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Corporate Governance and Carbon Emissions: A Review of the Existing Literature

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ABSTRACT

This study systematically examines the extant literature pertaining to corporate governance and sustainability through bibliographic analysis, utilizing keyword co-occurrence and co-citation networks as methodological frameworks. A total of 1984 individual publications were meticulously selected from the Lens Database, which explicitly addresses both the themes of "Corporate Governance" and "Carbon Emissions," with publication dates ranging from 2004 to 2024. This investigation functions as a preliminary framework for future analyses aimed at achieving a more comprehensive understanding of the research landscape associated with corporate governance and sustainability.

Keywords- Corporate Governance, Carbon Emissions, Bibliometric Analysis, Lens Database, Keyword Co-Occurrence, Co-Citation

INTRODUCTION

Corporate governance (CG) represents a structured framework of regulations and organizational constructs that facilitate the effective operation of business activities, which are understood as a reconciliation of the often-divergent interests of stakeholders (Du Plessis et al. 2018). CG encompasses a diverse array of domains within an organization. It may relate to an extensive compilation of activities and regulations formulated to ensure that corporations comply with established codes, as well as to the mechanisms through which corporations are directed and monitored; these regulations encompass both the legal frameworks of the jurisdiction in which the corporation operates and the internal procedural standards of the organization (Scherer et al. 2016).Consequently, the notion of a corporation's CG incorporates all the regulations and procedures that govern decision-making; it also delineates the strategies required to fulfil corporate objectives and, by extension, the methodologies for accomplishing these objectives as well as the evaluation of the outcomes attained.

Traditionally, the notion of corporate governance has been interpreted as a structural apparatus designed to protect shareholder investments from the exploitative tendencies of self-serving managers (Roberts and Van den Steen, 2000). However, in modern discussions, the concept of governance has progressively transformed to include a wider range of supervision over corporate conduct, which encompasses the implications for society and the environment(Naciti et al., 2022). This additional aspect related to corporate sustainability often arises in response to the expectations of stakeholders. Indeed, sustainability is increasingly acknowledged as an essential and crucial component of the strategic paradigms embraced by corporations (Iansiti and Levien, 2004), as well as of the relationships they develop with various partners throughout the value chain(Naciti et al., 2022).

Companies fundamentally address these by adopting strategies that enhance environmental performance and mitigate the impact of greenhouse gas emissions (Hoffman, 2000). The release of greenhouse gases (GHGs) alongside the over-reliance on carbon-centric energy sources represents a paramount challenge that threatens the stability and viability of businesses and economies on a global scale in the present-day context (Hatakeda et al., 2012; Hoffmann and Busch, 2008). The legitimacy derived from managing greenhouse gas emissions reduces liability exposure, enhances corporate reputation, optimizes resource utilization, and improves relationships with stakeholders (Bansal, 2005; Russo and Fouts, 1997; Shrivastava, 1995a). As a result, firms are pivotal in addressing these GHG-related challenges, particularly in managing emissions produced as by-products from extensive raw material processing and leveraging technological innovation (Hoffmann and Busch, 2008). Furthermore, the global shift towards achieving net-zero GHG emissions necessitates that corporations formulate distinctive strategies, mechanisms, and capabilities to facilitate this transition. The research conducted by He et al. (2021) indicates that carbon management and accounting are emerging as a specialized framework in response to the escalating levels of carbon emissions on a global scale.

The concurrent development of the notions of corporate governance (CG) and carbon emissions has been systematically examined in extant literature, which has scrutinized the principal elements at the confluence of these two domains. Nonetheless, these investigations frequently appear disjointed, and an all-encompassing theoretical framework that delineates the shared conceptual foundations, elucidates the interconnections among the various components, and proposes avenues for future inquiry is conspicuously absent. As a result, the objective of this paper is to clarify the progression of scholarly discourse surrounding corporate governance that emphasizes the mitigation of carbon emissions and to propose a conceptual framework that may act as a fundamental reference for future investigative pursuits within this domain.

In alignment with the methodological framework established by Van Eck and Waltman (2017), this manuscript employs text mining methodologies in conjunction with co-citation-based clustering analysis of academic literature covering the last two decades, specifically from 2005 to 2024. This rigorous analytical strategy elucidates the fundamental theoretical constructs of the domain under scrutiny, namely, corporate governance (CG) and carbon emissions, by elucidating the nature and strength of the interrelations that exist between these constructs, thereby revealing the diverse trajectories that researchers have historically pursued to associate CG with carbon emissions. Drawing upon the findings derived from this analytical framework, this paper subsequently posits potential theoretical advancements that warrant exploration in forthcoming academic inquiries.

The paper is structured in the following manner: Section 2 delineates the criteria utilized for the identification of historical publications pertaining to corporate governance and carbon emissions, along with the three analytical methodologies implemented for their examination. Section 3 articulates the findings derived from the analysis. Section 4 presents a concise examination of the historical evolution of the three primary clusters delineated in the prior section. Ultimately, Section 5 evaluates the ramifications of the findings and articulates conclusions(Naciti et al., 2022)

METHODOLOGY

2.1 Criteria used to draw the relevant literature

Prior academic publications investigating the interrelationship between corporate governance and carbon emissions have been extracted from the primary repository of the Lens Database, which serves as an open-source, comprehensive, and interdisciplinary bibliographic resource encompassing articles derived from journals, books, and conference proceedings(Naciti et al., 2022). The methodology applied for publication retrieval involved the utilization of the query “TS= (“Corporate Governance” AND “Carbon Emissions”)”, wherein TS denotes the "topic" of the respective publication. Our analysis was restricted to items disseminated within the temporal framework of 2003 to 2023, as the Web of Science indicates that the initial publication concerning the specified subject matter emerged in 2003. Furthermore, we constrained the focus of our investigation exclusively to texts published in the English language. As a result, the ensuing dataset consists of a total of 468 publications. This criterion for sample selection was employed in alignment with prior literature (Testa et al. 2020; Lazzeretti et al. 2017; Trujillo and Long 2018).

