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GOVERNANCE AND SUSTAINABILITY IN DEVELOPING COUNTRIES: INTELECTUAL STRUCTURE, TRENDS AND LESSONS FROM BRAZIL AND CHINA

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ABSTRACT

Objective: The purpose of this research is to analyze the intellectual structure and existing interconnections between governance and sustainability in developing nations, examining the prevailing trends and emerging topics. Additionally, the study compares Brazil and China, which are two of the most significant and diverse developing countries globally, with the goal of elucidating specific differences. This comparison aims to exemplify the similarities and disparities concerning sustainability and governance in these contexts.

Method: A mixed-methods approach through a systematic literature review to build the intelectual strucrure, with the use of the bibliometrix package in R software, and descriptive statistics and t-tests were employed with the World Bank Data to profile some aspects and compare both countries.

Results: Results bring evidence of a main interests related to governance impact and determinants, poluent emissions, corporate responsability and organization/country performance, within the literature. The study also suggets an inverse profile regarding governance and sustainability, with Brazil pointing to better sustainable conditions than China, however, with lesser business aspects to leverage development.

Originality: The study on governance and sustainability in developing countries stands out for its detailed analysis of governance factors affecting pollutant emissions and corporate responsibility. The study also performs a specific comparison between Brazil and China, in terms of sustainable development aspects.

Theoretical contributions: The study highlights a growing academic interest in governance and sustainability in developing countries, broadens the discourse to include key issues like pollutant emissions and corporate responsibility and country performance in terms o patent registration.

Keywords: Governance, Sustainability, Trends, Emerging topics, Developing countries, Performance.

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GOVERNANÇA E SUSTENTABILIDADE EM PAÍSES EM DESENVOLVIMENTO: ESTRUTURA INTELECTUAL, TENDÊNCIAS E LIÇÕES DO BRASIL E DA CHINA

RESUMO

Objetivo: O propósito desta pesquisa é analisar a estrutura intelectual e as interconexões existentes entre governança e sustentabilidade em nações em desenvolvimento, investigando as tendências predominantes e tópicos emergentes. Adicionalmente, o estudo compara o Brasil e a China, que são dois dos mais significativos e heterogêneos países em desenvolvimento globalmente, com o objetivo de elucidar diferenças específicas. Esta comparação visa exemplificar as semelhanças e disparidades no que concerne à sustentabilidade e governança nestes contextos.

Método: Uma abordagem de métodos mistos por meio de uma revisão sistemática da literatura para construir a estrutura intelectual, com o uso do pacote bibliometrix no software R, e estatísticas descritivas e testes t foram empregados com os dados do Banco Mundial para traçar o perfil de alguns aspectos e comparar os dois países.

Resultados: Os resultados trazem evidências de principais interesses relacionados ao impacto da governança e determinantes, emissões de poluentes, responsabilidade corporativa e desempenho de organização/país, dentro da literatura. O estudo também sugere um perfil inverso em relação a governança e sustentabilidade, com o Brasil apontando para melhores condições sustentáveis que a China, porém, com menores aspectos empresariais para alavancar o desenvolvimento.

Originalidade: O estudo sobre governança e sustentabilidade em países em desenvolvimento destaca-se por sua análise detalhada dos fatores de governança que afetam as emissões de poluentes e a responsabilidade corporativa. O estudo também realiza uma comparação específica entre Brasil e China, em termos de aspectos de desenvolvimento sustentável.

Contribuições teóricas: O estudo destaca um interesse acadêmico crescente em governança e sustentabilidade em países em desenvolvimento, ampliando o discurso para incluir questões chave como emissões de poluentes, responsabilidade corporativa e desempenho do país em termos de registro de patentes.

Palavras-chave: Governança, Sustentabilidade, Tendências, Tópicos emergentes, Países em desenvolvimento, Performance.

1.INTRODUCTION

In developing countries, the interplay between governance and sustainability is crucial for achieving long-term development goals. Governance refers to the traditions and institutions

by which authority is exercised, encompassing processes for selecting, monitoring, and replacing governments, the government's ability to effectively formulate and implement policies, and the respect of citizens for the institutions governing economic and social interactions. Sustainable development, on the other hand, aims at meeting the needs of the present without compromising the future generations' ability to meet theirs.

