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Organic versus cosmetic efforts of the quality of carbon reporting by top New Zealand firms. Does market reward or penalise?

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Abstract

This study explores the quality of carbon reporting (QCR) by New Zealand (NZ) firms and its changes over time. It also explores the impact of QCR on the market reputation of firms. Using a sample of 300 company-year observations between 2015 and 2020 from top listed firms of NZ, the study develops a 14-item QCR index. The study finds that the company-level QCR reporting by NZ firms overall is not praiseworthy, as firms need to improve QCR in many aspects (both in-house efforts as well as external reporting). Although QCR has increased over time, firms' QCR efforts cannot be treated completely authentic. Majority of firms in NZ have disclosed unaudited carbon information to investors and other stakeholders. Additionally, our study finds that QCR positively affects the market reputations of firms, and the market behaves accordingly. Specifically, firms' organic carbon efforts are paid-off (through increased market reputation) by the market players and cosmetic/decoupled behaviour is penalised (through decreased market reputation). This study is the first on QCR reporting using a sample of NZ firms and an account of their initiatives towards the carbon emission reduction initiative and related disclosures. The study's findings have policy implications.

KEYWORDS
cosmetic, legitimacy, market reputation, New Zealand, organic, quality of carbon reporting

1 | INTRODUCTION

Recent years have witnessed an exponential growth in, and commitment to, carbon reporting,[1] emissions trading schemes (ETS) and other initiatives towards the reduction of carbon emissions globally (Alsaifi et al., 2019; Matisoff et al., 2013; World Bank, 2021). A recent report published by the World Bank (2021) describes such exponential global growth as underlying a commitment to net-zero carbon emissions by mid-century. As stated in the report, as of December 2020, 823 cities and over 1540 companies from 127 countries have committed to decarbonising their activities by mid-century (World Bank, 2021). Globally, national regulators have also accelerated the process by displaying their commitment for carbon reduction (KPMG, 2020). For example, in 2020, a proposal for European Climate Law was

Abbreviations: 2SLS, two-stage-least squares; CDP, carbon disclosure project; GHG, greenhouse gas emission; GRI, global reporting initiatives; NZETS, New Zealand emissions trading scheme; QCR, quality of carbon reporting; RELI, reliability; RELV, relevance; REP, market reputation; TCFD, task force on climate-related financial disclosures; VIF, variance inflation factor.

announced legislating a 2050 climate neutrality objective and a 2030 Climate Target Plan to reduce emissions by at least 55% by 2030. In New Zealand (NZ), the Government passed a Climate Change Response (Emissions Trading Reform) Amendment Act in June 2020, putting in place a wide range of reforms to the NZ ETS (New Zealand Emission Trading Scheme) where the legislation imposed a cap of 160 $MtCO_2$ (metric tons of carbon dioxide) on the NZ ETS for 2021–2025 along with a provisional emissions budget for the country (World Bank, 2021). Additionally, China's national ETS commenced on 1 February 2021, mandating the reporting requirements for firms including the power sector, which emitted over 26,000 tons of CO_2 (carbon dioxide) annually over last 7 years (World Bank, 2021).

Against the above-mentioned growth and progress, it has been stressed that, in practice, achieving carbon reduction targets and improving carbon performance require firms to employ a more 'genuine' endeavour both internally and externally (in letting stakeholders know through external reporting). Trucost (2019), an affiliate of S&P Global, reviewed the Global 2500 largest companies' report on carbon emissions and the management of climate-related risks. Their findings revealed that companies' standard practice in climate risk management and reporting has continued to improve over previous years but still has a long way to go to tackle climate issues in ways that will meaningfully reduce climate change risk and impact (Trucost, 2019). Sullivan and Gouldson (2012), in their study of nine firms in the UK, reported that investors constantly express their dissatisfaction and criticise companies for not providing information that is value-relevant for their decision-making. Investors show little interest in firms' reported carbon information, as firms are not emphasising the quality of such information (Sullivan & Gouldson, 2012).

In the carbon literature, two different strands of research have emerged to date and lead to some debates/contradictions. In the first strand, researchers are outspoken in criticising firms' carbon attempts and commented that firms execute their carbon related responsibility and report carbon performance information in a manner that is merely ceremonial and cosmetic rather than authentic (Andrew & Cortese, 2013, 2011; Cho et al., 2012, 2015; Leung et al., 2015; Rankin et al., 2011). These researchers further argued that similar to other nonfinancial reporting and sustainability initiatives (Bose & Khan, 2022; Khan et al., 2020; Khan, Bose, Mollik, & Harun, 2021), firms do engage in carbon reporting to impress external stakeholders, but without adopting carbon reduction endeavours as authentic in-house practices (Comyns & Figge, 2015; Rankin et al., 2011). Firms dress-up their carbon performance in a rosy manner so that worsening carbon performance goes unnoticed by stakeholders (Comyns & Figge, 2015; Cotter et al., 2011). Arguably, establishing good quality of reported carbon information is pertinent to stakeholders. In the second strand of carbon research, studies have provided empirical evidence that firms' carbon reporting tends to reflect their commitment to ecological improvement and carbon information is thus relevant in decision-making in the stock market (Bui et al., 2020, 2021; Luo & Tang, 2014; Matsumura et al., 2014). Specifically, some studies have reported a positive role of carbon disclosure on the stock market (Alsaifi et al., 2019) or confirmed the relationship between carbon performance and carbon disclosure (Giannarakis et al., 2017) or evidenced the use of carbon offsetting information for product decisions by consumers (Warburg et al., 2021).

Against this backdrop, these debates have motivated us to further investigate and contribute to the first strand of research by investigating whether firms' carbon reduction efforts and endeavours reflect the actual underlying quality of reported carbon information (organic vs cosmetic). Additionally, we explore whether and how stakeholders (market) react to the quality of carbon reporting (*QCR* thereafter), specifically whether *QCR* has an impact on a firm's reputation. In the carbon literature, He et al. (2022) suggested that future carbon accounting research should contribute to the literature by detecting greenwashing and examining the causes and consequences of this practice. The current study aims to address this call. Our effort is timely as the quality of carbon information will have value relevance for investors and other stakeholders as well. Furthermore, the current study aims to provide deeper insights about the construct, QCR information, which encompasses two key aspects, namely, the relevance (in-house efforts of firms) and reliability (trustworthiness, stakeholder engagement, and transparency) of firms' reported carbon information. The terms, relevant and reliability, denote the attribute of the information (reported carbon information in the current study) for stakeholders, which is pertinent and valuable (relevance), as well as trustworthy and credible (reliable) for their decision-making.[2] When reported carbon information has attributes of both relevance and reliability, then this information becomes both acceptable and creditable to the stakeholders (more details, see Section 3.2).

The current study explores the *QCR* by NZ firms and any change (improvement) over time. Specifically, we examine whether and how carbon information voluntarily reported by large firms in NZ and whether stakeholders welcome (or punish) according to the quality of carbon information. Using the lens of both institutional and legitimacy theories (DiMaggio & Powell, 1983; Suchman, 1995), the current study addresses the issue of *QCR*. Using a sample of 300 firm-year observations between 2015 and 2020 from the top fifty (50) listed NZ firms, the study develops a 14-item *QCR* index. Our study finds that the *QCR* reporting by NZ firms is, overall, not praiseworthy, although *QCR* has improved over time. Firms in NZ need to improve both in-house and external reporting efforts of QCR in many aspects. These include the following: the formation of a carbon emission reduction committee and governance, ongoing feedback and stakeholder dialogue, value and timeliness of data, materiality and risk assessments and completeness, all of which are almost entirely absent from the reported information over our period of investigation. Additionally, the study finds that *QCR* affects firms' market reputations. Specifically, that society (market) rewards (or punishes) firms on the basis of their efforts to improve the QCR.