2.2 Analytical techniques employed for the purpose of clustering.

In this study, we employed the methodology delineated by Waltman et al. (2010), which is designated as the 'unified approach' for the cartography and clustering of bibliometric networks. This methodology serves as a foundation for the examination, clustering, and visualization of extensive bibliometric datasets. We utilized the Vos Viewer software (version 1.6.20), which integrates the 'unified approach' for the purposes of analysis and visualization(Naciti et al., 2022).

2.2.1 Keyword clustering

One of the fundamental aims of our research is to identify the key themes pertaining to specific keywords that have been extensively cited in the academic dialogue concerning Corporate Governance (CG) and carbon emissions, along with an examination of their interrelations. In other words, the prominence of themes within scholarly literature and their co-occurrence patterns elucidates the importance of these themes and the degree of the connections between them Waltman et al. (2010). The importance of themes and the degree of their interconnections can be represented as a network in which the former is depicted by the size of the nodes (circles), while the latter is illustrated by the thickness of the connecting lines(Naciti et al., 2022). In this paper, the importance of a keyword is operationally defined as the number of publications (' items' henceforth) that include the keyword(Naciti et al., 2022). The degree of interconnection between two keywords, designated as i and j, is measured by the number of items that contain both keywords in their titles, abstracts, or keyword listings. We will denote the frequency of co-occurrence for keywords i and j as cij (Waltman et al., (2010),

"Various approaches to cluster networks can be applied to bibliometric analyses. The 'unified approach' uses both the distance and strength of association between nodes as the basis for clustering, where the following term is minimized"(Naciti et al., 2022):

$$V(x_1, \ldots, x_n) = \sum_{i<j} s_{ij} d_{ij}^2 - \sum_{i<j} d_{ij} \quad (1)$$

where sij denotes the strength of association between keywords i and j are calculated

by

$$s_{ij} = \frac{2mc_{ij}}{c_i c_j} \quad (2)$$

where ci is the total number of co-occurrences of keyword i with all other keywords

such that:

$$c_i = \sum_{j \neq i} c_{ij} \quad (3)$$

whereas m denotes the total number of co-occurrences for all keywords such that:

$$m = \frac{1}{2} \sum_i c_i \quad (4)$$

Note that ½ in the equation removes the double counting between cij and cji.

Finally, dij is:

$$d_{ij} = \begin{cases} 0 & \text{if } x_i = x_j \\ 1/\gamma & \text{if } x_i \neq x_j \end{cases} \quad (5)$$

where γ is the resolution parameter, an arbitrary positive integer that determines the number of clusters to be obtained" (Naciti et al., 2022),(Van Eck and Waltman 2007; Van Eck et al.,2010).

2.2.2 Chronological analysis

"Another pivotal inquiry that our research endeavours to address is the extent to which the frequency of keywords in the selected literature has evolved over time. A chronological examination of keywords revealed the weighted mean of the years in which items incorporating a specific keyword were present. The mean year of occurrence for a particular keyword i is determined by

$$y_i = \frac{\sum_t (n_{it} t)}{\sum_t n_{it}} \quad (6)$$

where nit signifies the quantity of instances in which keyword i appears in year t (t= 2004, 2005, …, 2024). In a well-established domain devoid of substantial fluctuations in the literature's volume, the mean year of keyword occurrence is generally inclined to cluster around the median of the temporal range from which the literature is extracted. Conversely, in a domain exhibiting an ascending trajectory in the literature's volume, the average year of occurrence is inclined to skew towards more contemporary years” (Naciti et al., 2022).

2.2.3 Co-citation network clustering

Lastly, we examined the most frequently referenced items and their associated journals within the corpus of literature pertaining to corporate governance and carbon emissions, along with an analysis of their co-occurrence network(Naciti et al., 2022). The co-citation network was subsequently categorized using the methodology described in Section 2.2.1(Naciti et al., 2022). All mathematical formulations employed in Section 2.2.1 are applicable to the clustering of co-citation networks; however, the variable under consideration in this context pertains to the citations found in references within the literature, rather than keywords. Consequently, in this scenario, clusters are constituted by ensembles of publications that have been cited (backward references) by the sampled items. In other words, in contrast to the keyword clustering methodology delineated previously, the co-citation clustering technique examines the theoretical underpinnings of the sampled publications and attempts to ascertain which theoretical foundations have been invoked by these sampled publications to address the subjects of corporate governance and sustainability(Naciti et al., 2022)

RESULTS

Utilizing the parameters established in Section 2.1, we effectively obtained an extensive aggregate of 1984 scholarly works, which comprises 1973 journal articles and 11 conference proceedings. Approximately 80 percent of these works have been published within the preceding three-year period. Collectively, these works garnered an impressive total of 48966 citations by the year 2024, resulting in an average citation rate of 24.68 citations per work (see Fig. 1). The principal categories within the Lens Database that encompass the majority of these works include 'Business' and 'Economics,' followed by 'Biology' and 'Political Science' (see Fig. 2).