Effective governance is pivotal in achieving sustainable development outcomes. Taner Güney (2017) demonstrates that governance—through its various facets like rule of law, bureaucratic quality, and corruption control—has a significant positive effect on sustainable development across both developed and developing nations (Güney, 2017). This suggests that enhancing governance can lead to better management of resources and higher welfare levels.

Moreover, governance has been shown to correlate positively with economic development. Lameira and Ness (2010) used data from the World Bank and Transparency International to explore this relationship, finding that countries with better governance tend to have improved economic performance (Lameira & Ness, 2010). This highlights the role of governance in creating environments conducive to economic growth, which is essential for sustainability. Furthermore, governance impacts environmental protection, a critical aspect of sustainability. Rasoolimanesh et al. (2019) found that governance has a positive effect on environmental protection in developing countries, emphasizing its role in enforcing environmental regulations and promoting sustainable practices (Rasoolimanesh et al., 2019).

Despite the critical importance of governance and sustainability in corporate and organizational practices, the interrelationship between these two domains remains underinvestigated within the contexto of developing countries level of analysis. Environmental, Social, and Governance (ESG) criteria are becoming increasingly essential in the sustainability and ethical assessments of companies, especially in developing countries where they address unique and pressing challenges. There is a notable absence of comprehensive frameworks that effectively integrate governance with sustainability, highlighting a significant gap in current research. This lack of integration suggests that the governance mechanisms designed to support sustainability initiatives are not sufficiently detailed or explored in the literature (Aras & Crowther, 2008; Boeva, Zhivkova, & Stoychev, 2017). Additionally, empirical research linking governance structures directly to sustainability outcomes is still in its infancy. Studies often rely

on limited datasets or fail to encompass diverse industries or geographical areas, indicating an underinvestment in research that probes the impacts of governance practices across different contexts on sustainable development goals (Formentini & Taticchi, 2016).

Moreover, the focus of existing research is predominantly on corporate governance, neglecting broader governance issues such as public policies, international regulations, and the roles of non-governmental organizations. This narrow focus leaves a gap in our understanding of how governance at various levels—local, national, and international—affects sustainability outcomes (Kocmanová, Hrebícek, & Dočekalová, 2011). Furthermore, there is a theoretical divergence in how sustainability and governance are defined and operationalized within the academic and practical realms. This divergence complicates the creation of universally acceptable models that can be empirically tested and applied across different sectors and regions, underscoring the need for more rigorous theoretical and empirical work (Salvioni, Gennari, & Bosetti, 2016).

While governance and sustainability are frequently discussed together, there is a clear and pressing need for more comprehensive studies that integrate various governance aspects with sustainable practices to better understand and enhance their mutual reinforcement. The existing literature underscores the necessity for such research, pointing towards a more integrated and empirically robust approach to studying these critical issues. The relationship between governance and sustainability in developing countries is deeply interconnected. Strengthening governance is imperative for enhancing policy effectiveness, supporting economic growth, ensuring environmental protection, and fostering social development, which collectively contribute to sustainable development.

As exemplars of these aspects, Brazil and China contrast. Brazil and China serve as intriguing case studies for examining the interplay between governance and sustainability due to their unique political and economic contexts. In Brazil, the governance approach to sustainability has often been characterized by its focus on environmental policies and social inclusion, which are reflected in its efforts to preserve the Amazon rainforest and in its policies aimed at reducing poverty. However, political instability and corruption have sometimes undermined these initiatives, presenting challenges to effective governance and sustainable development. China, on the other hand, presents a different picture. The country has rapidly

industrialized and grown economically, which has prompted the government to implement a variety of regulations aimed at curbing environmental degradation and promoting sustainable urban development. The Chinese government's top-down approach in governance allows for swift policy implementation, which has been instrumental in its recent environmental initiatives, such as massive investments in renewable energy and the establishment of green technologies. However, issues such as transparency and public participation are still areas needing improvement to enhance the sustainability outcomes. Both countries highlight the complex relationship between governance structures and sustainability goals, demonstrating that while governance can significantly advance sustainability, challenges such as political will, corruption, and public engagement play crucial roles in shaping these efforts.