Our study makes the following contributions to the literature. We provide empirical evidence for, and a detailed account of, carbon-related reporting emerging as either organic or authentic. This line of research was largely overlooked in the carbon literature. Secondly, our study develops a holistic, multidimensional quality index for carbon reporting (both in-house and external) in order to understand the

QCR and assess the overall *QCR* of firms over time, a new initiative in the extant carbon literature. Finally, our study provides preliminary evidence that the market rewards (or punishes) firms based on firms' endeavours to create their *QCR* as either authentic or cosmetic. Firms' authentic efforts are paid-off (through increased market reputation) by the stakeholders and vice versa.

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

2 | LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

2.1 | Why the QCR is important?

Globally, the substantial increase in climate change risk has been paralleled by a similar increase in carbon reporting by firms. To illustrate, according to a recent report published by the Guardian (2017), during the last three decades, more than 70% of the world's greenhouse gas (GHG) emissions were emitted by just 100 global companies, of which most belong to developed countries. However, it has been evidenced that investors and other stakeholders are unable to rely on carbon reporting information for their decision-making owing to the lack of coherence and consistency of carbon information. According to a report published by Reuters (2010), only 10% of the FTSE350 companies included carbon data after external assurance. The report further added that big brands, such as British Airways, Thomson Reuters, Amazon, Johnson & Johnson, are among the 275 companies that have disclosed unproven nonfinancial and carbon information to investors (Reuters, 2010).[3] Against this backdrop, it is important that firms take responsibility for the frustration and dissatisfaction of investors and other stakeholders over carbon-related reporting and improve carbon quality duly.

2.2 | Review of previous studies on QCR and gaps in the literature

Empirically, many studies have provided evidence on determinants of carbon reporting and the relationship between carbon reporting and firm performance (see, e.g., Luo et al., 2012; Luo & Tang, 2014) including the joint effect of carbon disclosure and GHG emissions on firms' implied cost of equity capital (Bui et al., 2020).

Within the carbon accounting literature, there are very few studies that have explored the *QCR*. To illustrate, Cotter et al. (2011), in their case study on a single firm in Australia, have evidenced that carbon disclosures are somewhat skewed towards more positive aspects of climate change management information but missing the transparent reporting of carbon information. Although their qualitative study did not directly measure the *QCR*, it has provided insight into the standardisation of carbon reporting. Analysing a single year data from a sample of 187 ASX listed firms, Rankin et al. (2011) explored key explanatory factors (e.g., GRI format, environmental management, the presence of an environmental committee, corporate governance quality, EU ETS and firms' participation and response to CDP) for understanding the QCR in Australia and provided useful insights. Hrasky's (2012) study in Australia explored authentic versus cosmetic efforts in carbon footprint reporting based on 1-year data. Their study reported that while carbon-intensive sectors appear to be pursuing substantive action, the other sectors are relying more heavily on symbolic disclosure. Overall, while the above studies (Cotter et al., 2011; Hrasky, 2012; Rankin et al., 2011) have given some preliminary evidence on cosmetic types of carbon reporting of firms, none have explored the *QCR* from a broader quality perspective (both in-house and external effort) nor attempted to understand whether and how the market reacts (either rewards or punishes) as a result of firms' endeavours to form authentic versus cosmetic carbon reporting.

Comyns and Figge (2015) were probably the first to measure carbon reporting quality with a self-constructed multidimensional index based on seven principles: accuracy, completeness, consistency, credibility, relevance, timeliness and transparency. Their longitudinal study (1998–2010) of 45 global firms in a single industry (gas and oil) found that reporting of carbon quality has not improved significantly and suggested that regulation is needed to improve carbon reporting practices. However, the current study is also different from their study (Comyns & Figge, 2015). Specifically, their study considered GHG reporting quality in a single industry sector and so limited the generalisability of their findings. The current study considers multiple industries. Similarly, while Comyns and Figge's (2015) study used holistic dimensions of quality indicators for GHG information, their study overlooked other key dimensions of carbon quality information, namely, materiality and risk assessment, carbon emission reduction committee, carbon reduction strategy linked with the firm's business strategy and ongoing stakeholder engagement. Similarly, their study did not consider whether improvement of *QCR* by firms (if any), or absence thereof, is either rewarded or penalised by external stakeholders. We address this gap as well. Overall, an in-depth study of the relevance and reliability of reported carbon information from multiple industries over time has been surprisingly neglected in the past studies in the context of NZ. (For why and how the NZ context is interesting, see Section 2.5).

2.3 | QCR status: Are they developed in organic or cosmetic form (RQ-1)?

From the legitimacy theory perspective, companies voluntarily report carbon information to legitimise their operations within society and to demonstrate that their activities and initiatives are congruent with the expectations of society. This line of argument is supported by past studies (Clarkson et al., 2008; Patten, 2002; Qian & Schaltegger, 2017). Owing to increasing stakeholder awareness of environmental and carbon issues in recent years, organisations that emit high levels of pollution or have track records of poor

environmental and community performance tend to experience threats to their social legitimacy (Deegan, 2002; Deegan et al., 2000; Khan, 2010). Companies use nonfinancial reporting as an impression management strategy, to constructively influence the public's impression of the company and to regain their social legitimacy (Cho & Patten, 2007; Deegan, 2002; Khan et al., 2014; Khan, Bose, Mollik, & Harun, 2021; Suchman, 1995).

Merely reporting carbon information is unlikely to receive stakeholders' long-term approval unless the quality (both the relevance and reliability aspects) of the carbon information is established (Cho et al., 2015; Cotter et al., 2011). Relying on the 'decoupling' concept of new institutional sociologies (NIS) theory, the current study premises its understanding on the 'organic' versus 'cosmetic' aspects of *QCR* (DiMaggio & Powell, 1983; Meyer & Rowan, 1977; Suchman, 1995). The cosmetic aspect of carbon initiatives and their reporting is analogous to the concept of decoupling. As explained by Dillard et al. (2004, p.510), decoupling occurs when 'the organisational practice is not integrated into the organisation's managerial and operational process (it is decoupled …)'. We argue that cosmetic carbon initiatives and actions related to carbon reduction are undertaken by firms to exhibit the ceremonial conformity of their carbon reduction practices. Firms adopt this type of ceremonial behaviour to meet the demands of external stakeholders and institutional actors, without actually changing their internal organisational practices and operations (Cotter et al., 2011; DiMaggio & Powell, 1983; Meyer & Rowan, 1977). Here, firms employ linguistic strategies, construct positive carbon performance superficially and use eye-catching narratives on carbon performance information. The superficial reporting of carbon information by firms becomes irrelevant, valueless, biassed and unreliable to stakeholders since a balanced and transparent reporting of carbon information is overlooked (Cho et al., 2010; Comyns & Figge, 2015; Cotter et al., 2011; Ferguson et al., 2016). Given that this type of firms' carbon activities is developed in a deceptive form, such cosmetic carbon activities and reporting do not add any utility (relevance) and reliability in the eyes of stakeholders. Consequently, the 'cosmetic' carbon reporting can be described as irrelevant, unreliable and untrustworthy to stakeholders.

On the other hand, with an organic (authentic) approach to organisational carbon reduction practices, carbon reporting would be steered by a pure sense of accountability and stimulated by the genuine in-house efforts and initiatives undertaken by firms (Cotter et al., 2011; Hrasky, 2012; Rodrigue et al., 2013). Studies have explained that authentic non-financial practices would bring true internal changes in organisations, translating these changes into improved environmental/carbon performance (Khan, Bose, Mollik, & Harun, 2021; Rodrigue et al., 2013). Conceptualised as 'tightly coupled' practices in the literature applying institutional theory (DiMaggio & Powell, 1983; Meyer & Rowan, 1977), we add that the 'organic' practice of firms' carbon reduction practices would enable decision-makers to develop and initiate a range of activities internally. These include ongoing engagement with stakeholders, linking carbon reduction objectives to firms' objectives and long-term business strategy, setting performance targets for carbon, use of performance indicators for carbon reduction activities, carbon assurance, comparative carbon performance data over time and ongoing stakeholder consultations that are established within organisations (Comyns & Figge, 2015; Rankin et al., 2011). Furthermore, reported carbon information would include materiality and risk assessments and would be complete, accurate and include both positive and negative carbon performance information (Qian & Schaltegger, 2017). Firms 'organic' carbon practices will enhance the disclosed information's reliability and credibility (Comyns & Figge, 2015; Haigh & Shapiro, 2012; Rankin et al., 2011). It is argued that if non-financial information of firms is communicated with an authentic motive; it will meet the criterion of decision usefulness since non-financial information would then meet the information's relevance, comparability and reliability criteria (Chauvey et al., 2015; Khan, Bose, Mollik, & Harun, 2021). If reliable carbon information is communicated by firms, it would then assist stakeholders to assess the consistency of carbon performance data over time. Likewise, reporting of organic carbon information would meet the stakeholder's expectations. Consequently, stakeholders can rely on carbon information and use the information for their decision-making confidently (relevance to the users).