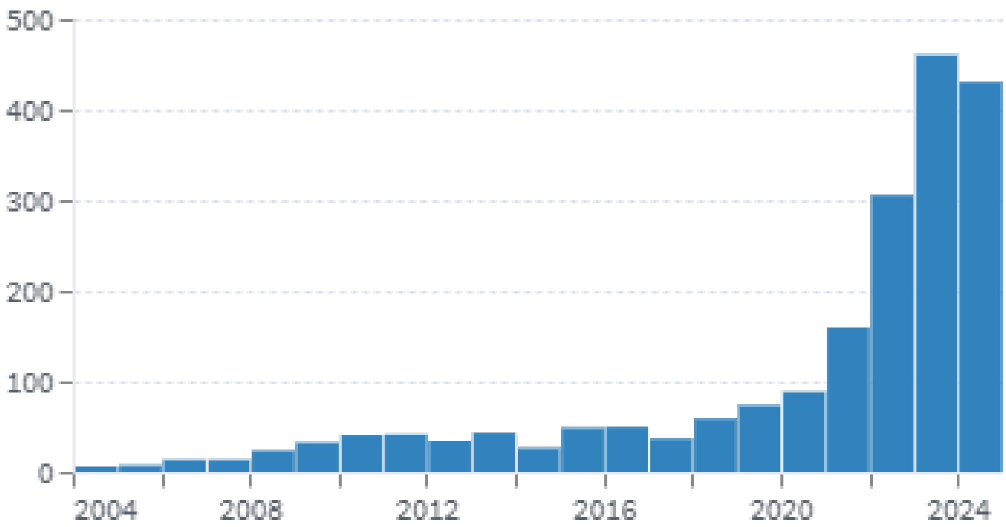

Fig 1- Year wise publications

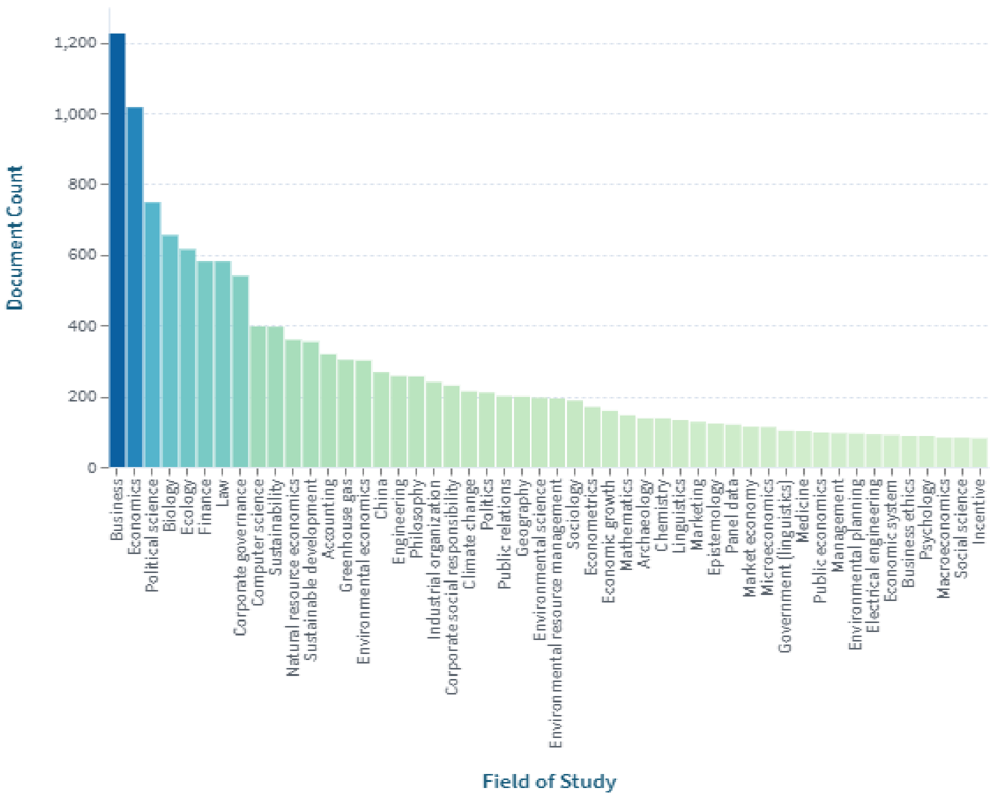

Fig 2- Lens database categories to which the 1984 articles belong

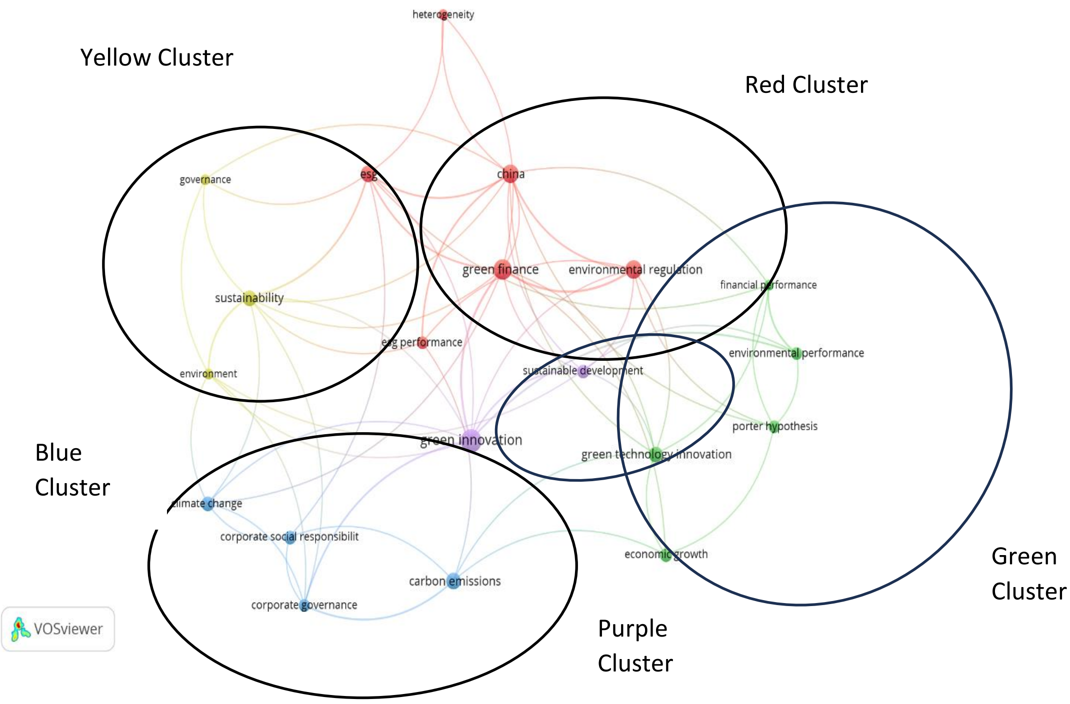

Fig 3- Keyword network clustering results

Figure 3 elucidates the results derived from the keyword co-occurrence network clustering analysis. In this illustration, 20 pertinent keywords are emphasized, having been selected from a comprehensive set of over 400 general terms (such as ‘results’ or ‘shows’) that were recorded a minimum of five times within the titles and abstracts of the 1984 publications sourced from the Lens database. The size of each circle represents the frequency of occurrence, whereas the hues signify the respective cluster affiliation of each keyword. As demonstrated in Fig. 3, the most frequently employed keywords encompass ‘Corporate Governance,’ ‘Carbon Emissions,’ and ‘Green Finance’ Waltman et al. (2010).

For the objectives of our clustering analysis, we identified five closely interrelated clusters, depicted in red, yellow, blue, and green in Figure 3. Notwithstanding the significant interconnection among these clusters and the occurrence of overlapping subjects, it remains attainable to identify their primary themes, which we have classified as ‘Green Finance’ (red), ‘Sustainability’ (yellow), ‘Financial Performance’ (green), and ‘Corporate Governance’ (blue), as well as ‘Sustainable Development’ (purple), respectively. Collectively, we discern two major structures within the network, specifically ‘Corporate Governance’ and ‘Carbon Emissions,’ whose nodes (keywords) are linked both directly and indirectly through the ‘Corporate Governance’ cluster. Conversely, the ‘Corporate Social Responsibility’ cluster demonstrates a more pronounced correlation with the ‘Carbon Emissions’ cluster.

