Review

Taking Stock of Carbon Disclosure Research While Looking to the Future: A Systematic Literature Review

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Abstract: Carbon disclosure research has sparked a growing interest due to climate change phenomenon and the impact thereof on the global market in recent years. Despite this trend, there is still a gap in knowledge regarding the role that carbon disclosure plays in the economic activities of corporations. Therefore, the purpose of this study is to systematically review the available literature on corporate carbon reporting by assessing current research trends, theoretical perspectives, and themes discussed in the field. A final sample of 168 studies from the Scopus database that explicitly discussed carbon reporting were included in this investigation. The results indicated an increase in the number of studies, especially in the last five years. In addition, carbon disclosure practices vary between different firm types, sectors, and countries. However, there is a shortage of empirical studies on some contexts that have rarely been considered. Moreover, it was found that the existing literature has only focused on the demographic characteristics of firms as the driving factor of carbon disclosure, while little attention has been paid to the attributes of governance, auditing, top management, and ownership. Nevertheless, there is no academic consensus on some determinants of carbon reporting, including profitability and the effect of the industry. With regard to the reporting quality, there is no evidence that less disclosed information means that reporting is rare in quality. This study provides a comprehensive, systematic analysis of carbon disclosure studies. The implications for future research are also discussed.

Keywords: carbon disclosure; carbon disclosure determinants; carbon disclosure consequences; carbon disclosure quality; carbon accounting; assurance

1. Introduction

Carbon disclosure in the annual reports of firms or other channels provides transparent information concerning greenhouse gas (GHG) emissions and climate change arising from a source that is controlled or owned by these firms. Over the last three decades, the evolution of firms’ environmental reporting has been a highly debated topic, and hence, carbon and climate change disclosure are receiving increased attention. Recent extreme changes in the climate have resulted in a continuous increase in GHG emissions, which have reached an alarming magnitude as a result of firms’ industrial activities, indicating the need to balance corporate environmental, social, and economic performance. Despite these alarming carbon emission levels, the disclosure of climate change and carbon-related information is still at a low level. Ooi and Amran [1] suggested that, in Malaysia, the majority of companies revealed minimal climate-change-related information, and nearly all of them disclosed less than half of the measurement indicators. This is similar to the reporting practices in other markets, such as Europe [2], Australia [3], and Canada [4].
The non-disclosing behavior of companies might be attributed to several factors, such as limited knowledge and awareness among firm executives and directors regarding environmental disclosure, a scarcity of resources, a lack of legal regulations, underperformance, apprehension about negative publicity, a lack of monitoring and instruction from advisors/consultants, and a lack of clear guidance, which may lead to many companies choosing not to publicly disclose their political accounting decisions in full or to only disclose a few of their accounting treatments [5–7].

Firms must learn and understand how carbon accounting and disclosure works in order to disclose accurate and valuable information regarding the risks and opportunities involved in carbon emissions. Firm-specific and country-level characteristics determine the reporting approach. However, transparent disclosure has become challenging, since there is no transparent carbon management and disclosure guidance in the literature, and different stakeholders perceive carbon activities differently. To date, the literature on all facets of carbon disclosure regarding firms in both developed and developing markets remains limited [1,8–10]. Thus, more research on the antecedents, consequences, quality, and assurance of carbon disclosure is needed. The topics of carbon and climate change reporting are understudied despite the increased interest in corporate environmental disclosure. This indicates that increased research on cross-cultural and international firms dedicated to carbon disclosure is required. Furthermore, scholars have commonly highlighted the lack of literature review work on carbon disclosure [11]. A literature review is a method by which reflections and insights related to the topic of interest shed light on prior findings in the body of knowledge and highlight some directions for further work [12,13]. Lodhia and Hess [11] focused on the mining industry when reviewing the existing knowledge on sustainability accounting and reporting. Havranek et al. [14] reviewed 101 studies related to the social cost of carbon. Borghei [15] conducted a bibliographic mapping of the literature on carbon disclosure instead of a detailed and critical assessment of the current literature, where a citation and network mapping of the literature was the structure of the study. For example, a theoretical review of the sample literature was not considered in that study, while in this research, the prior research settings, theories applied, and themes were reviewed.

The underlying aim of this study is to fill this gap by conducting a comprehensive and systematic review of multiple aspects of the carbon disclosure literature. Unlike a traditional review, a systematic literature review aims to mitigate the bias involved in evaluating the literature and improve future research quality. To do so, we followed a systematic method that has been applied in several studies [16–19] to search for all of the published literature on carbon disclosure. A total of 168 studies that explicitly discussed carbon reporting were included in this investigation. These studies were analyzed to answer the following research questions: (1) What is the current research trend in the field of carbon disclosure? (2) What are the most commonly applied theories in the field? (3) What are the common themes among scholars?

The investigation revealed that despite the perceived positive impact among stakeholders, companies tend to meet the regulatory requirements for carbon disclosure by avoiding the voluntary type of carbon reporting. Based on the number of documents published per year, the results showed that environmental issues had recently received ever-growing attention, with stakeholder, legitimacy, and institutional theories being the most common theoretical perspectives. In addition, there is no academic consensus about the effects of some factors. For example, Chu et al. [20] reported that profitability does not affect the quality and quantity of environmental disclosure, while other scholars [21,22] reported an inverse relationship between profitability and disclosure level. Similarly, mixed findings were reported for the industry type [5,20,23], government ownership [20], and capital structure [21,23].

This study adds to the existing literature by conducting a comprehensive, systematic review of studies that addressed carbon disclosure. Due to the lack of review work on this topic, we argue that this study will provide a clear roadmap for future research through
which future studies can be conducted. It has been suggested that a systematic literature review is a method for studying the knowledge base of the scholarly literature to develop insights, evaluate the accuracy of the literature, establish future research paths, and develop research questions.

This article is organized as follows: Section 2 presents the methodology and research strategy. Section 3 presents the review findings, and Section 4 discusses the limitations of previous literature and future research paths, followed by Section 5, which concludes the study.

2. Methodology

To provide a comprehensive review, we searched for all the published literature on carbon disclosure using a systematic approach. We followed the methodology that is widely applied in the literature [17,24,25] and relied on the Scopus database for literature mining. The Scopus database is said to be the largest indexed abstract database for peer-reviewed journals when compared to some other databases [16]. The following search string was utilized in the sample collection: Title-ABS-KEY (“Carbon OR carbon dioxide (CO₂) OR GHG OR Greenhouse OR “Climate change” OR “climate risk” OR “Climate resilient” OR “climate adapt*” OR “climate mitigat*” OR “global warming” AND “reporting*” OR “disclos*”). The keywords for carbon disclosure were selected after reviewing similar studies [15]. Note that an asterisk can be used in search engines as a substitute for any other letter(s). As shown in Figure 1, the search process resulted in 6092 studies as an initial sample. After the literature was limited to documents published in the English language, 125 studies in other languages were excluded. Then, we excluded studies published in books and conference proceedings, leaving only 4477 studies. By focusing on specific fields, namely, Environment Science, Business, Management, Finance, and Economics, the number of sample studies decreased to 535 studies.