Based on this problenatization, this study aims to investigate theoretically and empirically the realtionship between Governance and Sustainability in developing countries, portraying the intelectual landscape on these topics interplay, and comparing some aspects of governance and sustainability of Brazil and China, due to their representativeness, in terms of indicators and qualifying characteristics. We developed a systematic literature review as well as descriptive statistics and t tests of difference, with data from the World Bank.

2.THEORETICAL BACKGROUND

2.1 Sustainability in developing countries

Developing countries are important actors in Sustainability issues. At the same time, they deal with the challenging interplay of economic development while keeping Sustainability at the agenda, with an accountable view. ustainability in developing countries encompasses a broad range of challenges and opportunities across environmental, social, and economic dimensions. These issues are interconnected, requiring integrated solutions that consider the unique contexts of these nations. In developing countries, environmental sustainability is often focused on managing natural resources crucial for livelihoods and economic growth.

Challenges such as deforestation, biodiversity loss, water scarcity, and pollution are prominent. Effective management of these resources is essential for maintaining ecological balance and supporting future generations. For instance, deforestation in tropical regions not

only impacts local biodiversity and communities but also global carbon cycles, highlighting the need for sustainable land use practices (Khan & Khan, 2017). Social equity is a critical aspect of sustainability in developing nations, where disparities in access to healthcare, education, and economic opportunities are significant. Ensuring that all segments of the population can access these essential services is crucial for fostering inclusive development and improving quality of life.

The 2011 Human Development Report emphasizes the need to address sustainability and equity together, highlighting that environmental degradation and social inequalities often disproportionately affect the world's most disadvantaged people, making it difficult to achieve sustainable progress (Klugman, 2011). Economic challenges in developing countries include diversifying economies, creating jobs, and building resilient infrastructures. Sustainable economic growth involves developing economic policies that encourage not only growth but also ensure that it is broad-based and inclusive, reducing poverty and improving living standards for all. This requires innovative financing solutions, investment in sustainable industries, and support for small and medium enterprises as pillars of the economy. Effective governance is crucial for implementing and enforcing policies that support sustainability across all dimensions.

Developing countries often face challenges such as corruption, lack of policy coherence, and weak institutional capacities, which can undermine sustainability initiatives. Strengthening these institutions is critical for enhancing policy implementation and achieving long-term sustainability goals. Developing countries often require support from the international community to address their sustainability challenges. This includes financial assistance, technology transfer, and capacity building. Global governance mechanisms and international cooperation play pivotal roles in supporting these countries through knowledge sharing and direct support, facilitating progress towards sustainability goals. Sustainability in developing countries is a complex field that requires a multi-faceted approach, addressing interconnected environmental, social, and economic challenges. Strengthening governance and international cooperation, along with tailored local solutions, is essential for making sustainability a reality in these contexts. The research and insights provided by scholars like Himayatullah Khan and Judy Klugman contribute significantly to understanding and addressing

these challenges, supporting the global effort towards sustainable development that is inclusive and equitable (George, 2007; Labuschagne, Brent, & Van Erck, 2005).

Sustainability efforts and developments in developing countries are gaining increasing attention as these nations confront the intertwined challenges of environmental degradation, social inequality, and economic development. These issues are complex and multifaceted, necessitating a holistic approach to sustainability that integrates economic, social, and environmental dimensions. Environmental sustainability in developing countries often focuses on the protection and sustainable management of natural resources. This includes initiatives to combat deforestation, preserve biodiversity, and manage water resources sustainably. For instance, Khan and Khan (2017) discuss the importance of integrating environmental considerations with economic and social planning, emphasizing the critical need for sustainable resource management in these regions (Khan & Khan, 2017). On the social front, efforts are concentrated on improving access to essential services such as education, healthcare, and housing. The aim is to enhance social equity and ensure that all population segments can participate in and benefit from economic growth. The 2011 Human Development Report highlights the dual urgency of addressing both sustainability and equity to spur mutually reinforcing progress. It points out that sustainable development cannot be achieved without ensuring equitable access to resources and opportunities, which in turn supports broader economic and environmental goals (Klugman, 2011).