The ensuing result articulates the weighted mean year of keyword prominence across the 432 entries (see Fig. 4). The spectrum transitioning from blue to dark green, light green, and yellow represents the mean year of keyword prominence encompassing 2022 to 2024. Given the notable increase in published entries in recent years, the average years of occurrence are restricted to four years, specifically from 2022 to 2024. Nevertheless, the transitional dynamics within this period encapsulate the evolution of themes within the corporate governance and carbon emissions literature over the last two decades.

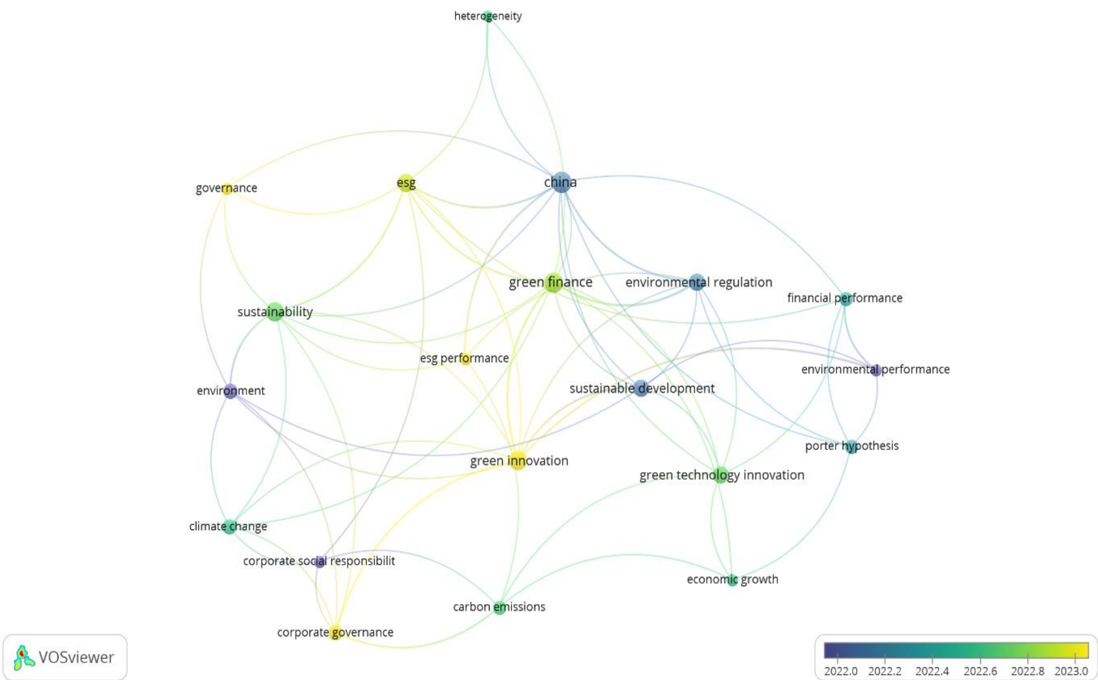

Fig 4 Chronological analysis of keywords in Overlay visualization

In conclusion, it is evident that the predominant terminologies within previous scholarly works have shifted from ‘Sustainability,’ ‘Environment,’ and ‘Climate Change’ to ‘Corporate Social Responsibility,’ ‘Corporate Governance,’ and subsequently to ‘Carbon Emissions,’ ‘Sustainable Development,’ and ‘Green Technology Innovation’ (as depicted in Fig. 4). Thus, this analytical framework clarifies how the central theme of investigation has transformed from more generalized (such as the implications of corporations on society) to more intricate aspects concerning the internal mechanisms that illuminate and drive firms’ sustainable behaviours (such as the impact of corporate governance on Carbon Emissions).