On a related note, studies have suggested that the practice of adopting non-financial reporting becomes established over time, (not overnight), as most firms become followers of industry-wide practices and need time for internal preparation (Deephouse & Carter, 2005; Gao et al., 2016; Khan, Bose, Mollik, & Harun, 2021). Khan, Bose, Mollik, and Harun (2021) have provided evidence that the quality of sustainability reporting for the banking industry has gradually improved over time although, initially, the quality of reported sustainability of sample banks was overly symbolic. Arguably, the *QCR* also develops over time, and improvement of quality carbon information should not be perceived as a one-off exercise. Hence, it is necessary to evaluate firms' efforts to improve the quality of firms' carbon information based on a longitudinal period. From the above discussion, the current study offers the following research question:

RQ-1: What is the quality of firms' reported carbon information (organic vs cosmetic)? Have firms' *QCR* changed over time?

2.4 | *QCR* and its impact on market reputation (RQ-2)

In the current study, we explore whether firms' attempts to improve *QCR* is welcomed by society (external stakeholders) or not. While consensus and theoretical arguments do exist in this regard, we need empirical evidence in this regard. We discuss the role of *QCR* on firms' reputations next.

2.4.1 | Hypothesis development: Impact of the quality of carbon reporting (*QCR*) on market reputation.

Scholars have commented that cosmetic (symbolism) legitimation strategies on carbon commitment are consistent with the idea of

pragmatic legitimacy (Ashforth & Gibbs, 1990; Cotter et al., 2011), where firms engage in self-interested behaviour calculated to earn the support of the organisation's most immediate audiences and to create a positive impression of their activities (Hopwood, 2009; Suchman, 1995). On the other hand, the use of authentic legitimation strategies involves material, real change in corporate goals, processes, activities and structures consistent with social norms, values and expectations (Ashforth & Gibbs, 1990; Cho et al., 2012). Both approaches to legitimation strategies tend to affect the firms' reputation in the market (Suchman, 1995).

Researchers have argued that 'cosmetic' carbon reporting tends to establish a potential legitimacy gap for firms (Cho et al., 2012; Toms, 2002). To close the legitimacy gap and to keep the social contract intact, firms must duly convince stakeholders that they have adopted the carbon issue honestly and responded appropriately to alleviate concerns about carbon emissions; otherwise, firms would be unable to build and maintain corporate reputation (Brown et al., 2010; Deegan & Unerman, 2011). Forburn and Van Riel (Fombrun & Van Riel, 1997, p. 10) define corporate reputation as '… a collective representation of a firm's past actions and results that describes the firm's ability to deliver valued outcomes to multiple stakeholders. It also encompasses a firm's relative standing, rating and images both internally to its employees and externally towards its stakeholders, in both its competitive and institutional environments'. Firms maintain their external reputation and image throughout maintaining their legitimacy (Deegan & Unerman, 2011). If legitimacy is lost, firms experience the risk of losing their external image in the market. Any threats to a company's legitimacy can lead to damage to its reputation in the market (Brown et al., 2010; Deegan & Unerman, 2011).

Indeed, organisational reputation is the outcome of preserving and maintaining organisational legitimacy. The underlying theoretical notion in this regard is that firms would regularly maintain their trustworthiness status in the eyes of stakeholders for survival. These trustworthy firms enjoy a high reputation in the market and receive ongoing support from stakeholders, while those deficient in legitimacy are viewed as less acceptable and unreliable and, therefore, are less likely to hold ongoing social support (Meyer & Rowan, 1977; Suchman, 1995). In effect, when firms engage in show-off carbon activities and report cosmetic carbon information, they manipulate the perceptions of stakeholders; such manipulative behaviour erodes firms ongoing reputation in the market. On the other hand, if firms adopt authentic initiatives to reduce an adverse carbon footprint, they are able to enjoy and hold the market reputation. Deegan (2002) argued that if the decision-makers of firms can convince stakeholders that they do not pose unacceptable environmental risks, then the threat to legitimacy is reduced, and the views external stakeholders hold of the firms are strengthened. Empirically, some studies have provided some preliminary evidence in this regard. To illustrate, Toms (2002) and Cho et al. (2012) found a positive association between quantity of environmental disclosure and a firm's environmental reputation (see also Brown et al., 2010; Hasseldine et al., 2005). However, the above-mentioned studies have not explored the relationship between the *QCR* and market reputation.

Based on the discussion above, we argue that firms with organic efforts in carbon reporting will attract a positive reputation in the market from market players (e.g., investors, potential fund providers and other key stakeholders). Such firms will enjoy continuous social approval to operate their activities owing to their favourable external images. On the other hand, if firms' carbon reporting is cosmetic, their market reputation will be impaired accordingly. Society penalises firms' cosmetic behaviours in many ways, namely, withdrawing social approval, decreased sales, loss of market competitiveness and market rating, failure to secure new capital from the market and impairment of intangible asset base (Attig et al., 2013; Cho et al., 2012; Deegan, 2002). Thus, cosmetic efforts of carbon reporting can negatively affect QCR and impair corporate reputations. In the specific theme of *QCR* in NZ, to date, we do not have any empirical evidence that shows an association between the *QCR* reporting and market reputation. From the previous discussion, we have *priori* expectation that firms' quality of reported carbon information will positively influence the market reputation of NZ firms. Formally stated,

> **H1.** The QCR positively influences the market reputation of firms.

2.5 | The research context: The case of NZ

We examined the above-mentioned research questions in NZ firms, where legislation has mandated carbon and environmental practices in recent years (Leining & Kerr, 2016). Within developed countries, NZ has higher GHG emissions track-record owing to its dependence on agriculture (Diaz-Rainey & Tulloch, 2018). The sector is one of the country's largest contributors to both gross domestic product and GHG emissions. For example, the agricultural sector alone is responsible for around 50% of NZ's GHG emissions, compared with only 12% for other developed countries (Treasury, 2007). In order to combat increasing GHG emissions, the government introduced and established the NZ emission trading scheme (NZ ETS) in 2008 through the Climate Change Response (Emissions Trading) Amendment Act (2008) following a decade of debate about how best to price carbon in NZ (Diaz-Rainey & Tulloch, 2018; Leining & Kerr, 2016).

NZ is a unique setting for this study for numerous reasons. First, it planned to be the only country in the world that included a comprehensive industry (both the forestry and agriculture sectors) in its ETS (Carver et al., 2017; Diaz-Rainey & Tulloch, 2018). This ETS has offered some other benefits for NZ firms. For example, unlike other ETSs (e.g., ETS elsewhere in the globe), the NZ ETS allowed unlimited importation of overseas carbon credits that could be used for surrender obligations-linking NZ into other international carbon markets' ETSs (Ranson & Stavins, 2016). This linking was expected to benefit small markets like NZ through generating market liquidity and acted as a safety valve on price because of the presence of many buyers and sellers (Treasury, 2007). Some amendments were passed in 2009 with some distinctive features; for example, sectors such as liquid fossil fuel, stationary energy, forestry and industrial processes were only

required to submit one emissions unit per 2 tonnes of CO_2 emitted (known as one-for-two). Additionally, ETS participants could pay a NZ $25 fixed-price per tonne of CO_2, meaning that participants could purchase unlimited NZ Units (NZU) at that price, effectively setting a cap on carbon prices (Bullock, 2012; Diaz-Rainey & Tulloch, 2018).

