reporting. All variable definitions are in Table 1. Heteroscedasticity-robust standard errors clustered at firm-level are shown in parentheses.
***Statistical significance at the 1% level.
**Statistical significance at the 5% level.
*Statistical significance at the 10% level.

Among the control variables, we found cash flows from operations (CFO) to be the most important determinant of the QCR. However, profitability (ROA), firm age (AGE), leverage (LEV) and dual listing (DUAL-LIST) were not associated with the QCR in either the relevance or the reliability component of QCR.

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5.2 | Additional analysis

In Table 7, we used lagged independent and control variables for the contemporary effect of the prior year firm QCR, similar to Bose et al. (2018). The use of lag also helps to address the issue of reverse causality. We found that the estimated coefficient for ETS_{t-1}, GRI_{t-1}, $E\&S_{t-1}$, $FEMALE_{t-1}$ and B_SIZE_{t-1} were still positive and significant at the 1% level for all models and thus supported our hypotheses. All other control variables were consistent with our baseline results with evidence in the literature.

5.3 | Robustness test

Similar to prior CSR studies, to address the potential endogeneity, we adopted the dynamic Generalised Method of Moments (GMM), developed by Blundell and Bond (1998) and applied by others (e.g., Bui et al., 2020, 2021; El Ghoul et al., 2011) and included the lagged QCR as an independent variable. Furthermore, to provide robustness for our results we used the Hansen's test (Hansen, 1982) to measure the over-identification of variables, as well as the Arellano and Bond's test (Arellano & Bond, 1991) for autocorrelation of errors. The results in Table 8 showed that the hypothesise variables, *ETS*, *GRI*, *E&S*, *FEMALE*, and *B_SIZE* were significant and positive for all three models. In Table 8, the results for the control variables were broadly consistent with the main results. Overall, Table 8 shows that the endogeneity issues were not likely to influence our main finding.

Moreover, we used the Hansen's Test QCR model (0.14), RELV model (0.16), and RELI model (0.13) to test for over-identification of variables (Table 8). The results indicated that we cannot reject the hypotheses of over-identification issues and the instruments are valid. The Arellano and Bond test gave comparatively similar results for the QCR model (0.42), RELV model (0.44) and RELI model (0.38), and in all models the hypotheses of no autocorrelation of errors in our models was recognised, given that the probability of *Z* values was greater than 0.05.

We further addressed omitted variable bias using firm fixed effects regressions as shown in Table 9. We found that in most of the specifications of QCR (RELV and RELI), results were qualitatively similar to baseline results.

TABLE 8 Determinants of quality of carbon reporting: Endogenity test

Variable(s)	Model 1 QCR Coefficient (*t*-value)	Model 2 RELV Coefficient (*t*-value)	Model3 RELIA Coefficient (*t*-value)
ETS	0.3381*** (4.38)	0.2581*** (4.22)	0.0797*** (3.80)
GRI	0.2384** (2.41)	0.1484* (1.88)	0.0859*** (3.23)
E&S	0.0135*** (5.25)	0.0107*** (5.21)	0.0028*** (4.12)
FEMALE	0.9544*** (2.91)	0.7876*** (3.02)	0.1622* (1.82)
B_SIZE	0.1406*** (4.26)	0.1121*** (4.28)	0.285*** (3.18)
AGE	0.0040* (1.81)	0.0032* (1.83)	0.0007 (1.29)
DUAL_LIST	−0.0766 (−0.94)	−0.0834 (−1.28)	0.0086 (0.39)
SIZE	0.0592* (1.73)	0.0649** (2.39)	0.0054 (0.58)
LEV	−0.1201 (−0.49)	−0.0069 (−0.04)	−0.1060 (−1.58)
ROA	0.0047 (0.03)	0.0375 (0.27)	0.0397 (0.83)
CFO	0.6628 (1.60)	0.4915 (1.50)	0.1705 (1.52)
$QCR_{t-1}/RELV_{t-1}/RELI_{t-1}$	0.1201** (2.43)	0.1021** (2.03)	0.1467*** (2.84)
Constant	0.1982 (0.35)	0.7388 (1.61)	−0.3014* (−1.92)
YEAR_FE	Yes	Yes	Yes
Hansen test			
Prob > χ^2	0.14	0.16	0.13
Arellano and Bond test for AR (2)			
Prob > *Z*	0.42	0.44	0.38

Note: Table 7 reports the GMM estimates the results of testing the determinants of quality of carbon reporting. All variable definitions are in Table 1. Heteroscedasticity-robust standard errors clustered at firm-level are shown in parentheses.
***Statistical significance at the 1% level.
**Statistical significance at the 5% level.
*Statistical significance at the 10% level.

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TABLE 9 Determinants of quality of carbon reporting: Firm fixed effects regression

Variable(s)	Model 1 QCR Coefficient (*t*-value)	Model 2 RELV Coefficient (*t*-value)	Model3 RELI Coefficient (*t*-value)
ETS	0.3559*** (4.38)	0.2595*** (4.27)	0.0811*** (3.97)
GRI	0.2241*** (2.42)	0.1549** (2.11)	0.0790*** (3.01)
E&S	0.0142*** (4.71)	0.0092*** (4.72)	0.0025*** (3.52)
FEMALE	0.8411*** (2.92)	0.7218*** (2.82)	0.1000 (1.10)
B_SIZE	0.1129*** (3.62)	0.0911*** (3.62)	0.229*** (2.80)
AGE	0.0040 (1.62)	0.0024 (1.59)	0.0008 (1.32)
DUAL_LIST	−0.0392 (−0.62)	−0.0546 (−0.83)	0.0217 (1.00)
SIZE	0.0411 (1.12)	0.0525** (2.10)	0.1107 (1.22)
LEV	−0.1524 (−0.82)	−0.0211 (−0.28)	−0.1311** (−2.08)
ROA	0.0571 (0.39)	0.0721 (0.59)	0.0149 (0.38)
CFO	0.7021* (1.82)	0.5347* (1.69)	0.1876* (1.72)
Constant	0.1899 (0.48)	0.5711 (1.28)	−0.3801** (−2.28)
YEAR_FE	Yes	Yes	Yes
FIRM_FE	Yes	Yes	Yes
Adj. R^2	0.3515	0.3310	0.3401