Economically, developing countries are focusing on diversifying their economies, enhancing agricultural productivity, and promoting industries that are both environmentally and socially sustainable. Economic sustainability also involves creating jobs that offer fair wages and conditions, which is crucial for reducing poverty. The work by Labuschagne, Brent, and Van Erck (2005) on assessing sustainability performance in industries reflects the need for operational initiatives that align with sustainable development goals, particularly in the manufacturing sector, which is pivotal in many developing countries (Labuschagne et al., 2005). While developing countries face unique sustainability challenges, they also possess the opportunity to design and implement innovative solutions that integrate environmental, economic, and social considerations. The progress in these areas, as detailed in the scientific literature, shows a path forward that other regions might emulate. The focus on improving

governance, alongside strategic economic and social initiatives, is key to achieving long-term sustainability goals.

Effective governance and robust policy frameworks are fundamental to achieving sustainability in developing countries. These frameworks need to ensure that sustainability practices are integrated across all levels of government and business operations. George (2007) discusses the internal tensions within the three-pillar sustainability approach, which includes the economic, social, and environmental aspects. The study suggests that achieving sustainable development in developing countries requires significant changes in economic structures and governance systems, both nationally and globally (George, 2007). In this sense, Governance emerges as an integral part of sustainability developments and efforts.

2.2 Governance in developing countries

At the same time that Sustainability has gained attention of researchers and practitioners over the past few decades, this interest has come with accountability concerns. Governance in developing countries is a multifaceted concept that impacts all aspects of development—from economic growth and social stability to institutional integrity and public administration. Understanding and improving governance in these contexts is crucial due to the unique challenges these countries face, including resource limitations, corruption, and the need for effective administrative structures.

One of the primary areas where governance plays a critical role is in economic growth. Research by Azmat Gani (2011) highlights the significant impact that governance factors like political stability and government effectiveness have on the economic performance of developing countries. These elements of governance are positively correlated with growth, indicating that a stable and effective government can foster a conducive environment for economic activities and development. Conversely, issues such as corruption and lack of accountability have a negative correlation with economic growth, suggesting that addressing these issues can lead to improved economic outcomes (Gani, 2011). The governance at the local level also plays a crucial role in shaping the development trajectories of countries. Anwar Shah (2006) provides a comparative analysis of local governance in countries such as South

Africa, Uganda, and India. His findings suggest that responsive, responsible, and accountable local governance can significantly improve the delivery of public services and enhance the quality of life for citizens. Effective local governance ensures that public resources are utilized efficiently and that public services are aligned with the needs of the community (Shah, 2006).

Further exploring the interface between public management and governance, Huque (2013) discusses how public management reforms can support governance by promoting values such as efficiency, transparency, and participation. While public management itself is not a substitute for governance, effective public management practices can enhance governance by updating and adjusting institutional structures to better serve public needs. This approach underscores the importance of governance mechanisms that adapt to changing circumstances and meet the evolving demands of the population (Huque, 2013).

Addressing the capabilities necessary for implementing good governance, Kenneth Hope (2009) emphasizes that many developing countries lack the capacity, rather than merely the will, to foster good governance. He argues that capacity development for good governance should be comprehensive, simultaneously addressing change and transformation at individual, institutional, and societal levels. Such initiatives must be locally owned and controlled to ensure their relevance and sustainability (Hope, 2009).

However, exploring the paradoxical nature of governance, Sam Wilkin (2011) provocatively suggests that bad governance, characterized by centralized power and less democratic processes, has sometimes been beneficial for rapid development in countries like China. This perspective challenges traditional views and suggests that under certain conditions, unconventional governance structures can drive development effectively (Wilkin, 2011). governance in developing countries requires a nuanced, multi-dimensional approach that integrates economic, social, and administrative reforms. The literature underscores the need for governance practices that are not only theoretically effective but also pragmatically applicable and sustainable within the specific cultural and institutional landscapes of these countries. The ongoing dialogue in academic and policy circles continues to shed light on the complexities of governance and its critical role in shaping the futures of developing nations.