Second, despite its comprehensive ambitions, the effectiveness of the NZ ETS has been questioned since NZU prices collapsed in 2011 and bottomed out in mid-2013. It has been argued that the declines in NZU prices over this period were the result of transition rules introduced by the government in 2009 and the unlimited ability to import carbon offsets. A report published by the Ministry for the Environment (2013) projected that net emissions will reach 90 million tonnes of CO_2 by 2040. This 50% rise in emissions (from 1990 levels) contrasts starkly with the government's 2050 target of a 50% reduction, which would be 29.9 million tonnes of emissions. Third, 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. Additionally, it became the first country in the world to introduce a law that will require the financial industry, namely, banks, insurers and investment managers, to report the impacts of climate change on their business. The first reports will be made by companies in 2023 (Reuters, 2021). Against this backdrop, reporting of carbon is still voluntary for firms in NZ. It is therefore essential to understand NZ firms' efforts towards carbon reporting quality because the different industrial sectors in the context operate in a complex environmental and carbon setting and the reaction of listed firms in the carbon market is a matter for meaningful and timely academic investigation.

3 | RESEARCH DESIGN

3.1 | Sample and data

To answer the study's research questions, we selected the top 50 (as of 26 July 2021, they represent 84% of the total market capitalisation) firms operating in diverse industries listed on the NZ stock exchange for the years 2015–2020. The total sample consisted of 300 firm-year observations. The data for our analysis were collected from multiple sources. Specifically, information on the QCR was hand-collected from the sustainability reporting of firms, and sustainability and non-financial reporting was the unit of analysis. In the absence of separate standalone sustainability reporting of sample firms, various sections of companies' annual reports were used, such as the chairman's statement, directors' report, corporate governance disclosures, corporate social responsibility disclosures and notes on the financial statement. Finally, data relating to control variables were collected from the Bloomberg database.

3.2 | Measures of the QCR

We employed a content analysis technique to quantify the *QCR* index following prior studies. For measuring the *QCR*, we developed and constructed of the quality, items of which are adapted from the prior studies and duly refined for the context of the study (e.g., Comyns & Figge, 2015; Khan, Bose, Mollik, & Harun, 2021; Michelon et al., 2015; Rankin et al., 2011). Khan, Bose, Mollik, and Harun (2021) used 11 items for measuring the quality of sustainability reporting and broadly categorised the quality indicators under two categories, namely, relevance and reliability. We adapted their quality construct for our carbon reporting quality but added an additional three items of carbon quality indicators, namely, materiality and risk assessment, governance and carbon reduction committee and completeness. As a result, our scale has broadened the rigour of the scale developed by Khan, Bose, Mollik, and Harun (2021). Relying on a total of fourteen (14) items, the construct *QCR* was captured under two dimensions such as relevance (six items) and reliability (eight items) of carbon information.

The relevance dimension captured issues such as carbon reduction strategy linked with companies' overall business strategy, stakeholders' engagement, carbon performance targets, carbon performance indicators, integration with business operations and the carbon emission reduction committee and governance. These issues are principally displaying firms' efforts for in-house carbon reduction initiatives and, thus, represent real internal effort to implement the carbon reduction agenda. According to GRI (2002), the internal initiatives undertaken by firms for sustainability activities and associated governance and risk factors are to be within the scope of the relevance of information (GRI, 2002). Overall, we argue that the more relevant the carbon information, the better would be the quality of the reported carbon information and vice versa. The reason is that firms' *QCR* efforts will then be organic and genuine. When different aspects of relevance dimension of the carbon quality information exist and are reported by the firms, it would denote that firms' initiatives for *QCR* are organic and genuine to combat carbon risks.

The reliability dimension of the *QCR* information captures the ongoing feedback and stakeholder dialogue, trends over time, readability, verifiability, accuracy, value and timeliness of the data, materiality and risk assessments and completeness (see Appendix A for details of wording). Our items of *QCR* are also consistent with the recommendations of principles by the Task Force on Climate-related Financial Disclosures (TCFD, 2017) for reliable and trustworthy disclosure on carbon and climate risk information (TCFD, 2017). In the current study, we expected that the more reliable the reported carbon information, the better the *QCR* information, more authentic will be firms' endeavour to report carbon information and vice versa. In other words, if the reliability dimension of the *QCR* information is increased, the reported carbon information will be more organic.

If firms adopt an 'organic' nature of carbon reporting quality, we expected that their carbon reporting practices would be associated with higher scores in all indicators of the *QCR* of firms with better score in the overall *QCR*. On the other hand, if firms use a 'cosmetic' approach to QCR, we expected to find poor scores among indicators of the QCR practices. QCR is calculated as the arithmetic average of

the weighted scores on all *R* and *Re* items (14 items). The total *QCR* scores were calculated as a ratio of the sum of the score of each subindicator, scaled by the maximum possible score for the firm. Following prior studies (Chauvey et al., 2015; Khan, Bose, Mollik, & Harun, 2021), we used the 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. Additionally, following prior studies (Bose et al., 2018; Khan, Bose, Mollik, & Harun, 2021), we used Cronbach's alpha coefficient to assess the internal consistency of our reporting index. The alpha coefficient of our disclosure index is 0.845, indicating that the items included in our *QCR* capture the same underlying constructs.[4] A second aspect that can introduce subjectivity is the coder(s) used to collect the data (Milne & Adler, 1999). To ensure reliability in the data collection and coding, three independently involved coders completed the content analysis of the annual reports at three-time intervals. 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 the coders were then addressed through consultation and, by revisiting the reports when required, a guideline suggested by prior research (Krippendorff, 2018).

3.3 | Measures of the market reputation

To measure market reputation, we used the credit rating of firms as a proxy. Following prior research on credit ratings (Attig et al., 2013; Gounopoulos & Pham, 2017), we used Standard & Poor's (S&P) long-term issues of credit rating. After 1998, this rating is based on the overall quality of the firm's outstanding debt, either public or private. We transformed the S&P ratings into conventional numerical scores, where 22 represents an AAA rating and 0 reflects no rating. Appendix B presents the S&P ratings scale and our conversion scores. We have used the credit rating of firms as a proxy of market reputation for a few reasons. First, credit rating indicates financial reputation, credit quality, as well as the market reputation/standings of debt instrument issuers (governments, private firms and corporations) to repay principals and interest on their debts (Stowell, 2018). Second, to form a rating, credit agencies conduct a thorough external analysis of both macrolevel factors, namely, business operations, technology, industry, market, as well as microlevel factors, namely, the company's market position, quality of management and governance, risks and operations, cash flows and the companies institutional and competitive environments (Choudhry, 2012; Stowell, 2018). Lastly, in recent years, numerous rating agencies (e.g., S&P Global Ratings, Moody's Investors Service and others) incorporate climate-related credit factors as well as environmental, social and governance (ESG) factors into their formal credit analysis across all sectors if the factors are believed to be material and relevant to assessing creditworthiness (TCFD, 2021).