Figure 1. The flow chart of the sample collection.

In the final stage, we screened the title and abstract of the sample and found that out of 535 documents, only 186 studies explicitly addressed carbon disclosure-related topics. To maintain the reliability of the review process, two authors screened and coded the sample for irrelevant studies and recorded the results on a separate spreadsheet. Thereafter, one
author independently repeated the same process focusing on the eliminated studies. This process confirmed the final sample of the literature included in this review. Our study was not restricted to a specific period or journal, as we aim to explore all the research development related to carbon reporting. In line with other scholars (i.e., [16,26]), this review focused on the yearly trend of publication, prior research settings, theories applied, and themes discussed in the sample literature.

3. Results

The literature mining process has resulted in 168 research articles available in Scopus-indexed journals related to carbon disclosure. The result showed that environmental issues have received ever-growing attention in recent years. The oldest document is dated back to 1999 [27], and there was a gradual increase in publications. As shown in Figure 2, the studies have increased significantly in specific years, such as in 2011, and the years from 2011 to 2021. In 2011, the increase was likely due to the impact of the Kyoto Protocol (which started in 2008 and ended in 2012). The next rise in the number of publications that occurred in 2015 might be influenced by the Paris Agreement, which brought all nations together in an ambitious effort to combat global warming and adapt to climate change.

Furthermore, following the Department for Environment, Food and Rural Affairs’ (DEFRA) guidance in 2009, the first year that reflected companies’ voluntary disclosure of GHG emissions was 2011. After its introduction in 2009, companies that applied DEFRA guidance 2010 had it reflected in the 2011 disclosure report [28].

Figure 2. The number of studies per year.

Although some industries have received greater attention, such as oil and gas [8,29], tourism [30], and the automotive industry [31], due to environmental pressure groups or regulatory authorities, the number of annually published documents remained less than four documents in total until 2011. One possible reason is that the cost of implementing organizational changes now is much lower than the future costs of socioeconomic disruption caused by environmental damage and uncontrolled climate change. In recent years, voluntary initiatives, including the non-profit Carbon Disclosure Project (CDP), have increased on a global scale, putting pressure on companies to disclose their initiatives and performance in terms of carbon emissions. Such efforts aimed to increase transparency and enhance emissions management have recently risen internationally. Consequently, carbon disclosure has attracted researchers’ attention in recent years.
3.1. Prior Research Settings

In Table 1, the investigation shows that the empirical studies that discussed carbon disclosure accounted for 50 percent of the published documents, while the number of review and qualitative studies is very limited. Based on research methods, the sample literature was divided into five types: (1) Qualitative research, (2) Quantitative research, (3) Review, (4) Descriptive, and (5) Non-empirical research. There are five literature reviews providing information on subjects such as greenhouse and energy reporting [32], sustainability accounting and reporting [11,15,33], and selective reporting [14]. There is a lack of comprehensive reviews of multiple aspects of carbon disclosure aspects. Concerning the geographical distribution of the studies, developed nations contributed more than half of all papers on the carbon disclosure issue, indicating that these countries are important actors in the growth of this field. These countries include the UK, Australia, and the USA. Furthermore, the analysis revealed that limited studies are being conducted in African, Latin American, and Middle Eastern nations, whereas the majority of the literature is primarily and regularly gathered data from industrialized countries [23,34–37]. Hence, further work may evaluate how firms operating in less developed markets can become more transparent in reporting environmentally subtle practices, including carbon-related activities.

Table 1. Prior literature settings.

| Method                   | 2000–2005 | 2006–2010 | 2011–2015 | 2016–2021 | Total |
|-------------------------|-----------|-----------|-----------|-----------|-------|
| Empirical               | 5         | 21        | 67        | 93        |       |
| Non-empirical           | 4         | 6         | 10        | 10        | 30    |
| Descriptive             | 2         | 1         | 8         | 9         | 20    |
| Qualitative and Case study | 5         | 12        | 17        |           |       |
| Review                  | 5         | 3         | 8         |           |       |
| Country                 |           |           |           |           |       |
| International           | 2         | 8         | 22        | 32        |       |
| UK                      | 5         | 10        |           | 15        |       |
| Australia               | 7         | 5         |           | 12        |       |
| Europe                  | 1         | 2         | 8         | 11        |       |
| USA                     | 1         | 2         | 2         | 3         | 8     |
| China                   | 1         | 7         |           | 8         |       |
| Canada                  |           |           |           |           | 6     |
| Malaysia                | 1         | 4         |           | 5         |       |
| Bangladesh              |           |           |           | 4         | 4     |
| South Africa            | 1         | 3         |           | 4         |       |
| France                  | 1         | 2         |           | 3         |       |
| India                   |           |           |           | 3         | 3     |
| Spain                   | 2         | 1         |           | 3         |       |
| Indonesia               |           |           |           | 2         | 2     |
| Turkey                  |           |           |           | 2         | 2     |
| Italy                   | 1         | 1         | 2         |           | 2     |
| Netherlands             | 1         | 1         |           | 2         |       |
| Other countries *       | 1         | 1         | 2         | 4         | 8     |
| Total                   | 2         | 6         | 34        | 88        | 130   |

* Other countries include Brazil, New Zealand, Saudi Arabia, Germany, Nigeria, Austria, Sweden, and Greece.
3.2. Theories Applied in the Literature

Various theories have been used to analyze carbon disclosure in theoretical, descriptive, and empirical articles. In total, 25 different theories were applied in the selected literature, with 17 theoretical perspectives each used in only one paper, while 80 studies did not apply any theory (see Table 2). The prior studies (e.g., [20,38]) suggested that further facilitation of the theoretical development of carbon disclosure facets in future work is needed. The most common theoretical lens is legitimacy theory (48 papers), followed by stakeholder theory (23 papers), institutional theory (17 papers), signaling theory (15 papers), and agency theory (8 papers). These results are consistent with previous studies [16]. The review of the literature demonstrates frequent cases in which a single theoretical lens was applied [1,39,40]. These studies assume that businesses do not operate in a vacuum but are community members and, as such, must obey the guidelines, values, and ethics of the community to which they belong and, therefore, should not harm the community. Hence, to ensure an organization’s success and survival, it should guarantee that its activities are viewed as being in full compliance with societal values and norms. Therefore, corporate disclosure policies are viewed by management as an essential tool for influencing external perceptions of their company in order to demonstrate that it is a good corporate citizen and to validate its corporate practices in environmental, social, and political areas.