2.2.1 Monitoring Sustainability and Governance in developing countries

The investigation on the interplay between Sustainability and Governance is on the best interests of governments and the civil Society as a whole. Keeping the monitoring of these aspects is one importante task to point out directions and corrections. The World Bank plays a significant role in monitoring and supporting sustainability and governance efforts in developing countries. This role is critical as it shapes the strategies and policies that affect environmental management, governance structures, and sustainable development outcomes. The World Bank has taken proactive steps in monitoring environmental progress and integrating sustainability into its framework for development. As detailed by Dryzek (1996), the World Bank has evolved from contributing to environmental challenges to attempting to rectify these through the creation of environmental indicators. These indicators aim to support the quest for sustainable development by providing data that helps in decision-making at the national level. The publication "Monitoring Environmental Progress: A Report on Work in Progress" underscores the shift in the World Bank's approach towards embracing sustainable development as a core component of its operations (Dryzek, 1996).

The governance aspect of sustainability is equally significant. The World Bank's efforts to help developing countries build state capacity are crucial in enhancing governance. De Janvry and Dethier (2012) analyze how the World Bank's advocacy for effective governance and capacity building in public sectors has been a core feature of its strategy. However, they note that while the intention is clear, the results have often been disappointing. The structural organization of the World Bank and the emphasis on project disbursement over long-term capacity building have been pointed out as areas needing reform. This insight suggests a need for a shift in how governance projects are monitored and evaluated (De Janvry & Dethier, 2012). Urbanization and infrastructure development are other areas where the World Bank's monitoring of sustainability practices is crucial.

A study by Liyin Shen et al. (2017) evaluates the sustainability performance of urbanization in BRICS countries, highlighting the significant influence these countries have on global sustainable development. The research indicates varying degrees of sustainability in urbanization processes, pointing to the need for tailored strategies that align with the specific

challenges and dynamics of each country. This study underscores the importance of the World Bank's role in promoting sustainable urbanization practices that consider environmental and social impacts (Shen et al., 2017). While the World Bank has established frameworks and policies aimed at enhancing sustainability and governance, the effectiveness of these initiatives often comes under scrutiny. The organization's ability to adapt and reform its approaches in response to the complexities of global sustainability challenges remains vital. Ensuring that sustainability and governance reforms are not only implemented but also lead to tangible improvements in the living conditions in developing countries is crucial for the credibility and effectiveness of the World Bank's efforts in these sectors.

The World Bank has data from the major economies, and in particular interest of this research, Brazil and China emerges and representatives of developing contries on the interplay of Sustainability and Governance, as they are distinct in culture, social and economic aspects, which brings interesting nuances to be observed.

2.3 Brazil and China, two giants and two realities

Brazil and China, two influential players on the global stage, exhibit both striking similarities and profound differences across various dimensions including economic growth, cultural dynamics, sustainability efforts, and governance structures. These elements not only shape each country's internal development trajectories but also influence their bilateral relations and their respective roles in the global arena.

Both nations are considered emerging economies with significant impacts in their regions. China has experienced rapid economic growth, largely driven by a manufacturing boom, which has also propelled extensive urbanization. Conversely, Brazil's economic growth has been more moderate with a stronger emphasis on the service sector. Urbanization in Brazil does not match the scale or pace observed in China, leading to different urban dynamics and challenges. The comparison of their urbanization processes reveals that while both countries face the urban-rural divide, the manifestations and implications of urbanization are distinct due to differing industrial bases and development policies (Zeng et al., 2016). Cultural differences between Brazil and China are significant, despite both countries growing closer economically

and politically. Hofstede's cultural dimensions reveal considerable disparities in how each society operates. Brazil often exhibits more openness and fluidity in social interactions, which contrasts with China's more structured and hierarchical society. These cultural traits affect not only domestic business practices but also international collaborations and negotiations, underscoring the importance of cultural sensitivity and understanding in fostering stronger bilateral ties (Xi, 2016).

Sustainability poses a complex challenge for both Brazil and China, as each country seeks to reconcile rapid economic growth with environmental conservation. Brazil's role as a major supplier of raw materials to China has implications for its land use and sustainability policies. At the same time, China's investment in renewable energy projects in Brazil, such as hydroelectric power, has sparked controversies regarding their environmental and social impacts. These investments highlight the intricate balance between advancing renewable energy and addressing local community concerns, pointing to the nuanced nature of sustainable development in international trade and investment relationships (Raftopoulos & Riethof, 2016).