3.4 | Models and estimation

We ran the following models to test Hypothesis 1.

$$\mathrm{REP}_{i,t=}\alpha_{0+}\alpha_1\mathrm{QCR}_{i,t+}\alpha_2\mathrm{SIZE}_{i,t+}\alpha_3\mathrm{LEV}_{i,t+}\alpha_4\mathrm{ROA}_{i,t+}\alpha_5\mathrm{AGE}_{i.t+}\alpha_6\mathrm{LISTING}_{i.t+}\mathrm{YEAR\_FE}+\mathrm{INDUSTRY\_FE}+\epsilon_{i,t} \quad (1)$$

$$\mathrm{REP}_{i,t=}\beta_{0+}\beta_1\mathrm{RELV}_{i,t+}\beta_2\mathrm{SIZE}_{i,t+}\beta_3\mathrm{LEV}_{i,t+}\beta_4\mathrm{ROA}_{i,t+}\beta_5\mathrm{AGE}_{i.t+}\beta_6\mathrm{LISTING}_{i.t+}\mathrm{YEAR\_FE}+\mathrm{INDUSTRY\_FE}+\epsilon_{i,t.} \quad (2)$$

$$\mathrm{REP}_{i,t=}\chi_{0+}\chi_1\mathrm{RELI}_{i,t+}\chi_2\mathrm{SIZE}_{i,t+}\chi_3\mathrm{LEV}_{i,t+}\chi_4\mathrm{ROA}_{i,t+}\chi_5\mathrm{AGE}_{i.t+}\chi_6\mathrm{LISTING}_{i.t+}\mathrm{YEAR\_FE}+\mathrm{INDUSTRY\_FE}+\epsilon_{i,t} \quad (3)$$

All variables are defined in Table 1

TABLE 1 Variable definition

Notation	Variable name	Definition	Source
REP	Market reputation	Reputation is proxied by S&P credit rating.	Annual (2015–2000)
QCR	Quality of carbon reporting	The arithmetic mean of the weighted scores on all relevance and reliability items stated in appendix	Annual report/other reports (2015–2020)
RELE	Relevance	The arithmetic mean of the weighted scores on all relevance items stated in appendix	Annual report/other reports (2015–2020)
RELI	Reliability	The arithmetic mean of the weighted scores on all reliability items stated in appendix	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)
AGE	Company age	Date of listing in the New Zealand stock exchange	Annual report (2015–2020)
LISTING	Dual listing	Dummy variables take the value of 1 for if the company traded more than one stock exchange, otherwise 0.	Annual report (2015–2020)

We controlled for a set of variables commonly used in the studies for our model (Bonsall et al., 2017; Ham & Koharki, 2016). We also included both year and industry fixed effects to control for unobserved year and industry effects. The industry is defined based on the S&P/NZX sector code.

4 | FINDINGS AND DISCUSSION

As Table 2 Panel A shows, the *QCR* score has improved from 2015 to 2020 (mean value 1.18 in 2020; 1.15 in 2019; 0.96 in 2018; 0.75 in 2016; 0.74 in 2015). However, overall *QCR* scores are very low. These findings deserve further attention. For example, out of 14 points of *QCR* items, NZ firms have achieved only 1.18 points (8.428%) in 2020 although their *QCR* point score has increased over the period studied. Their carbon reporting can by no means be regarded as organic; rather, information appears at this stage to be cosmetic, as they need exponential improvement in many quality indicators, as discussed next.

The requirements that carbon information be subject to formation of a carbon emission reduction committee and governance (*R6*), ongoing feedback and stakeholder dialogue (*Re1*), value and timeliness of data (*Re6*), materiality and risks assessments (*Re7*) and completeness (*Re8*) are almost entirely absent from the reported information over our period of investigation (with mean scores of 0.01, 0.01, 0.05, 0.03 and 0.04, respectively, in 2015, 2016, 2017, 2018, 2019 and 2020). This finding is surprising given that NZ is a developed country where, in recent years, many policy makers pay increasing attention to initiating mandatory carbon reporting. From Table 2 Panel A, we can further see that the requirements for carbon information to be subject to an independent external verification (*Re4*) and for information to meet the criterion of accuracy (*Re5*) are significantly absent from the sample firms' reported information, although trends are rising (from 0.16 in 2015, 2016 to 0.24 in 2020). In other words, over 83% of firms (in 2015 and 2016) and more than 75% firms within our sample in 2020 did not have external verification before their carbon information was communicated externally. Specifically, most of larger companies in NZ have disclosed unaudited carbon information to investors and other stakeholders. In terms of the item accuracy (*Re5*), although mean score has increased over the years (from 0.08 in 2015 to 0.19 in 2020), the overall mean value is low (0.13). Similar findings are also found for the item, readability (*Re3*). The overall mean score of this item is 0.16, although the mean score has increased over the years (the highest mean value is 0.24 in 2020; lowest was 0.10 in 2015). In other words, in 2020, more than 75% of firms' carbon information reporting failed the readability criteria (specifically, absence of logical structure, graphical presentation of data, use of drawing and other presentation tools necessary to understand the reported information clearly).

However, the sample firms have displayed improvements and made a noticeable development in areas such as carbon emission reduction strategies linked with business strategy/objectives (*R1*), engagement with key stakeholders (*R2*), carbon performance targets (*R3*), carbon performance indicators (*R4*) and trends over time (*Re2*) over the 6 years, but firms should not be complacent at this stage. Rather, they should try to keep hold of their current endeavours and improve further in areas such as carbon performance targets (*R3*), carbon performance indicators (*R4*), integration of carbon reduction practice with business processes/operations (*R5*) and trends over time (*Re2*), where approximately 70%, 76%, 79% and 60% of firms have reported nothing and need key improvements in these four aspects.

Overall, both in-house practices for carbon and other external commitments need to be improved exponentially since the information communicated by NZ firms is not fully authentic. This finding echoes Andrew and Cortese's (2011) comments, who shared 'we are a long way from producing quality carbon information, and it continues to be important to question whether the trickle-down benefits of carbon-sensitive capital markets are the most effective way to manage climate change' (p.137). The results are consistent with previous findings (Cho et al., 2012) and Hopwood's (2009) concern that many companies attempt to direct their environmental/carbon disclosure more towards symbolic disclosure than towards providing authentic information.

In terms of industry-wide quality information, as shown in Table 2, Panel B, the consumer staples industry secured top position (*QCR* mean of 1.39). This was then followed by consumer discretionary (*QCR* mean of 1.30), utilities (*QCR* mean 1.21), energy sector (*QCR* mean 1.20), industrial sector (*QCR* mean 1.12), and technology industry (*QCR* mean of 0.17).

Table 3 provides descriptive statistics of the variables. The mean (median) of *REP* is 4.888 (0.000), that is, on average, most of our sample firms have credit ratings between CCC and CCC-. The mean (median) of *QCR* is 0.9344 (0.7500). Initially, we tested whether firms with organic *QCR* will have higher market reputation than firms with cosmetic *QCR*. For that, we initially grouped our total sample firms into two groups based on the median value (Table 4). Firms above the median value were categorised as high *QCR* firms with organic efforts (154 firms), and firms below the median value were categorised as low *QCR* firms with cosmetic efforts (146 firms) reported in Table 4. As shown in Table 4, *t*-test results indicate that there are mean differences (4.8232) between high *QCR* (7.2273) and low *QCR* firms' (4.8232) and these differences are statistically significant ($p < 0.01$). The results indicate that the market reputation is higher for firms exercising and endeavouring 'organic' *QCR* than for firms engaged in 'cosmetic' *QCR*. The result provides initial support of our study hypothesis.

Table 5 reports the correlation among the 13 variables. To address the multicollinearity, we calculated a variance inflation factor (*VIF*). The *VIF* is well below 10 (3.59), and thus, collinearity is not a problem in this study.