Table 2. Theories applied in prior studies.

| Theory Name                  | 2000–2005 | 2006–2010 | 2011–2015 | 2016–2021 | Total |
|------------------------------|-----------|-----------|-----------|-----------|-------|
| Legitimacy theory            | 1         | 10        | 9         | 28        | 48    |
| Stakeholder theory           | 1         | 8         | 14        | 23        |       |
| Institutional theory         | 1         | 4         | 12        | 17        |       |
| Signaling theory             |           |           | 15        | 15        |       |
| Agency theory                | 3         | 4         | 7         |           |       |
| Voluntary disclosure theory  | 2         | 4         |           | 6         |       |
| Resource based-view theory   | 3         |           |           |           | 6     |
| Political cost theory        |           |           |           | 2         | 2     |
| Other theories *             | 2         | 6         | 9         | 17        |       |
| No theories                  | 8         | 7         | 25        | 40        | 80    |

*Other theories include capital market theory, contingent theory, transaction cost theory, upper echelons theory, microeconomic theory, modern banking theory, modern portfolio theory, neo-classical economic theory, neo-institutional theory, proprietary costs, risk society theory, capital needs theory, social representations theory, social identity theory, chaos theory, board capital theory, and institutional theory.

3.2.1. Legitimacy Theory

In our sample literature, 48 papers used the legitimacy theory. This theory suggests that there is a social contract between business and society. As a result, it allows for a greater level of carbon disclosure to ensure compliance with the law and society standards where mandatory reporting is insufficient [8,10,41]. This theory is a multidimensional concept that includes regulatory and voluntary legitimacy, as previous studies use them as an essential part of understanding the different dimensions and contributing to broadening the understanding of carbon disclosure by firms. Within the same socially constructed system of beliefs, norms, and values, legitimacy can be implemented in a wide perception or expectation that an entity’s activities are favorable, suitable, or appropriate. In the sample literature, scholars have applied legitimacy theory to evaluate the antecedent of carbon disclosure [5,8,20], consequences [34,42], assurance [6], and disclosure quality [10,41]. Lokuwaduge and Silva [3] have applied this theory to investigate the interconnection between the environmental, social, and governance risk disclosure practices in Australian firms and supported the legitimacy theory. Similarly, other studies have supported the legitimacy theory (e.g., [43,44]). Kouloukou et al. [43] found that environmental disclosure
is greater in high-profile sectors with more community concerns than in firms with less polluting potential.

3.2.2. Stakeholder Theory

One of the popular ethical theories in the corporate environment is the stakeholder theory, as it expresses the needs and desires of diverse stakeholders from various operating institutions [16,45]. It was applied in 23 studies to assess the possible impact of various stakeholders in the community on firms’ disclosure practices. The basic idea from the discipline of strategic management is that structural disclosure is a management tool for meeting the information needs of the targeted stakeholders [24]. Executives utilize the information to influence or manipulate important stakeholders to obtain the resources needed to sustain their firms. Studies have applied this theory to assess the impact of investment firms on climate change disclosure [46], environmental disclosure awards [47,48], reporting of environmental social and governance risk [3], and reporting quality [8,29]. As stakeholder theory predicts, Radu and Maram [49] found that the behavior of directors extends beyond maximizing shareholder wealth and adjusting the interests of a diverse set of stakeholders. In addition, Cotter and Najah [50] reported a significant association between climate change reporting and institutional investor pressure, strengthening stakeholder theory concepts and proving the potential of this powerful and legitimate stakeholder group to influence company reporting activities. However, despite stakeholder theory explaining the motivations for carbon disclosure practice, it does not help us highlight the differences between corporations carried out in different environments when compared to institutional theory, which focuses on the social perspective and isomorphism within the institutional environment [31]. For example, Comyns [8] suggested that despite the fact that European corporations originally embraced more aggressive climate change plans and were exposed to societal and political burdens on the topic, these firms do not have considerably higher disclosure quality, which is difficult to explain from the standpoint of stakeholder theory, as corporations are expected to respond to local stakeholder pressure through environmental reporting.

3.2.3. Institutional Theory

This theory initially focused on the implicit meanings of institutional beliefs, myths, or regulations and the methods through which a distinct theme emerged. This concept was taken further to emphasize the diverse nature of such organizational processes and how these procedures explain differences amongst corporates [51]. It outlines how corporations may gain trustworthiness in their social surroundings by being more consistent across scenarios as a result of the natural ecology of isomorphism. Institutional theory complements legitimacy and stakeholder theories in comprehending how organizations react to social and institutional pressures. This theory has been widely supported in the sample of environmental disclosure literature [28,52,53].

3.2.4. Agency Theory

Agency theory suggests that the conflict of interests among executives and owners has brought some problems, such as information asymmetry and agency costs [18,54–57]. Despite the fact that it is often associated with the principal and agent conflict of interests, agency perspective is applied in the literature to explore topics such as the guidance of the Department for Environment, Food, and Rural Affairs (DEFRA) and GHG emissions disclosure [58], environmental performance and disclosure [5], and assurance disclosure practice [6]. It has been suggested that this theory, in combination with socio-political theories, could be used to explain several elements of environmental reporting. According to agency theory, the mandatory reporting of carbon emissions is value-relevant because it reduces information asymmetry [49].
3.2.5. Other Theoretical Perspectives

Other theories are barely applied. Out of 25 different theories applied in the carbon disclosure literature, 17 of them were applied in only one study, such as the capital market theory [59], transaction cost theory [60], upper echelons theory [28], proprietary costs [22], and risk society theory [61]. Additionally, political cost theory, which normatively addresses how political costs influence the management behavior toward accounting regulations that allow earnings to be deferred from present to future periods, is discussed in two research studies [23,36]. Similarly, nine articles used the signaling theory that discusses communication between firms and stockholders that reduce information asymmetric. Resources-based view theory was applied only in three research articles to assess carbon disclosure in relation to the board diversity and the value relevance of such disclosure [62–64].

Our findings suggest that new and current behavioral and cultural theories may be useful in guiding future research and addressing a variety of complicated issues linked to carbon disclosure practices. The behavioral theory was used by De Massis et al. [65] to complement the agency argument in explaining family involvement and the influence of family ownership on the top management team and firm performance. As agency theory is common in the sample literature, it could be complemented with behavioral theory to provide a more fine-grained understanding of various carbon disclosure determinants such as ownership structure and governance attributes.