Note: Table 8 reports the OLS firm fixed effects regressions results of testing the determinants of quality of carbon reporting. All variable definitions are in Table 1. Heteroscedasticity-robust standard errors clustered at firm-level are shown in parentheses.
***Statistical significance at the 1% level.
**Statistical significance at the 5% level.
*Statistical significance at the 10% level.

6 | CONCLUSION

The current study examined the QCR and the influence of multiple factors such as the role of regulatory guidelines, the use of GRI reporting framework, and E&S performance, on the QCR. It also investigated the influence of corporate governance attributes (e.g., women's representation on the board, specifically, diversity on the board and board size) on the QCR. Using 6 years of data from the top firms in NZ, our main findings are three-fold; (i) carbon reporting in NZ top firms is of low quality but trends seems to be improving over time; (ii) the QCR is influenced by several factors, namely: the ETS regulations, the use of GRI reporting template and, the level of E&S performance; (iii) the governance attributes, namely presence of women directors on board and board size, positively affect QCR. The findings of the study have contributed to the academic literature (discussed in the introduction section).

The current study's results have practical value as well, particularly for decision makers and the securities exchange regulators in NZ. First, the regulatory intervention and regulatory rules and guidelines for carbon are required for QCR development and improvement. Given that overall, the QCR scores of our sample firms is not satisfactory, regulatory intervention should be continued as it not only requires firms to comply with regulation but also increases the QCR per se in many areas internally and externally (discussed previously). Ongoing monitoring of carbon performance by regulators has no other alternatives. Second, the GRI guidelines should be implemented immediately across the listed firms (24% of firms used the GRI in our sample), and related monitoring for progress towards implementing these standardised reporting guidelines should be done by the regulator, so that firms' QCR is improved. Lastly, as board diversity for firms is key to ensuring QCR, firm's decision makers and regulators should focus extensively on ensuring board diversity (women representation on board) in the corporate sector in the context.

Despite the above-mentioned implications, we acknowledge some limitations of the study. First, the study considered data from only one advanced economy, and therefore, findings should not be applied beyond that context. Second, more empirical works will also help to authenticate other possible explanatory factors using other theoretical lens, and governance elements (e.g., separation of chief executive officer and board chairperson roles, presence of independent directors, the use of different carbon committees and others) for carbon reporting quality. The effect of QCR on firms' benefits, namely market performance, as well non-financial performance (stakeholders' satisfaction, stakeholder trust, or other market participants' reactions) can also be investigated in future carbon quality related studies. Future research can also investigate and detect some internal mechanism for greenwashing of carbon information as well as transparency relating to the level carbon emission information (Scopes 1, 2 and 3) using case study research methodologies. Lastly, our findings were applied to only the top 50 NZ firms' QCRs; therefore, findings should not be generalised to small firms. However, empirical investigation of the QCR by all listed firms in NZ, understanding QCR using more longitudinal

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periods of data, and factors influencing QCR for firms are worthy of future investigation.

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APPENDIX A: SAMPLE COMPANIES

SL	Company name
1	Air New Zealand Limited (NS)
2	Argosy Property Limited
3	Arvida Group Limited
4	Auckland International Airport Limited
5	Australia and New Zealand Banking Group Limited
6	Chorus Limited (NS)
7	Contact Energy Limited
8	Ebos Group Limited
9	Fisher & Paykel Healthcare Corporation Limited
10	Fletcher Building Limited
11	Fonterra Shareholders' Fund (NS)
12	Freightways Limited
13	Genesis Energy Limited (NS)
14	Gentrack Group Limited
15	Goodman Property Trust (NS)
16	Heartland Group Holdings Limited
17	Infratil Limited

(Continues)

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SL	Company name
18	Investore Property Limited
19	Kathmandu Holdings Limited
20	Kiwi Property Group Limited
21	Mainfreight Limited
22	Mercury NZ Limited (NS)
23	Meridian Energy Limited (NS)
24	Metlifecare Limited
25	Oceania Healthcare Limited
26	Port of Tauranga Limited
27	Precinct Properties New Zealand Limited (NS)
28	Property for Industry Limited
29	Pushpay Holdings Limited
30	Restaurant Brands New Zealand Limited
31	Ryman Healthcare Limited
32	Sanford Limited (NS)
33	Scales Corporation Limited
34	Skellerup Holdings Limited
35	Sky Network Television Limited
36	SkyCity Entertainment Group Limited (NS)
37	Spark New Zealand Limited
38	Stride Property Ltd & Stride Investment Management Ltd (NS)
39	Summerset Group Holdings Limited
40	Synlait Milk Limited (NS)
41	The A2 Milk Company Limited
42	The New Zealand Refining Company Limited
43	The Warehouse
44	Tourism Holdings Limited
45	Trustpower Limited
46	Vector Ltd
47	Vista Group International Limited
48	Vital Healthcare Property Trust
49	Westpac Banking Corporation
50	Z Energy Limited

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