TABLE 2 Descriptive statistic of QCR

Panel A: Quality of carbon reporting (QCR) by year

	Relevance						Reliability										
	R1	R2	R3	R4	R5	R6	Re1	Re2	Re3	Re4	Re5	Re6	Re7	Re8	QCR[a]	RELV[b]	RELI[c]
Year	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
2020	0.58 (0.49)	0.80 (0.73)	2.00 (1.64)	1.96 (1.42)	0.32 (0.47)	0.04 (0.19)	0.02 (0.14)	0.52 (0.50)	0.24 (0.43)	0.24 (0.43)	0.58 (0.67)	0.06 (0.24)	0.08 (0.27)	0.08 (0.27)	1.18 (0.78)	0.95 (0.59)	0.23 (0.22)
2019	0.56 (0.50)	0.86 (0.35)	2.08 (1.71)	1.84 (1.29)	0.30 (0.46)	0.02 (0.14)	0.02 (0.14)	0.52 (0.50)	0.22 (0.41)	0.24 (0.43)	0.50 (0.64)	0.04 (0.19)	0.04 (0.19)	0.04 (0.19)	1.15 (0.74)	0.94 (0.57)	0.20 (0.20)
2018	0.50 (0.50)	0.76 (0.43)	1.62 (1.70)	1.74 (1.30)	0.22 (0.42)	0.00 (0.00)	0.02 (0.14)	0.44 (0.50)	0.16 (0.37)	0.20 (0.40)	0.34 (0.51)	0.04 (0.19)	0.02 (0.14)	0.02 (0.14)	0.96 (0.72)	0.81 (0.57)	0.16 (0.17)
2017	0.46 (0.50)	0.70 (0.46)	1.26 (1.54)	1.60 (1.19)	0.16 (0.37)	0.00 (0.00)	0.00 (0.00)	0.34 (0.47)	0.16 (0.37)	0.16 (0.37)	0.32 (0.55)	0.04 (0.19)	0.02 (0.14)	0.04 (0.19)	0.83 (0.68)	0.70 (0.53)	0.14 (0.18)
2016	0.42 (0.49	0.66 (0.47)	1.12 (1.43)	1.50 (1.18)	0.14 (0.35)	0.00 (0.02)	0.00 (0.00)	0.30 (0.46)	0.10 (0.30)	0.16 (0.37)	0.28 (0.53)	0.04 (0.19)	0.00 (0.00)	0.02 (0.14)	0.75 (0.65)	0.64 (0.51)	0.11 (0.17)
2015	0.42 (0.49)	0.62 (0.49)	1.1 (1.56)	1.52 (1.28)	0.12 (0.38)	0.00 (0.00)	0.00 (0.00)	0.28 (0.45)	0.10 (0.30)	0.16 (0.37)	0.24 (0.51)	0.06 (0.24)	0.00 (0.00)	0.02 (0.14)	0.74 (0.70)	0.63 (0.55)	0.10 (0.17)
Total	0.49 (0.50)	0.73 (0.44)	1.53 (1.64)	1.69 (1.28)	0.21 (0.40)	0.01 (0.10)	0.01 (0.09)	0.40 (0.49)	0.16 (0.37)	0.19 (0.39)	0.38 (0.58)	0.05 (0.21)	0.03 (0.16)	0.04 (0.18)	0.93 (0.73)	0.78 (0.57)	0.16 (0.19)

Panel B: 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: R1 = carbon emission reduction strategies link with business strategy/objectives; R2 = Engagement with key stakeholders; R3 = Carbon performance targets; R4 = Carbon performance indicators (PIs); R5 = Integration with business processes/operations; R6 = carbon emission reduction committee and governance; Re1 = Ongoing feedback and stakeholder dialogue; Re2 = Trends over time; Re3 = Readability; Re4 = Verifiability; Re5 = Accuracy; Re6 = Value and timeliness of data; Re7 = Materiality and risks assessments; Re8 = Completeness; QCR = the arithmetic mean of the scores on all Rs and Re′.

[a]QCR (0–2.63).

[b]RELV (0–2.17).

[c](0–.88).

TABLE 3 Descriptive statistics

Variable(s)	Mean	Median	SD	P25	P75
REP	4.8800	0.0000	7.3629	0.0000	14.0000
QCR	0.9344	0.7500	0.7342	0.1667	1.6458
RELV	0.7778	0.6667	0.5719	0.1667	1.3333
RELI	0.1567	0.1250	0.1946	0.0000	0.2500
SIZE	21.4028	21.2823	1.6967	20.4785	22.1649
LEV	0.4919	0.4675	0.1950	0.3512	0.6080
ROA	0.0639	0.0720	0.1519	0.0340	0.1080
AGE	18.6160	17.0000	16.2923	7.0000	24.0000
LISTING	0.5533	1.0000	0.4979	0.0000	1.0000

Note: All variable definitions are given in Table 1.

TABLE 4 Mean *t*-test between high and low QCR companies using pooled sample

	High QCR = 1 (154)	Low QCR = 0 (146)	Mean difference	*t*-value
Rating	7.2273	2.4041	4.8232	5.99***
	High RELV = 1 (160)	Low RELV = 0 (140)	Mean difference	*t*-value
Rating	6.9750	2.4857	4.4893	5.5223***
	High RELI = 1 (151)	Low RELI = 0 (149)	Mean difference	*t*-value
Rating	7.0795	2.6510	4.4284	5.4532***

Abbreviation: QCR, quality of carbon reporting.
***Significance level of 1%.
**Significance level of 5%.
*Significance level of 10%.

4.1 | Regression results

The regression results of the 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 the regression results of the two dimensions of overall reporting quality, that is, relevance (*RELV*) and reliability (*RELI*).

Hypothesis 1 asserts that the *QCR* is positively associated with the market reputation (*REP*). The coefficient of *REP* is positive and statistically significant (*Coff* = *1.8106*, $p < 0.01$) with adjusted R^2 of 0.3936, as shown in Column (1), suggesting that the *QCR* has increased the market reputation, thus supporting Hypothesis 1. Furthermore, we documented the positive association of the *QCR* with two dimensions of overall reporting quality, that is, both relevance (*Coff* = 2.1313, $p < 0.01$) and reliability (*Coff* = 7.3251, $p < 0.01$). This is not surprising as the improvement of carbon activities that addressed improvements in both the in-house efforts of firms and their external communications is ultimately applauded and welcomed by the market.

Of the control variables, we found firm size (*SIZE*) and profitability (*ROA*) to be the most important determinants of the *QCR*. Firms' age (*AGE*) was found to negatively affect *QCR* in both the relevance and reliability dimensions. The relationship can also be explained from the viewpoint of liability of obsolescence in which company reputation decreases with age (Barnett, 1997). The decrease has been attributed to environmental drift, resulting from rivalry and competition (Utterback & Abernathy, 1975) and organisational inertia (the syndrome of too big or too old to change). However, Leverage (*LEV*) and Dual listing (*LISTING*) were not associated with the *QCR* in either the relevance or the reliability components of *QCR*.

4.2 | Robustness and sensitivity analysis

In this section, we report robustness tests that have been performed to assure that our main result is robust to alternative assumptions and model conditions. Overall, the results from the alternative assumptions and model conditions are quantitatively similar to our main results. First, similar to prior sustainability studies (Khan, Bose, Mollik, & Harun, 2021; Michelon et al., 2015), the potential endogeneity might weaken the finding of the causal relationship between *QCR* and market reputation. For example, a company's option

TABLE 5 Correlation matrix

Variable(s)	REP	QCR	RELV	RELI	SIZE	LEV	ROA	AGE
REP	1.0000							
QCR	0.2866 (<0.01)	1.0000						
RELV	0.2551 (<0.01)	0.9863 (<0.01)	1.0000					
RELI	0.3318 (<0.01)	0.8743 (<0.01)	0.7821 (<0.01)	1.0000				
SIZE	0.5969 (<0.01)	0.2251 (<0.01)	0.1877 (<0.01)	0.2977 (<0.01)	1.0000			
LEV	−0.3257 (<0.01)	0.0332 (0.56)	0.0332 (0.56)	0.0277 (0.63)	0.3135 (<0.01)	1.0000		
ROA	0.0106 (0.85)	0.1167 (<0.05)	0.1082 (<0.10)	0.1223 (<0.05)	0.1403 (<0.05)	−0.0093 (0.87)	1.0000	
AGE	−0.1709 (0.77)	0.1709 (<0.01)	0.1682 (<0.01)	0.1504 (<0.01)	0.1522 (<0.01)	0.0491 (0.39)	0.1147 (<0.05)	1.000
LISTING	0.2444 (<0.01)	0.1636 (<0.01)	0.1279 (<0.05)	0.2413 (<0.01)	0.2780 (<0.01)	0.1642 (<0.01)	−0.0429 (0.45)	−0.1432 (<0.05)

Note: All variable definitions are given in Table 1.

regarding whether to engage in *QCR* activities might not be independent of its reputation, in this scenario, our findings may be subject to reverse causality (Eliwa et al., 2021; Khan, Bose, Mollik, & Harun, 2021; Khan, Bose, Sheehy, & Quazi, 2021).