3.3. Thematic Analysis

This section evaluates the sample studies of carbon disclosure based on the themes discussed. The literature is concentrated on seven different topics, including climate change management, strategy and policy research, and quality of carbon disclosure. At the same time, a few studies discuss the drivers of carbon disclosure, carbon disclosure outcomes, assurance of carbon disclosure, carbon accounting, and the Paris agreement.

3.3.1. Climate Change Management, Strategy, and Policy Research (32 Studies)

The growing focus on firms reporting on carbon and climate change management, driven by stakeholder interests, including investors and regulators, leads to a critical question: what is the most effective strategy to ensure such disclosure? However, the impact of carbon-specific legislation on corporate carbon disclosure is little understood. In addition, there are few studies that indicate how legislation for climate change strategy at a national macro-level affects companies’ voluntary environmental disclosures [52]. In recent years, such reporting has become a vital component of the basic business activities that contribute to the value of a company. Regulation and policies have long been proven to be successful strategies for enhancing environmental accountability. Governments frequently use legislation and subsidies to encourage environmentally beneficial actions, while consumers and investors frequently express their concern for the environment by backing environmentally conscientious businesses [66]. Milanés-Montero et al. [67] argued that the growth in environmental disclosures in annual reports is a result of the drive to present a less unfavorable image to stakeholders, not solely due to mandated regulation. However, despite the positive image impact among stakeholders, companies tend to meet the regulatory requirement of carbon disclosure and avoid voluntary reporting [3].

Fagotto et al. [68] suggested that, in the USA, the government is required to improve market efficiency and enact legislation requiring product labeling and industrial reporting of GHG emissions. Investors, business partners, employees, community residents, and customers would be able to compare vehicles, air conditioners, lawn mowers, and manufacturing plants as a result of such disclosure. A well-designed transparency system is critical for any climate change strategy to start the required trade or other regulatory approaches. Others have claimed that changing corporate behavior will need a concurrent effort to boost firms’ compliance incentives via reforms in national institutions [69]. Additionally, external environmental reporting and internal strategies, procedures, and activities were discovered to have a dynamic interaction [70], and in comparison to non-affected enter-
prises, companies affected by the legislation boosted their disclosures [71]. Legislators, however, should consider the organizational differences of firms in forming an efficient carbon disclosure. The question that remained unanswered is how policymakers can better construct regulations and standards to make good-quality reporting on GHG emissions easier for all types of businesses, such as multinational companies [38] and medium/small companies [1,58]. Rahman, Rasid, et al. [52] reported evidence that carbon pricing has an indirect institutional effect on the quality of voluntary environmental disclosures.

Moreover, global GHG reporting procedures are being standardized through the use of reporting guidelines such as the Greenhouse Gas Protocol (WBCSD and WRI, 2004), the Global Reporting Initiative (GRI) guidelines (Global Reporting Initiative 2006, 2002, 2013), and industry-specific reporting regulations. Both international and national standards mandate reporting on GHG emissions. For instance, the EU Emissions Trading Scheme (EU ETS) mandates that businesses submit annual reports on verified CO2 emissions from regulated facilities, while some stock markets require listed companies to submit sustainability reports. However, regulatory and political pressure and attitudes toward climate change can also vary between countries and geographical regions. Furthermore, it should also be noted that most of the previous studies in our sample have focused on policies and regulations related to carbon disclosure (see Table 3). Nevertheless, little is known about the topic in developing markets, as most of these studies [2,69,71–73] were conducted using data from developed countries.

Table 3. Sample of studies on climate change and carbon strategy, policy, and management.

| Author | Country | Theory | Findings |
|--------|---------|--------|----------|
| [1] Malaysia Institutional theory | Despite the low level of corporate climate change reporting, the findings result showed that Malaysian businesses are concerned about climate change and are developing climate change business plans. |
| [2] Europe None | Most large companies have now established the management systems and processes necessary for them to effectively manage their emissions and related business risks. Companies with significant greenhouse gas emissions have noticeably stronger governance oversight and reporting. |
| [3] Australia Stakeholder and legitimacy theories | Firms tend to disclose indicators that are influenced by current regulatory obligations, but voluntary reporting was not popular, despite the fact that it may generate a favorable image among stakeholders. |
| [38] Netherlands Institutional theory | A theoretical framework is developed to provide an explanation of GHG emissions reporting. |
| [52] 53 countries Institutional theory | The voluntary environmental reporting quality is influenced by the carbon price in an indirect institutional way. Non-government recommendations such as the Global Reporting Initiative and ISO 14001 certification have an institutional impact on voluntary environmental reporting. |
| [58] The UK Stakeholder and agency theories | The 2009 guidance has had a significant effect on the level of GHG disclosure, and corporate governance mechanisms also affect the extent of GHG information disclosure. |
| [68] The USA None | Policymakers must create transparent processes that formally acknowledge the roles of user groups in oversight, evaluation, and improvement proposals. |
### Table 3. Cont.

| Author | Country | Theory | Findings |
|--------|---------|--------|----------|
| [70]   | New Zealand | None | External environmental reporting was discovered to have a dynamic interaction with internal strategies, processes, and activities, which helped to integrate viability into organizational practices and foster the growth of environmental reporting. |
| [71]   | Australia | Legitimacy theory | Firms affected by legislation raise their reporting as compared to non-affected firms. When compared to the same firm prior to implementations, in legislation-affected businesses, a rise in the quantity of emissions volume is reported. Greater emitters who are subject to legislation have higher levels of voluntary reporting. |
| [73]   | Norway, Canada, and France | Stakeholder theory | Climate change is constructed in a variety of ways in the reports. Total portrays climate change as a responsibility that the corporation is willing to accept; Suncor Energy portrays it as a business risk; and Statoil portrays it as a business opportunity. The risk representation, on the other hand, is the most common in the content as a whole. |
| [74]   | Australia | Microeconomic theory | Proposes a “checklist” for evaluation of the risks and opportunities created by pricing carbon to address this analytical chasm. |
| [75]   | International | Neo-classical economic theory | The use of global climate change disclosure as an educational tool may develop students’ interests in accounting for their carbon emissions decisions and activities. |
| [76]   | Non-empirical | None | If industrial society pushes for significant reductions in greenhouse gases, it will happen in part through a transformation in how utilities develop power for their customers and how their customers use it. |
| [77]   | Australia | None | Where conversion information was not available in a recognized government publication, the use of varying conversion value sources resulted in wide discrepancies in reported emissions for similar activities. This undermines the assessment quality, makes comparison of results across organizations difficult, and can lead to inappropriate carbon management strategy choices and misallocation of resources. |
| [78]   | International | None | Investment in emissions abatement within the tourism sector, combined with strategic external carbon offsets, was found to be approximately 5% more cost effective over the period 2015–2050 than exclusive reliance on offsetting. |