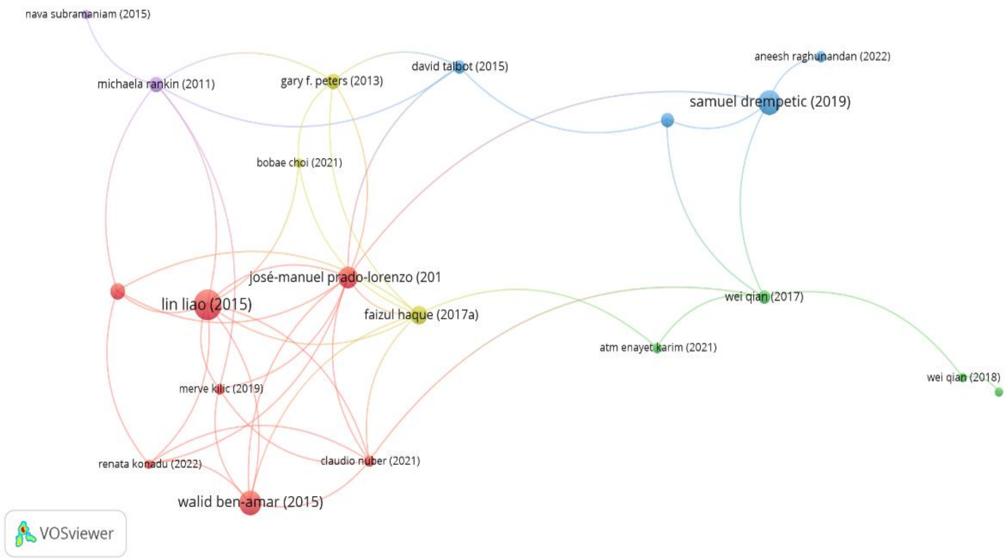

Fig 5 Result of Co Citation Network Clustering

Figure 5 illustrates the results of the clustering analysis conducted on the co-citation network, which highlights the existence of five primary clusters, represented in red, green, yellow, blue, and purple, respectively. Lin Liao (2015) is identified as the most critical node within the red cluster and is esteemed as the most extensively cited work in the overall corpus pertaining to corporate governance and sustainability literature. Similarly, Samuel Drempetic (2019) is recognized as the most prominent node within the blue cluster, accounting for the second highest citation frequency overall. Faizul Haque (2017a) is acknowledged as the leading cited publication within the yellow cluster.

Each of these clusters encompasses a diverse array of topics within the realms of corporate governance and the literature on carbon emissions, thus rendering the discernment of the principal theme of each cluster a particularly formidable endeavor. Nevertheless, it is important to emphasize that the red cluster—which is fundamentally anchored in the seminal works of Lin Liao (2015), Walid Ben Amar (2015), and Jose Manuel Prado-Lorenzo (2011)—primarily engages with the domain of corporate social responsibility. In a similar vein, it is reasonable to infer that the green cluster, which integrates Well Qian's pivotal study titled 'Revisiting carbon disclosure and performance: Legitimacy and management views' (Well Qian 2017), predominantly relates to the topic of carbon disclosure mechanisms. Finally, the purple cluster, which includes publications such as those by Micheala Rankin (2011) and Nava Subramaniam (2015), primarily comprises works that examine Corporate Social Responsibility and its related themes.

"These three classifications represent the fundamental and most significant theoretical foundations upon which the entire field of corporate governance and carbon emission disclosure is based. The first foundation (red cluster) focuses on the structure of corporate boards and the assurance of corporate social responsibility. It explains the existence of principal-agent relationships at various organizational levels, which greatly influence decision-making, strategy development and implementation, and the achievement of performance targets. These aspects are crucial to the theoretical evolution of corporate governance in a broad sense and are particularly important due to their sustainability implications. The second foundation (red cluster) primarily relates to stakeholder theory and social capital theory, which guide the formulation of corporate aims and objectives. These theoretical frameworks emphasize that businesses should not solely concentrate on economic and financial performance, as corporate actions have considerable effects on diverse stakeholder groups and society as a whole. The third theoretical foundation (blue cluster) directly engages with accounting theories that underpin sustainability reporting (such as socio-political theories of voluntary disclosure). According to these theories, sharing internal information (beyond legally required accounting disclosures) can have both positive and negative consequences for corporations. As a result, finding an appropriate balance in the trade-off between the advantages and disadvantages of disclosing sustainability-related information becomes a key concern for companies, potentially affecting their social standing and overall performance." (Waltman et al. (2010)

The relationship between the results derived from keyword clustering and those associated with co-citation clustering represents a complex undertaking, as numerous highly cited scholarly contributions illustrated within co-citation network clusters exert influence across multiple keyword clusters. Nonetheless, certain connections among these clusters can be clarified. For example, the red-hued co-citation cluster illustrated in Fig. 5, which is primarily focused on the foundational works of Lin Liao (2015), Samuel Drempetic (2019), and Faizul Haque (2017a), appears to exhibit a significant correlation with the 'Corporate Social Responsibility' keyword cluster (in red), as demonstrated in Fig. 3. In a similar vein, the green co-citation cluster depicted in Fig. 5 predominantly references the key studies conducted by David Tailbot (2015), Gary F. Peters (2013), and Bobby Choi (2021), thereby showcasing a close alignment with the

'Corporate Governance' (Yellow) and 'Carbon Emissions' (green) keyword clusters presented in Fig. 3.

A BRIEF LITERATURE REVIEW

4.1 CSR and Carbon Emissions reporting

Although the findings derived from the keyword cluster analysis indicate that the yellow and green clusters depicted in Fig. 3 should be regarded as distinctly separate entities, the subjects addressed by the two categories of publications in the corporate literature exhibit a logical interconnection and a robust relationship (Naciti et al., 2022). Moreover, the number of items within the green keyword cluster (carbon emissions reporting) is significantly lower than that within the yellow cluster (Corporate Social Responsibility). Consequently, to facilitate a more coherent interpretation of the results obtained, we chose to amalgamate the former with the latter and treat the two categories as singular, comprehensive entities, which we have designated as Corporate Social Responsibility (CSR) (Naciti et al., 2022).