First, following Sun et al. (2020), we used instrumental variables in a two-stage-least-squares (2SLS) regression. We argue, based on mimetic isomorphism of institutional theory, that there is a mimetic effect on firms (Reppenhagen, 2010), inducing firms to disclose quality carbon information if their competitors adopt the same practice. Thus, a firm's reporting quality of carbon information is influenced by its competitors and peers in the same industry over time. As a result, we used industry-year mean (*MEAN_IND_YEAR_QCR*) as our instrument. We excluded the focal firm's carbon information to eliminate the firm's influence on the instrumental variable when calculating the industry-year mean. Hence, the instrumental variable reflects the average carbon information of the focal firm's competitors within the same industry and across years.

Table 7 shows the results with this instrumental variable approach. Column (1) reports the first stage where we find that the instruments are positively and significantly associated with *QCR*, supporting our argument that a firm's disclosure of quality carbon information is determined by industry factors. In the second stage, we replaced *MEAN_IND_YEAR_QCR* with the predicted *P_QCR* generated from the first stage. The results show that the coefficient on *P_QCR* is positive and significant at 1%. This suggests that firms with higher-quality carbon information report higher market reputations and consistent with the main results (Table 6). The postestimation tests for the two stages of the instrumental variables regressions are reported underneath the results within Table 7.[5]

We control the self-selection bias using Heckman's (1997) two-stage correction approach. In the first stage, this study used carbon information as a dummy variable that takes a value of one if the firm reports carbon information (*CAR*), and zero otherwise. This study used companies that report carbon information as treatment firms and firms outside the sample as control firms. Consistent with Lennox et al. (2012), we used the proportion of firms that reported carbon information in a specific industry (*P_CAR_DISC*) and previous year's decision to report carbon information (*CAR_D_LAG*) to satisfy exclusion restriction criteria and expected a positive sign. We expected that these two variables would satisfy the exclusion restriction criteria, as they are related to *CAR* but not to the market reputation. In Table 8, Column (1), the first stage regression results show that the coefficients of the two exclusion restrictions are positive and significant, *P_CAR_DISC* (0.9625, $p < 0.01$) and *CAR_D_LAG* (0.8987, $p < 0.0$) respectively. Column (2) shows the second stage regression results (Table 8). We find that *LAMDA* is not statistically significant. However, most importantly, here, our key variable (*QCR*) still remains significantly positive and qualitatively unchanged. These results further establish the causal link between corporate reputations and *QCR*.

Finally, in order to assure that industries that are more heavily represented in our sample do not drive the results, we further examined the sensitivity of our results by excluding the real estate sector,

TABLE 6 Quality of carbon information and market reputation: Baseline regression results

	REP = dependent variable		
Variable(s)	Model 1 Coefficient (t-value)	Model 2 Coefficient (t-value)	Model 3 Coefficient (t-value)
QCR/RELV/RELI	1.8106*** (3.62)	2.1313*** (3.34)	7.3251*** (3.82)
SIZE	2.8247*** (9.72)	2.8687*** (9.89)	2.7683*** (9.45)
LEV	−2.9834 (−1.27)	−3.2423 (−1.38)	−2.6592 (−1.13)
ROA	4.8859** (2.13)	4.7649** (−2.07)	5.1137** (−2.23)
AGE	−0.0602*** (−2.73)	−0.0589*** (−2.66)	−0.0619*** (−2.81)
LISTING	0.2335 (0.31)	0.3451 (0.46)	−0.0640 (−0.09)
Constant	−52.3738*** (−10.26)	−53.3261*** (−10.47)	−50.2123*** (−9.65)
YEAR_FE	Yes	Yes	Yes
INDUSTRY_FE	Yes	Yes	Yes
Adj R^2	0.3936	0.3896	0.3966
N	300	300	300

Note: All variable definitions are given in Table 1. *t*-values are shown in parentheses (robust SE).
***Represents significance level of 1%.
**Represents significance level of 5%.
*Represents significance level of 10%.

TABLE 7 Quality of carbon information and market reputation: 2SLS instrumental variable approach

Variable (s)	First stage QCR Coefficients (*t*-value)	Second stage REP Coefficients (*t*-value)
MEAN_IND_YEAR_QCR	0.9690*** (10.75)	
P_QCR		1.9054** (2.23)
SIZE	0.1080*** (3.98)	2.6481*** (9.58)
LEV	−0.8032*** (−3.53)	−1.7164 (−0.76)
ROA	−0.0803 (−0.34)	−4.3422* (−1.93)
AGE	0.0017 (0.77)	−0.0491** (−2.26)
LISTING	0.0844 (1.14)	0.7320 (0.99)
Constant	−1.9398*** (−3.80)	−50.8252*** (−10.08)
YEAR_FE	Yes	Yes
INDUSTRY_FE	Yes	Yes
Adj R^2	0.3796	0.3940
N	300	300
Underindentification test		95.221 (0.000***)
Kleibergen–Paap rk LM statistics		135.696
Week identification test		57.56
Kleibergen–Paap rk Wald *F* statistic		
Cragg–Donald Wald *F* statistics		
Overidentification test of instruments		
Hansen J statistic		0.0210(0.848)

Note: Robust *t*-statistics are in brackets. All variable definitions are given in Table 1.
***$p < 0.01$. **$p < 0.05$. *$p < 0.10$.

TABLE 8 Quality of carbon information and market reputation: Heckman selection model

Variable (s)	First stage CAR Coefficients (*t*-value)	Second stage REP Coefficients (*t*-value)
P_CAR_DISC	0.9625*** (3.17)	
CAR_D_LAG	0.8987*** (2.92)	
P_QCR		1.4831*** (2.82)
SIZE	0.4014*** (3.72)	3.9841*** (3.91)
LEV	−0.8241 (−1.47)	−5.7814** (−2.64)
ROA	0.9874 (1.26)	−0.7411 (−0.46)
AGE	−0.0062 (−1.21)	−0.0487*** (−3.11)
LISTING	−0.0812 (−0.87)	−0.2589 (−0.42)
LAMDA		3.1041 (1.36)
Constant	−10.1427*** (−4.01)	−52.6201*** (−3.55)
YEAR_FE	Yes	Yes
INDUSTRY_FE	Yes	Yes
Adj R^2	0.2487	0.5887
N	782	300

Note: Robust *t*-statistics are in brackets. All variable definitions are given in Table 1.
***$p < 0.01$. **$p < 0.05$. *$p < 0.10$.

which had high numbers of observations. Our results (not reported in the table) are robust for exclusion of this industry from the regressions.

5 | CONCLUSION

This study examines the *QCR* by top NZ firms and its changes over time. It also explores the impact of *QCR* on the market reputation of firms. Using 50 firm's data over 6 years, our principal findings are threefold: (i) The QCR of NZ's top firms is 'cosmetic' in nature, although indicators used in the *QCR* have gradually improved over the

years of our investigation; (ii) NZ firms need to exponentially improve both their in-house efforts and external reporting for many indicators (discussed previously); (iii) Additionally, our study finds that *QCR* affects the market reputations of firms, specifically, society/stakeholders reward (or punish) firms in the market on the basis of their efforts to improve *QCR*.

The current study contributes to the carbon accounting literature in a number of ways. Firstly, understanding the *QCR* and its character (organic vs cosmetic) has been largely ignored in previous carbon accounting research. To this end, we provide a clear account on the relevance and reliability of the reported carbon information of firms and their 'organic' versus 'cosmetic' initiatives for reducing carbon emission. Secondly, our study investigates the QCR by developing a comprehensive *QCR* index that considers both internal management practices (in-house initiatives) and external reporting perspectives of carbon information. Hence, the current study contributes to the literature by capturing the construct quality of carbon information more comprehensively, a noble initiative in the carbon literature. Thirdly, to the best of our knowledge, our study is the first in the literature to provide an account of market reactions (does society/stakeholder reward or punish?) attributable to the nature of *QCR* adopted by firms. Fourthly, the current study contributes to the carbon literature by providing an in-depth account of the variations in quality of carbon information both over time, as well as in multiple industries. This allowed us to have a more holistic understanding of the issues about improving *QCR*, through a longer-term lens and a wider range of industries. Lastly, the findings of the current study have contributed in the context of NZ by providing a story of top listed NZ firms' commitment towards *QCR*.