### 3.3.2. Quality of Carbon Disclosure (36 Studies)

The literature reviewed is increasingly delving into the natural environment and societal issues, focusing on the quality of carbon and climate change disclosure. In addition, attention has been focused on standalone reports released by firms. However, a question remains: Does less information disclosed by firms mean that information low quality? Environmental disclosure by firms in most countries is still limited when comparing current disclosure practices and anticipated disclosure practices by various stakeholders; these countries include Brazil [43], Bangladesh [10], Malaysia [1], and Australia [5]. Hoştut and Hof [31] argued that a lack of information does not imply that the reports are of poor quality. In Australia, Comyns [8] found that large firms do not have better-quality reports but publish more GHG emissions data.
As shown in Table 4, there is literature exploring the interrelationship between environmental disclosure and performance. It was found that environmental performance, as evaluated by CO$_2$ emissions, is not linked to environmental disclosure across the firms in our sample [79]. Additionally, prior studies have confirmed that disclosure quality varies significantly between counties, sectors, and firm types. In line with legitimacy theory, for example, Hassan and Guo [80] found that firms in carbon-intensive industries utilize standalone environmental reports to portray themselves as a good corporate citizen, even when they are not, and these firms have a tendency to provide more environmental data in standalone reports than companies that include both financial and environmental disclosure in their annual reports. In addition, businesses in countries with a strong commitment to the environment and carbon emissions trading are more likely to disclose detailed environmental data [79].

Despite the fact that companies are disclosing information about climate risks, the level of disclosure remains low [43]. It has been suggested that the lack of regulations and an attitude of low social responsibility between corporations lead to a very low degree of climate change reporting [10]. Despite this low level of disclosure, firms can and do use linguistic tactics to influence environmental ratings [81]. Similarly, Nik Ahmad and Hossain [41] argued that much of the conversation is rhetorical and can be seen as business efforts to consider the climate change issues in conjunction with a goal to appear legitimate and control perceptions.

Table 4. Sample of studies on climate change and carbon disclosure quality.

| Author  | Country  | Theory                                | Findings                                                                                                                                                                                                 |
|---------|----------|---------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| [4]     | Canada   | Legitimacy and signaling theories      | Energy and mining companies increased their quantity and quality of long-term value creation disclosure in 2014 as compared to 2012. Even though increases in disclosure quality could be observed, overall disclosure quality was still at a low level. |
| [29]    | International | Stakeholder and legitimacy theories       | Between 1998 and 2010, the quality of GHG reporting did not dramatically improve. The quality of reporting varies throughout the seven quality aspects, which can be discussed by information typology. |
| [30]    | International | None                           | In the hotel business, carbon footprint reporting is sparse, and even large enterprises’ assessments are vague, unreliable, and incomparable.                                                               |
| [43]    | Brazil   | Legitimacy theory                      | Although Brazilian companies tend to disclose information on climate risks, the level of this type of disclosure remains relatively low.                                                                   |
| [59]    | Japan    | Capital market theory                  | The emissions reporting formats can be standardized by extensible Business Markup Language, and this allows the emissions reports and the financial reports to be combined                                            |
| [61]    | The UK   | Risk society theory                    | Private climate change reporting is dominated by a discourse of risk and risk management. This emerging risk discourse derives from institutional investors’ belief that climate change represents a material risk, that it is the most salient sustainability issue, and that their clients require them to manage climate change-related risk within their portfolio investment. |
| [63]    | International | None                           | Reducing carbon emissions positively affects the financial performance of firms                                                                                                                        |
3.3.3. The Antecedent of Carbon Disclosure (39 Studies)

Environmental reporting, despite its complexity, is gradually becoming a critical concern. Although environmental disclosure is of the highest priority, organizations’ carbon and climate change disclosure practices are still limited in most countries. It has been suggested that companies from various sectors globally must engage in this environmental issue, as must government and organization contributions. Therefore, it becomes vital for firms to better understand the demographic, cognitive, organizational, contextual, and financial factors of carbon disclosure in different countries and sectors [20,36,89].

As shown in Table 5, the literature has evaluated a few antecedent factors of carbon and climate change disclosure, including governmental guidance [8,58], GHG emissions [90], institutional investors [46], award variables [47], firm size [20,21,23], government ownership [5,23], firm age [23], market capitalization [22], industry type [5,20], leverage [21].

Table 4. Cont.

| Author | Country       | Theory                                      | Findings                                                                                                                                                                                                 |
|--------|---------------|---------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| [79]   | 35 countries  | Legitimacy theory                            | Firms in countries with a high commitment towards the environment and a carbon emissions trading scheme (measures of social concern for environmental protection and emissions) are likely to disclose more comprehensive environmental information. In addition, we find that firm size, age of the assets, listing status, and media exposure influence disclosure. |
| [82]   | Spain         | None                                        | Incorporating carbon footprint into Green Public Procurement can operate as a powerful catalyst for eco-innovation.                                                                                         |
| [83]   | China         | None                                        | The results indicate that the CO$_2$ emissions in China for the year 2005, which the Second National Communication reported, are more reliable than the rest of the years. |
| [84]   | The USA       | Stakeholder, voluntary disclosure, and legitimacy theories | When comparing 2010 to 2008, there is a statistically significant rise in climate change information sharing, but no such effect when comparing 2010 to 2009. In 2009, compared to 2008, there was a significant rise in transparency. |
| [85]   | Seven countries | Stakeholder theory                      | Businesses gain advantages from the measurement and disclosure process are more varied than anticipated. They might be internal or external, and they can be operational or strategic. |
| [86]   | The UK        | Stakeholder theory                          | Investors need to be able to draw meaningful comparisons between firms, and firms reporting on climate change falls far short of that. As a result, investor interest in these data has dwindled. |
| [87]   | International | Legitimacy theory                           | In exposing the high incidence of non-compliance in GRI reporting and the use of impression management strategies by companies, this study shows that it will be difficult or impossible for stakeholders to reasonably assess, monitor, and compare companies’ climate performance on the basis of these reports. |
| [88]   | The USA       | None                                        | Potentially material and highly differentiated financial impacts. For many companies, the minimized compliance costs of a four-pollutant cap-and-trade regulatory regime would be less than those of a three-pollutant regime that omitted controls on carbon dioxide emissions. Fragmented regulatory requirements would have the highest compliance costs. |
systematic risk [21], board size [58], ownership concentration [58], and director ownership [58].