The fundamental premise of Corporate Social Responsibility (CSR) revolves around the notion of accountability, specifically the capacity to convey its social obligations to a broad spectrum of stakeholders and shareholders (Demirag, 2018) in a thorough and transparent manner. The dialogue concerning social responsibility emerged in the 1960s, during which the eminent economist Friedman (1970) advocated for the doctrines of free market economics by asserting that the singular obligation of a corporation is to allocate its resources and engage in endeavours that augment profits, as long as such actions conform to the prescribed regulations of the market. Fundamentally, enterprises are authorized to partake in competition, provided they refrain from engaging in deceptive or fraudulent conduct (Friedman, 1970). Nevertheless, Friedman’s proposition, characterized by some scholars as “moral minimalism” (Freeman and Werhane 2005), has catalysed an extensive body of literature focused on business ethics that scrutinizes the scope and nature of the social responsibilities of economic actors.

In 1987, the World Commission on Environment and Development articulated the definition of sustainability, as delineated in the Brundtland report, which provided a comprehensive overview of the global environmental and developmental landscape (Brundtland et al. 1987). In subsequent years, various conferences and initiatives have emerged, notably the gathering in Rio de Janeiro in 1992, which characterized sustainability as a multifaceted concept encompassing environmental, economic, and social dimensions. This succession of recommendations and conferences, apart from elucidating the notion of sustainability, has been instrumental in raising awareness among governments and corporations regarding the necessity of undertaking affirmative actions to facilitate the advancement of developing nations, as this objective can only be realized through the confluence of sustainability and social responsibility(Naciti et al., 2022).

The initial theoretical framework that predominantly emphasized the notion of stakeholders was introduced by Freeman (1984) in the publication "Strategic Management: A stakeholder approach," which delineates what has been contemporarily termed as "stakeholder theory." Grounded in a perspective that situates the corporation within a socio-economic milieu, stakeholder theory facilitates a realignment of organizational goals and objectives to accommodate the anticipations of the corporation's most significant stakeholders (Freeman 1984). Indeed, a corporation should be regarded as an economic and social entity that comprises a diverse array of participants. Consequently, organizations must be directed towards establish an appropriate equilibrium between potentially conflicting economic ambitions and social obligations. Hill and Jones (1992) have recently advanced a stakeholder-agency paradigm; from their perspective, managers can be conceptualized as stakeholder agents. The crux of this innovative paradigm is that stakeholders engage in relationships with managers to execute organizational functions with maximal efficiency. In turn, the stakeholder model is intrinsically linked to the overall performance of a corporation.

In addition to its strict economic aspect, corporate operations possess a socio-environmental dimension that influences the realities faced by various actors, specifically stakeholders. Furthermore, through its strategic-reflective function, communication has a more significant impact on corporate behavior than previously observed (Invernizzi et al. 2004). Thus, through a heightened degree of coherence and synergy across all corporate communication initiatives and external expectations, alongside managerial and production activities, the organization's reputation is bolstered. As a result, sustainability reports acquire dual significance as an effective mechanism for disseminating information regarding corporate policies (Schaltegger and Wagner 2006) in terms of enhancing and preserving human, natural, and social resources. In turn, sustainability reports facilitate the assessment of corporate social responsibility (Aras and Crowther 2009), foster a business management image that garners community consensus (Kolk 2008), and enhance reputation, which is essential for cultivating broad public trust in the firm (Zadek 2001).

4.2 Corporate governance mechanisms

As demonstrated by the bibliometric analysis, a novel area of inquiry pertaining to the relationship between corporate governance and sustainability has emerged, specifically emphasizing corporate governance mechanisms (as depicted by the yellow cluster in Fig. 3). The strategic management of a corporation in relation to sustainability is imperative for establishing long-term objectives (Figge et al. 2002). According to Aras and Crowther (2009), there are two primary rationales for considering corporate governance mechanisms as crucial for sustainability performance. First, the achievement of sustainable performance necessitates significant investment and long-term strategies, which in turn impose a substantial influence on the company's capital structure and profitability (Hart and Ahuja 1996). Second, the natural environment demands various levels of coordination, both within the organization and encompassing the entire supply chain alongside other stakeholders (Marcus and Gefen 1998). Consequently, governance is being progressively applied to a more comprehensive form of oversight concerning corporate activities, which encompasses their effects on the environment and society (Giddings et al. 2002). This supplementary dimension frequently emerges in response to stakeholder demands and has the potential to engender tensions and conflicts among shareholders, boards of directors, and managing directors, as it compels them to adopt corporate responsibilities in a novel manner (Maignan 2001). The benefits derived from the implementation of sustainable strategies within the corporate context are encapsulated by the concept of sustainable profit (Lankoski, 2006). Sustainable profit is associated with the generation of direct economic value, thereby rendering the practice of augmenting environmental and social impacts (Seelos and Mair 2005).

Several scholars have recently investigated the correlation between corporate strategies and firms' carbon emissions(Naciti et al., 2022). For instance, Kolk and Pinkse (2008), in their evaluation of how a firm's strategic management responds to climate change, discovered that corporate climate strategy is interconnected with the firm's management approach to stakeholders. Lee (2012) analyzed the relationship between corporate carbon strategies in developing nations and firm performance. He demonstrated that firms that adopt more innovative strategies concerning climate change are capable of capitalizing on new business opportunities, while enhancing their competitive advantage without undermining their productivity(Naciti et al., 2022).

Thus, encouraging companies to embrace sustainable strategies transcends mere ethical responsibility; rather, the ensuing positive returns in terms of economic performance, organizational efficiency, competitive capability, and improved reputation render them particularly appealing (Kotabe & Murray, 2004). Consequently, it becomes evident that sustainability has the potential to be an integral component of governance strategies when incorporated into best practice analyses (Cetinkaya et al. 2011). The challenge in quantifying the tangible spillovers of sustainable strategies can be attributed to the nature of the benefits they confer, which predominantly consist of intangible assets. This enables the corporation to establish a profile characterized by enhanced image, superior product quality, and brand reliability. In this context, it is apparent that this cluster of publications is closely related to the preceding one, particularly concerning the subset of publications associated with sustainability reporting(Naciti et al., 2022).