The current study's results have practical value for decision-makers and the regulators in NZ in many ways. First, while companies' *QCR* has tended to gradually move from cosmetic to authentic carbon practices, company and policy makers should stimulate and encourage firms to concentrate on many key areas of quality indicators for improvement (discussed earlier) and to display authentic *QCR* initiatives. Secondly, the firms should concentrate on adopting authentic *QCR* in the future, as without implementing authentic efforts, they will pay a price (through reduction of market reputation). The country's Prime Minister has recently declared that the country will be first in the world to adopt mandatory carbon reporting by 2023. The country's regulators should take a proactive role in this regard by making external verification mandatory (over 70% firms reported carbon information without external verification in 2020) and collectively undertake other initiatives with other local regulators (e.g., the Financial Market Authority, NZ; NZ Stock Exchange; and the Ministry for the Environment) to monitor other areas of improvement for carbon information. Regulators now have a business case to push listed firms to improve *QCR* in many aspects. Our findings on how stakeholders reward or penalise based on *QCR* (and its different forms) would probably serve as early signals for firms' decision-makers for rethinking and revisiting their attitudes in this regard.

Nevertheless, the findings of the study should be interpreted with caution. The study considers data from only one advanced economy and therefore findings should not be applied beyond that context. Future study is encouraged to explore the same theme in other advanced economies. Second, more empirical work should also be conducted to help to authenticate other aspects of the quality, for example, stakeholders' perceptions about firms' QCR or factors driving QCR. A case-based study using one or two firms or applying a survey method of collecting data would be desirable. In the study, we have measured market reputation using credit rating agencies scores, which may merely signal one aspect of market reputation. Future research should consider more composite measures of market reputations addressing other aspects of reputations such as reputation perceived by customers, communities, suppliers and overall brand value of firms. Our findings were also applied to the top 50 firms only. How QCR develops over time in other top firms (say the top 100 NZ firms or all listed firms) and how their overall attempts for carbon quality are different in other developed countries' firms is worthy of investigation. Globally, more research in this area should be undertaken in different contexts, so that academic understanding is further developed and stakeholders can be aware of organic versus cosmetic types of legitimisation reporting.

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CONFLICTS OF INTEREST

We declare that there are no conflicts of interest for the paper with any authors or other parties.

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ENDNOTES

[1] In the carbon literature, the assessment of Greenhouse Gas (GHG) emission is considered as firms' initiatives to measure carbon footprint and carbon reduction. Alternatively, carbon reporting measures and reports emissions outputs produced as a results of different processes/activities of firms such as the burning of fossil fuels, deforestation, industrial processes, agricultural practices, including the use of fertiliser and raising livestock and the use of various consumer products (Lohmann, 2009), a detailed discussion of which is beyond the scope of the current study, as the current study focuses on the quality of reported carbon information.

[2] The operational definitions of the terms relevance and reliability are used in past nonfinancial reporting research and are also explained and outlined by the accounting regulators, namely, the International Accounting Standard Board (IASB) and the Financial Accounting Standard Board (FASB) (see Chauvey et al., 2015; Khan, Bose, Mollik, & Harun, 2021) for details).

[3] In a recent global study, Earnest and Young (2021) reported that carbon disclosure remains ahead of quality as only 3% of sampled firms (n = over 1100 firms) received a score of 100 out of 100 in the quality index.

[4] Khan, Bose, Mollik, and Harun (2021) reported an alpha coefficient value of 0.702 for their quality of sustainability disclosure index.

[5] The tests show that our instruments satisfy the conditions of exogeneity, relevance and thus valid for estimation.

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APPENDIX A.

List of items for quality of carbon reporting.

Panel A: Relevance (R)	
R1: Carbon emission reduction strategies link with business strategy/objectives	Carbon emission reduction strategies are clearly linked with the business strategy/objectives of the firm. Assign 1 if this information is presented; otherwise, 0.
R2: Engagement with key stakeholders	The report identifies of the firms key stakeholders and their expectations about carbon reduction are considered in decision-making process. Assign 1 if this information is presented; otherwise, 0.
R3: Carbon performance targets	The reports present carbon performance targets set for the future, targets set in the previous reporting period and the level of their achievements. Carbon performance targets are considered in area of carbon emission reduction plan. Carbon performance/reduction target is measured on a 5-point scale (ranging from 0 to 5), depending on the number of contents/items of carbon performance targets provided in this area. For example, if a company reports five or more carbon reduction targets set by the management for different business activities, the company is assigned the maximum 5 points, but 0 points if no carbon reduction target information is provided. The point score is then normalised by dividing by 5 to obtain a weighted score of 1 (5/5) for that area. If a company reports two carbon targets, the company is assigned 2 out of 5, giving a weighted score of 0.4 (2/5) but is assigned 0 out of 5 if it reports no carbon performance target, resulting in a 0 (0/5) weighted score. Therefore, the weighted score ranges from 0 to 1 for carbon performance target indicators.
R4: Performance indicators for carbon reduction	The report shows quantitative information about the company's carbon performance indicators used for different carbon mitigation activities. The value of the carbon performance indicators (R4) was measured in the same way as the carbon performance targets (R3). Therefore, the total weighted carbon performance indicators score for a company can be anywhere from 0 to 1.
R5: Integration with business processes/ operations	The report confirms the inclusion of carbon emission reduction in the internal decision-making process and its implementation in the company's basic operations (e.g., purchasing, marketing, lending and other companying operations). Assign 1 if this information is presented; otherwise, 0.
R6: Carbon emission reduction committee and governance	The report contains firms internal initiatives of forming carbon emission reduction committees, other corporate governance initiatives to monitor and improve performance. Assign 1 if this information is presented; otherwise, 0.
Panel B: Reliability (re)	
Re1: Ongoing feedback and stakeholder dialogue	The report contains a mechanism that allows a feedback process (e.g., contact point for suggestions or questions, hotline, email, reply card and questionnaire) with key stakeholders for carbon risk. Assign 1 if this information is presented; otherwise, 0.
Re2: Trends over time	Information is contained over several reporting periods, indicating the direction of change in carbon emission reduction efforts. Assign 1 if comparative information over different periods is presented; otherwise, 0.
Re3: Readability	The report has a logical structure; uses graphical presentation of the data; uses drawings and explanations where required; or uses other tools to help navigate through the document. Assign 1 if this information is presented; otherwise, 0.
Re4: Verifiability	External verification is used for carbon emission reduction reporting or information on climate-related risk. Assign 1 if this information is presented in the report; otherwise, 0.
Re5: Accuracy	This study assigns 3 points for monetary reporting of carbon emission reduction information, 2 points for quantitative but non-monetary reporting and 1 point for only qualitative reporting; otherwise, 0.
Re6: Value and timeliness of data	The report describes the processes and procedures of collection, aggregation and transformation of data into information objectively and with integrity. It also describes timely reporting of the carbon emission reduction performance information. Assign 1 if this information is presented; otherwise, 0.
Re7: Materiality and risks assessments	The report contains information on company's initiatives to identify all 'material' information about key business operation, that information might affect firms achieving carbon emission reduction agenda, assessing threats/risks for implementation of carbon emission reduction initiatives and scanning of external market. Assign 1 if this information is presented; otherwise, 0.
Re8: Completeness	The report contains both positive and negative types (say, accident rates, number of injuries for carbon emission, accidents (fires, smokes from electricity and other energy etc.) of carbon emission reduction performance information. Assign 1 if this information is presented; otherwise, 0.

APPENDIX B.

Conversion table of S&P credit ratings.

Standard & poor's issuer credit ratings	Assigned numerical values
AAA	22
Aa+	21
AA	20
AA-	19
A+	18
A	17
A-	16
BBB+	15
BBB	14
BBB-	13
Bb+	12
BB	11
BB-	10
B+	9
B	8
B-	7
CCC+	6
CCC	5
CCC-	4
CC	3
C	2
D	1
Not rated	0