Table 5. Sample of studies on the determinants of climate change and carbon disclosure.

| Author | Country | Theory | Findings |
|--------|---------|--------|----------|
| [5]    | Italy   | Legitimacy, stakeholder, and agency theories | There is a positive effect on environmental disclosure related to government shareholdings in firms’ ownership structures, business industries, and size. |
| [20]   | China   | Legitimacy theory | Larger companies operating in an industry that has higher levels of carbon dioxide emissions tend to have higher levels of greenhouse gas disclosures, consistent with the expectation of legitimacy theory. However, profitability and overseas listing were not significantly related to greenhouse gas reporting. |
| [22]   | USA, Australia, Canada, and Europe | Proprietary costs, stakeholder or legitimacy theories | In addition to planned Global Reporting Initiative (GRI) indicators on GHG emissions, there is a direct relationship between corporation size, market capitalization, and information disclosure. There is an inverse link between ROE and disclosure. |
| [36]   | Turkey  | Political cost and legitimacy theories | Profitability, listing status, bank size, and age all have a significant and favorable impact on the level of climate change disclosure. |
| [37]   | Bangladesh | Signaling and legitimacy theories | Large companies are reporting on more climate change issues than others because of their legitimized positions in the market. Again, a lack of regulation and a culture of low social accountability among the companies contribute to a very low level of disclosure on climate change. Surprisingly, multinationals are not providing satisfactory disclosure. |
| [46]   | International | Stakeholder, legitimacy, agency theories | The evidence presented in this chapter suggests that institutional investor coalitions have had a global influence on the scope and content of the climate change disclosures of large businesses. |
| [47]   | Malaysia | Stakeholder, legitimacy theories | The award factor has a noteworthy positive link with the quantity and quality of Malaysian companies’ CSR disclosure procedures. |
| [48]   | The UK   | Stakeholder and legitimacy theories | The level of environmental disclosure and the consequent possibility of receiving an award is influenced by industry membership; the extent of environmental information disclosure is not the same in all industries. No evidence was found to support the influence of disclosure on formal or external assurance and some specific environmental activities. |
| [58]   | The UK   | Stakeholder, agency theories | The publishing of the 2009 guidance substantially impacts GHG disclosure and governance practices (number of boards, director ownership, and ownership concentration) also impact the scope of GHG disclosure. |
| [64]   | Canada   | Critical mass, agency, stakeholder theories | A higher percentage of women on boards increases the likelihood of voluntary climate change disclosure in line with critical mass theory. |
| [89]   | Malaysia | Agency, signaling, and stakeholder theories | The study concludes that there is a link between the analyzed board governance factors and the quality of sustainability reporting. |
Table 5. Cont.

| Author | Country | Theory | Findings |
|--------|---------|--------|----------|
| [90]   | The USA | Voluntary disclosure, stakeholder, and legitimacy theories | There is a direct relationship between the amount of GHG emissions and the extensiveness of climate change disclosure. |
| [91]   | Malaysia | Resources dependency and agency theories | The findings show that the presence of women (Malays) on boards positively impacts dividend yield (dividend payout), with this effect being conditional on the level of free cash flows generated by firms. |
| [92]   | Australia | Stakeholder theory | Per the article, more stringent governance frameworks and management systems are anticipated to emerge around GHG reporting given the recent introduction of the carbon pricing mechanism and its nexus to companies’ financial performance. |
| [93]   | The UK | Legitimacy, signaling, and agency theories | Internal governance, capital outlay, and carbon emission disclosure all have an advantageous association. |
| [94]   | Australia | Legitimacy theory | Larger, more visible companies are more likely to provide their carbon disclosure in greater detail. |
| [95]   | India | Critical mass and board capital theories | Companies with at least three female directors tend to disclose more information. |
| [96]   | International | Stakeholder theory | Carbon disclosure has an impact on all stakeholders. For the link between carbon performance and carbon disclosure, just one stakeholder group (government) functions as a moderator. |
| [97]   | The USA | None | Participants in the program engage in highly selective reporting: in the aggregate, they increase emissions over time but report reductions. |
| [98]   | Australia | Institutional theory | Companies with multiple female directors make GHG emissions-related disclosures that are of higher quality. |

By reviewing the literature, it was found that there is no academic consensus about the effect of some factors. For example, Chu et al. [20] reported that profitability does not influence the quality and quantity of environmental disclosure, while other scholars [21,22] reported an inverse relationship between profitability and disclosure level. Similarly, mixed findings were reported for industry type [5,20,23], government ownership [20,23], and capital structure [21,23]. Additionally, other studies have not found carbon disclosure to be affected by factors such as audit firm size [23], overseas listing [20], media visibility [8], and multinational firms [37].

3.3.4. Consequences of Carbon Disclosure (25 Studies)

In recent years, there has been a strong urge for firms to publish more environmental- and carbon-related information to the public as firm performance and valuation are no longer measured by the financial bottom line alone. Hence, commitment has become a significant strategic concern for all corporations, as improving environmental disclosure and effective communication has the ability to benefit a wide range of stakeholders.

The literature on carbon disclosure suggests that efficient reporting is favored by both customers and shareholders, especially in firms with good environmental performance [66]. However, there is no academic consensus on whether carbon disclosure is beneficial for organizations. Carbon emission disclosure is found to exert a positive effect on firm value, and the industrial type and environmental presentation can toughen the influence relationship of carbon emission disclosure on firm value [42,99] while this relationship is reported to be mixed (positive and negative) by Ganda [34] based on the performance measure used. In addition, Alsaifi et al. [62] reported that investors react negatively to carbon disclosure
announcements made by FTSE 350 corporations through the Carbon Disclosure Project (CDP). Other studies [100] argued that the disclosure of carbon emissions has no direct impact on the value of a firm, and other factors could influence this association. This inconsistency is similar to prior studies on the GHG emissions and firm value, which were found to have a negative [49,101,102], non-linear [103], and insignificant relationship [104]. Given that the association between carbon disclosure and performance depends on performance indicators applied in studies, comparison between accounting-based and market-based measures remains the focus of future research or other corporate performance measures, which include operational, market, product, customer, and internal dimensions [4,34]. In addition, no study has investigated the specific reporting on long-term value creation. Interestingly, it was found that existing studies neglected the non-financial consequences of carbon disclosure, such as (but not limited to) firm reputation, competitive advantage, financial constraints, and growth [16,105]. Table 6 elaborates a summary of the outcomes of the carbon disclosure consequences.