4.3 Board composition

The concluding cluster (represented in green), discerned via keyword cluster analysis (refer to Fig. 3), relates to the structural composition of the board of directors. The board of directors represents the paramount governance mechanism within an organization; consequently, its composition, encompassing variables such as gender, age, nationality, and professional qualifications, is deemed an essential determinant of organizational performance (Rao & Tilt, 2016), particularly with respect to sustainability performance. Historically, boards have often been examined as monolithic entities, and prevailing business practices have frequently overlooked the significance of board composition and its implications for decision-making processes, strategic formulation, and overall performance (Useem 1986). In adhering to this paradigm over the past decade, scholars have concentrated their investigations on empirical evidence concerning the role of boards of directors with a specific emphasis on their efficiency (Hall 1993).

Recently, however, there has been a marked increase in focus on board diversity. Corporate governance reflects the equilibrium among various proposed solutions within an organization. Indeed, according to the theory of social and psychological dynamics (Adams, 2008), compensatory effects may manifest within the board of directors from minority groups (including gender), which could influence organizational performance. Numerous researchers have established that the diversity present within boards of directors can yield organizational advantages, ranging from enhanced competitive positioning, such as the potential to implement more robust marketing strategies or attract superior human resources, to improve overall performance (Cox and Blake 1991). According to literature (Erhardt et al. 2003; Kang et al. 2007; Pelled 1996), diversity can be defined as the variance in board composition associated with observable demographic characteristics such as gender, age, ethnicity, nationality, cultural background, religion, and degree of independence (Aguilera et al. 2008; Filatotchev and Wright 2005; Uhlaner et al. 2007) as well as other less visible dimensions (including education, professional experience within the industry, and specific skills). The management of diversity has been a focal point in organizational agendas since the early 1990s, with numerous executives and academics contending that diversity exerts both short- and long-term effects on various facets of the organization (Robinson & Dechant, 1997).

According to John and Senbet (1998), the critical characteristics that determine a corporate governance model capable of safeguarding property rights holders include the number of independent directors, the existence of subcommittees, the segregation of responsibilities between the CEO and the Chairman, and, ultimately, the volume of shares held by directors. Indeed, a board consisting of a substantial number of administrators would encounter difficulties in coordinating its activities, thereby hindering active participation from all members and leading to ineffective monitoring. Moreover, the establishment of subcommittees augments the supervisory authority of non-executives, and the delineation of the CEO and Chairman roles is anticipated to enhance the independence of the governance body(Naciti et al., 2022).

All of these dimensions have recently been correlated with sustainability practices and organizational performance(Naciti et al., 2022). In particular, researchers have indicated that the corporate governance framework ought to facilitate mechanisms that enhance not only the financial performance of a firm but also its sustainable performance by fostering broader stakeholder engagement (Rao and Tilt 2016; Carter et al. 2010; Naciti 2019). Furthermore, investors are likely to be more predisposed to engage with organizations that exhibit heightened responsiveness to sustainability. Consequently, through the lens of corporate sustainability, the function of the Board of Directors extends beyond the mere objective of optimizing shareholder welfare, as it also encompasses ethical consideration for stakeholders (Burke and Mattis 2013).

DISCUSSION AND CONCLUSION

This study systematically examines the extant literature pertaining to corporate governance and sustainability through bibliographic analysis, utilizing keyword co-occurrence and co-citation networks as methodological frameworks. A total of 1984 individual publications were meticulously selected from the Lens Database, which explicitly addresses both the themes of "Corporate Governance" and "Carbon Emissions," with publication dates ranging from 2004 to 2024. These publications were subjected to rigorous analysis, employing three distinct visualization methodologies: clustering of keyword co-occurrence networks, chronological trends in keyword evolution, and clustering of co-citation networks. Moreover, an exhaustive analysis of the existing literature pertinent to each of the delineated principal keyword network clusters was performed.

It was observed that the frequency of publications meeting our established screening criteria exhibited a notable increase over time; approximately 50 percent of the 1984 selected items from the specified timeframe between 2004 and 2024 were published within the most recent three years. It is posited that the increasing volume of literature concerning corporate governance and sustainability not only reflects a heightened focus on sustainability as a global imperative, but also signifies an increasing acknowledgment of the essential role that corporations are expected to assume in fostering sustainability(Naciti et al., 2022). This trend is further evidenced by the commitments of corporations under various policy frameworks, including the Sustainable Development Goals (SDGs), wherein corporate leaders are pledging to address critical issues such as safety, environmental stewardship, climate change, innovative responses to community needs, and approaches to sustainable value creation (UN, 2015). Additionally, it is contended that the rising awareness of challenges associated with climate change, exemplified by the Paris Climate Agreement established in 2015 by 195 nations and the subsequent Conference of the Parties (COP25) convened in Madrid in 2019, serves as a further catalyst for the scholarly discourse on corporate governance to increasingly prioritize sustainability (Rogelj et al. 2016). Under the auspices of the Paris Agreement, nations have committed to curbing their greenhouse gas emissions in accordance with Nationally Determined Contributions (NDCs), many of which necessitate corporate involvement (UNFCC 2008).

Furthermore, it has been observed that, notwithstanding the inaugural mention of Sustainable Development occurring in 1987, when Gro Harlem Brundtland, who served as the President of the World Commission on Environment and Development (WCED), presented the report titled "Our Common Future," scholarly publications on these two subjects commenced only a decade later, specifically from 1999(Naciti et al., 2022). It is posited that the lag in addressing these two subjects in an interrelated manner can be attributed to the fact that, in the initial years following the Brundtland report, both scholars and practitioners prioritized the exploration of technical and legal dimensions (Davidson 1996; Robinson 1998), and it was only subsequently that there emerged a recognition of the necessity to address these matters in the corporate echelon (Naciti et al., 2022).