Table 6. Sample of studies on the outcome of climate change and carbon disclosure.

| Author | Country | Theory | Findings |
|--------|---------|--------|----------|
| [34]   | South Africa | Legitimacy theory | Carbon emission disclosure generates a positive relationship with ROA but a negative association with market-based indicators. |
| [42]   | Indonesia | Legitimacy, Signaling, and stakeholder theories | Carbon emission disclosure has a positive and significant effect on firm value as carbon emission disclosure is a form of corporate concern for the environment positively responded by the market and becomes the basis for investors to make their considerations in assessing the company’s sustainability. |
| [49]   | Canada | Signaling theory | GHG emissions and firm value have a negative relationship. |
| [53]   | The UK | Institutional and stakeholder theories | No relationship between carbon emission disclosure and the disclosure of SDGs. |
| [66]   | France | Stakeholder theory | Shareholders interpret and perceive firms’ environmental information disclosure differently than consumers. |
| [99]   | The USA | None | Information had an economically important and statistically significant impact on capital market returns. Poorly rated firms suffered market penalties. In contrast, we find limited benefits for firms receiving good ratings. |
| [100]  | Indonesia | Stakeholder, signaling, and legitimacy theories | The impact of carbon emission disclosure and excellent corporate governance on firm value is mediated by financial performance. |
| [102]  | India | Institutional theory | Carbon emissions results in a detrimental effect on a company’s earnings per share. |
| [104]  | International | Legitimacy theory | Only for Return on assets (ROA) 2007 is CO₂ emission variation a statistically significant but negative variable; for the other years, it is not statistically significant for either ROE or ROA. |
| [101]  | Australia | Signaling theory | The amount of direct emissions is inversely proportional to the market value of a company. When companies are divided into groups based on whether they give voluntary carbon information in regard to their mandated disclosures, groups with low disclosure scores and groups with poor carbon management performance show detrimental consequences of direct emissions. |
Table 6. Cont.

| Author | Country       | Theory                        | Findings                                                                                                                                                                                                 |
|--------|---------------|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| [103]  | The UK        | Economic theory               | This study shows that there is a non-linear link that increases with company success at first and later decreases. Despite popular and policy-driven environmental imperatives over this time period—as well as rising evidence of the corporate added-value of having an “environmental conscience”—firms have been sluggish to adopt voluntary emissions disclosure. |
| [106]  | The UK        | Resource-based view theory     | Voluntary carbon disclosure is positively associated with firm financial performance.                                                                                                                                                                          |
| [107]  | Europe        | Legitimacy, signaling, and stakeholder theories | For enterprises subject to the EU Emissions Trading Scheme’s regulations, increased exposure to physical risks is related to lesser information asymmetry, whereas, for other firms, the relationship flips.                                                                 |
| [108]  | 34 Countries  | Agency and legitimacy theories | Extensive carbon disclosure mitigates the penalty associated with a greater cost of equity capital.                                                                                                                                                      |
| [109]  | Malaysia      | Signaling theory              | ROA and earnings per share (EPS) are negatively impacted by voluntary carbon reporting, although return on equity and Tobin’s Q are unaffected.                                                                                                               |
| [110]  | Europe        | Chaos theory                  | Carbon disclosure proves the presence of structural breakpoints, namely, the influence of the CDP reporting on stock prices and internet search trends of the tested enterprises for specified time periods.                                                  |
| [111]  | The USA       | None                          | A new metric, Environmental Capability Enhancing Asset (ECEA), is introduced as the underpinning for the conversion of non-monetary CO2 emission and sequestration measures to monetary values.                                                             |
| [112]  | Netherlands   | None                          | The main conclusion is that the current target-setting process in the CO2 Performance Ladder did not necessarily lead to the establishment of the most ambitious goals for CO2 emission reduction. Other approaches for setting target levels, such as minimum performance levels, must be considered to maintain the CO2 Performance Ladder as a valid tool for green public procurement. |
| [113]  | Australia     | Modern banking theory         | The results suggest that investors perceive that banks incorporate carbon risk considerations into their lending decisions.                                                                                                                                 |

3.3.5. Carbon Accounting (9 Studies)

Carbon management accounting is a set of data management tools that aid in the decision-making process for carbon projects that adhere to the concept of sustainability. The process of detecting, assessing, and monitoring GHG emissions at all levels of the value chain and detecting, assessing, and monitoring emissions on the ecosystem’s carbon cycle is known as carbon management accounting. Carbon management accounting is a subset of carbon accounting that includes the processes and procedures that enable the implementation of carbon reduction operations. The limited studies on carbon accounting have discussed the carbon accounting process [114], accounting approaches [115–117], uncertainty in carbon management [39,117], and carbon permits and environmental reporting [118]. It has been found that there is still a diversity of approaches with regard to how firms report emission rights [115]. Hence, there is a lack of uniformity, and thus comparability, in GHG emissions reported [114]. Therefore, information regarding a company’s GHG emissions could cause people to believe it has fewer regulatory costs or regulation risks than it actually has [114]. Furthermore, inter-organizational and intra-organizational
agreements are also possible, as carbon management strategies and procedures can help to improve GHG emissions performance [119].

However, to have a better understanding of the technical issues behind the convergence of several carbon accounting methods, more research is needed, especially data from different sectors, and a comparison of experience may reveal additional practical implementation issues and ways for overcoming these challenges [32,116].

3.3.6. Assurance of Carbon Disclosure (5 Studies)

The assurance process may push firms to create and publish more trustworthy and accurate information and enhance companies’ environmental commitments. There are limited studies on the assurance of carbon and climate change disclosure. The literature on the environment argues that firms do not choose to assure their environmental actions, as the assurance service are costly, or there is a notion that it does not add value to the reports. It has been found that firms which report environmental information are likely to have guaranteed sustainability [120]. Several fundamental distinctions between financial and carbon auditing must be taken into account as businesses determine how to best support increasingly essential sustainability reporting [121]. In Bangladesh, non-carbon firms tend to have their CSR disclosure assured [6]. In addition, Hassan and Ibrahim [48] did not find a link between disclosure and formal or external assurance.

3.3.7. Paris Agreement (5 Studies)

At the 21st Conference in Paris, France, in December 2015, the Paris Agreement was arranged by 196 Parties to the United Nations Framework Convention on Climate Change (UNFCCC) in December 2015. This agreement represents a critical moment in national and international climate change policy. It has a total of 21 legally enforceable articles, the first of which establishes each country’s longstanding mitigation of climate change and adaptation goals. States have committed, among other things, to significantly decrease global warming to 2 °C over pre-industrial levels by limiting their GHG emissions. Not just national states but also non-state entities, such as municipalities and major businesses, will be critical in attaining this level of GHG reductions. The Paris Agreement introduced novel approaches to addressing nations’ obligations for climate change, incorporating subtle differentiation of specified groups of countries (i.e., Least Developed Countries) for certain substantive concerns (i.e., climate financing) and certain processes (i.e., timelines and disclosure). However, the agreement may be problematic since, under customary international law, governments are solely liable for the conduct and omissions of their official institutions. As a result, governments, as the primary parties obligated, make agreements that will be more or less effective based on the active participation of a number of non-state players. In general, the successful implementation of the Paris Agreement is critical for the global community’s long-term development, and it will play a critical role in attaining the United Nations’ Sustainable Development Goals, which were established in 2016. The literature reported that since the introduction of the agreement, it is not consistent in the case of support (capacity building, transfer of technology, and climate finance) but is consistent in mitigation and adaptation [122]. Overcoming the free-rider dilemma in carbon emissions is central to a successful extensive international climate-change agreement [123]. One significant issue of such voluntary initiatives is ensuring adherence to agreed-upon obligations while eliminating selective or greenwashing reporting. Certain organizational arrangements are unavoidable, such as verification systems and independent monitoring and measuring [7].