Furthermore, a temporal analysis of keywords has indicated a transition from more conceptual abstractions toward an increasingly strategic and implementable framework. To illustrate, more theoretical terminologies such as 'society,' 'business ethics,' and 'corporate responsibility' demonstrate mean years of occurrence approximating 2022, while the mean years of occurrence for more specific terms such as 'independent director,' 'board size,' and 'female directors' are trending closer to 2024. This developmental arc signifies the intensifying stakeholder pressure for meaningful initiatives pertaining to sustainability (Barnett et al. 2018). Organizations that adopt sustainability strategies witness an annual growth rate surpassing 20 percent. Over the preceding 15 years, millennials are anticipated to inherit a cumulative total of $24 trillion, representing the most substantial wealth transfer in historical terms (Hildebrand and Deese 2019).

The clustering analysis of the co-citation network reveals that stakeholder theory remains a fundamental framework in the rapidly evolving literature concerning corporate governance and sustainability. In the framework proposed by Freeman's stakeholder theory, the corporation is perceived as a composite of varied and frequently discordant interests arising from the diverse array of entities that constitute the 'family' of stakeholders, and it is the intrinsic nature of the corporation that endows it with the capacity and responsibility to coordinate and engage with these different stakeholders Waltman et al. (2010). The primary emphasis on corporate social responsibility and business ethics, coupled with the significant presence of Freeman (1984) within the co-citation network, highlights the pivotal influence of stakeholder theory during the formative phases of corporate governance and sustainability scholarship; the advent of terms related to board composition, including the board of directors, independent directors, and female directors, signifies the contemporary impact of stakeholder/agency theory within academic discussions.

Second, as demonstrated through a chronological analysis of keywords (Fig. 4), contemporary scholarly investigations pertaining to the fields of corporate governance and carbon emissions appear to exhibit an increasing emphasis on clarifying the impact of distinct elements of corporate governance on the sustainability practices, strategies, and performance of organizations. In particular, issues related to gender diversity within the board of directors' composition, as well as concerns regarding the independence of board members in the decision-making process and their relationship with sustainability, seem to arouse significant interest among recent academic studies(Naciti et al., 2022). Undoubtedly, these facets merit more extensive examination, whether through the incorporation of additional and innovative factors (for example, the cultural dimensions characteristic of multinational corporations), analysing the interrelations among various components, or by exploring how diversity-related issues are mirrored in the development of strategies, which are subsequently transformed into implementation and ultimately yield performance outcomes.

Third, our investigation elucidated that dimensions associated with policy tend to be neglected in both historical and contemporary scholarly inquiries. Indeed, the policy elements related to corporate environmental conduct (such as initiatives aimed at incentivizing firms to embrace environmental technologies; Kemp 1997) have constituted a substantial focal point of prior research undertakings. Nonetheless, scholars have allocated relatively diminished attention to the mechanisms by which policy regulations may influence the interrelationships among corporate governance frameworks, strategic approaches, and sustainability outcomes. Consequently, this study delineates a compelling pathway for future inquiry, encompassing significant theoretical and practical implications. Finally, we engage with the discourse surrounding the theoretical underpinnings of investigations that scrutinize the interconnection between corporate governance and sustainability. As our research has demonstrated, the preponderance of studies within this sphere predominantly relies on stakeholder and agency theories as their conceptual foundations. While these theories are unquestionably instrumental in examining the dynamics of corporate governance structures and mechanisms, along with their overarching repercussions on sustainability, they are insufficient when addressing more intricate dimensions. For instance, the essential requirement to operationalize a corporate sustainability strategy articulated at the board level into implementable actions by employees necessitates the integration of specific organizational theories (Waltman et al., 2010). Likewise, the impact of the institutional framework on corporate governance and its correlation with sustainability initiatives enacted by firms warrants analysis through the prism of bespoke institutional theories. Furthermore, the manner in which the heterogeneity of board composition influences decision-making processes pertaining to sustainability objectives is a matter that cannot be sufficiently elucidated solely through stakeholder and agency theories; rather, insights gleaned from psychological theories or those related to organizational behaviour may provide significant perspectives in this regard(Naciti et al., 2022). Thus, the overarching necessity for the development of novel theoretical frameworks addressing existing challenges within the field has become increasingly conspicuous.

The field of management studies will not only gain from these efforts aimed at surpassing current theoretical paradigms, but this academic inquiry will also yield significant insights pertinent to the formulation of policy and the practical implementation of strategies to effectively tackle the urgent questions associated with corporate sustainability practices.

In consideration of these factors, we assert that the body of scholarly work pertaining to corporate governance and sustainability is on the brink of considerable growth in the imminent years. An important avenue for future research may entail evaluating the extent to which diverse corporate governance frameworks contribute to improved sustainability outcomes. Our analysis revealed a significant deficiency of empirical studies examining the effectiveness of governance practices in the context of corporate sustainability within the current body of literature, thereby necessitating a heightened focus on establishing a connection between governance issues and carbon emission performance. Specifically, we argue that forthcoming research should respond to the pressing call from the corporate sphere to address global climate change and the Sustainable Development Goals (SDGs), especially in light of recent critical events across various global regions that have accentuated this imperative, similar to the findings of (Rao and Tilt 2016).

Despite its notable contributions, this research is characterized by several limitations. The extensive compilation of articles was solely cataloged within the

Lens Database, which is acknowledged as one of the most prestigious and pertinent resources within the scholarly community. As a result, contributions from various alternative platforms were excluded, notwithstanding their possible significance in uncovering emerging themes.

Furthermore, this investigation functions as a preliminary framework for future analyses aimed at achieving a more comprehensive understanding of the research landscape associated with corporate governance and sustainability. It would be advantageous to utilize diverse bibliometric and non-bibliometric methodological approaches, including content analysis or the PRISMA framework(Naciti et al., 2022).

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