4. Discussion and Future Research Agenda

Carbon emissions are reaching alarming levels, and more academic attention has been paid to carbon performance and disclosure in recent years. In this study, we critically reviewed all studies on carbon and climate change disclosure following a systematic methodology.
4.1. Determinants of Carbon Disclosure

It was found that there is no academic consensus on the drivers of carbon disclosure, including firm profitability, ownership structure, and capital structure. For example, Chu et al. [20] revealed that profitability does not affect the quality and quantity of environmental disclosure, while other scholars [21,22] reported an inverse relationship between profitability and disclosure level. This inconsistency could be attributed to several factors that future research needs to address in further work, such as small sample size [1,5,36], sample unit of large firms [1,80,101], sample period [104], statistical research methods [43,89], and the data source being secondary data only [20,58]. We, therefore, encourage future research to address these issues. Future work could also look beyond the direct impact of such determinants and consider relevant moderating/mediating factors to better explain carbon disclosure determinants’ complex nature.

In addition, several determinants of carbon disclosure have yet to be investigated. For instance, ownership structure has been investigated in four studies with a focus on government ownership [5,23], director ownership [58], and ownership concentration [58]. However, other ownership facets have not been considered, such as foreign, institutional, multinational, family, and managerial ownership (for more insight into the corporate disclosure drivers, see Zamil et al. [16]. It should be noted that there are fewer studies investigating contextual factors (governance attributes, top management, and audit characteristics) that affect the quality of carbon disclosure. Further research might focus on developing countries, small businesses, and various industries and employ primary data to uncover better evidence of the motivations for reporting or non-reporting GHG emissions information. Sciulli [124] suggested that great attention has been dedicated to the corporate sector’s role and scope of sustainability reporting; however, less research has been conducted in the government sector.

4.2. Methodological Issues

In terms of data collection, future studies should use a variety of research approaches (for example, content analysis, interview/questionnaire, or longitudinal studies) to determine the temporal effect of carbon disclosure studies [34,47,53,70,80]. We also call for studies to use or compare the other avenues of disclosure, such as press releases and websites. Compulsory disclosure regulations may alter reporting behavior in newer media settings, as most research has depended on yearly and sustainability reports [36,58,71].

Moreover, to enrich the climate change and carbon reporting literature, future research might look into the differences that may exist between small and large businesses, as tiny companies may have different reasoning for where and how they release environmental data. In addition, it has been suggested that comparison between different sectors (industrial, financial, transportation, etc.), firm types (small, medium-sized firms, multinational, private, public, etc.), and countries (developing and developed) are promising areas for future empirical research [1,29,34,100]. Different companies have different motives for commencing reporting on company-related environmental issues and performance data. It has also been commonly held that industrial sectors show significant variability in the type and level of environmental activity reporting [79,80,125]. These studies found that companies from carbon-intensive industries disclose more social and environmental information than those from non-carbon intensive industries. Furthermore, there is a difference in the reporting behavior between headquarters and subsidiaries as subsidiaries are located in developing countries, while headquarters are sited in developed countries, which is subject to different disclosure regulations. Consequently, climate change constitutes different challenges for different industries, and hence, different (symbolic) responses might be developed reflecting the stance of the industry [9].

4.3. Carbon Disclosure Quality

After reviewing the literature, some questions remain unanswered. For example, does less information disclosed by firms mean low quality? Environmental disclosure
by firms in most countries is still limited compared to various stakeholders’ actual and expected disclosure procedures. In Australia, Comyns [8] found that larger companies do not report to a higher standard but provide more information about their GHG emissions. Additionally, will standardizing the format of environmental and sustainability increase the quality and quantity of the information disclosed? To what extent does the information provided represent the truth of the facts stated? Furthermore, how are externally disclosed data used internally? How does climate governance affect carbon disclosure? Bui et al. [126] argued that the association between climate governance and carbon disclosure is not clear.

5. Concluding Remarks

The accounting literature is increasingly delving into society and the natural environment issues, focusing on the quality of carbon and climate change disclosure due to firms’ industrial activities, stressing the need to balance corporate social, economic, and environmental performance. Despite alarming carbon emission levels, disclosure of climate change- and carbon-related information is still at a low level. This study systematically assesses the state of research on carbon disclosure published on the Scopus database. A comprehensive search was conducted using twelve carbon and climate change reporting keywords. We have identified a final sample of 168 research articles related to this topic that were published between 2002 and 2020. The growing academic interest in this issue could be attributed to the understanding that the current cost of adopting organizational action is insignificant compared to the future costs of economic and social disturbance caused by environmental degradation and unabated climate change.

It was found that the sample literature has focused on the following main approaches, namely, climate change management and strategy, carbon disclosure quality, antecedent of carbon disclosure, determinants of carbon disclosure, carbon accounting, carbon disclosure assurance, and the Paris agreement. Our study provides an essential perspective to the literature on the direction of current research on carbon disclosure, a topic of increasing importance at the current stage and receiving increasing interest from various stakeholders. Furthermore, previous literature has expanded research on corporate environmental-related issues. Thus, we systematically approached the topic of carbon disclosure to identify shortcomings in the current literature and encourage scientists to fill the gaps in the future. This research is unique because it provides additional incentives and recommendations for future research to fill the gaps in the studies analyzed. We presented an up-to-date assessment of the research landscape on the subject of carbon disclosure, providing valuable observations and future research proposals.

Our study has some limitations. First, relevant knowledge may come from studies not included in the selected list, as this study focused on the studies that explicitly examined carbon disclosure. Second, a more extensive review study can be conducted, considering multiple databases and the Web of Science and Scopus databases or comparing the carbon disclosure literature between different markets. Finally, future research could focus on specific aspects of GHG emissions and carbon-related topics such as carbon footprint, carbon reporting assurance, and environmental governance.

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