Governance structures in Brazil and China differ markedly, reflecting their unique political systems and historical developments. Brazil's democratic framework supports a governance style that encourages public participation and transparency, whereas China's centralized system allows for rapid decision-making and implementation. These fundamental differences influence each country's domestic policies and international strategies. For instance, China's assertive approach to international relations and its ambitions for global leadership contrast with Brazil's more regional focus and its role as a mediator and stabilizer in Latin America (Sucre, 2011). The comparative analysis of Brazil and China reveals a complex tapestry of interlinkages and divergences across economic, cultural, sustainability, and governance dimensions. Understanding these aspects is crucial for both nations as they navigate their paths towards sustainable development and more robust international roles. Their experiences offer valuable insights into the challenges and opportunities of global interdependence in the 21st century.

2.4 Value in the Interplay of Sustainability and Governance

Benefits are commonly translated into value. Value is a concept with a vast amount of discussion, and definitions. However, is a consensus that value can be translated into perception of gains, depending on the standoint of each stakeholder. Corporate governance and sustainability are no longer isolated concepts within the business realm but have evolved into intertwined elements that drive modern corporate strategies. As businesses face increasing scrutiny regarding their role in society and the environment, the incorporation of sustainability within the governance framework has become imperative for both ethical compliance and business success.

Historically, corporate governance primarily focused on maximizing shareholder value, often at the expense of other stakeholders. However, as societal expectations have shifted, there has been a gradual movement towards more inclusive governance models that consider the impacts on all stakeholders, including employees, communities, and the environment. As sustainability becomes a core component of corporate identity, companies are redefining their strategies to incorporate sustainable practices. Klettner, Clarke, and Boersma (2014) highlight this trend, noting significant advancements in how large Australian corporations integrate sustainability into their operations. These companies are not only developing sustainability strategies but are also ensuring these strategies are a central part of leadership roles and corporate governance. The authors observe that this integration is facilitated by leadership structures designed to oversee and implement these strategies effectively, ensuring that sustainability is woven into the fabric of organizational culture (Klettner, Clarke, & Boersma, 2014).

The global business environment is also witnessing a convergence of governance practices towards sustainability. Salvioni and Gennari (2016) discuss how sustainability has started to influence corporate governance systems worldwide, suggesting a 'de facto convergence' where despite differences in corporate governance structures across countries, there is a unifying trend towards sustainable practices. This convergence indicates that companies, regardless of their native governance models, are finding common ground in

sustainability, which is becoming a universal benchmark in corporate governance (Salvioni & Gennari, 2016).

The economic implications of sustainable corporate governance are profound. Rezaee (2016) synthesizes various research findings to argue that integrating governance, social, ethical, and environmental dimensions into corporate strategy not only addresses stakeholder expectations but also enhances firm value. This integration helps companies identify and seize opportunities for innovation and growth, contributing to long-term financial performance (Rezaee, 2016).

Furthermore, sustainable practices are linked to better financial returns as evidenced by Grove and Clouse (2018), who found that companies engaging in environmental, social, and governance (ESG) reporting generally achieve higher financial returns than those that do not. This relationship underscores the importance of transparency and accountability in corporate governance, suggesting that investors and other stakeholders value companies that commit to sustainable practices (Grove & Clouse, 2018). The integration of sustainability into corporate governance is not merely a trend but a fundamental shift in how companies operate and conceive their roles within the global ecosystem. This new paradigm emphasizes ethical responsibilities and long-term value creation, ensuring that companies can sustain their operations and stakeholder relationships in an increasingly complex and demanding world, translating their integration into value created, cocreated ad delivered to different stakeholders.

3.METHOD

This study is categorized as a mixed-methods research endeavor, utilizing both qualitative and quantitative approaches to achieve a comprehensive understanding of the research problem. The integration of these methods allows the study to benefit from the depth provided by qualitative data, such as detailed contextual insights from literature or subjective feedback, and the breadth afforded by quantitative data through measurable, statistically analyzable elements. This combination not only enhances the robustness of the findings but also ensures they are generalizable across different contexts (Creswell, 2021).

As an exploratory study, the research aims to delve into a topic that has not been extensively studied before. This approach is particularly useful in fields where little is known,

allowing researchers to uncover new insights, identify trends, and recognize relationships without the constraint of pre-existing hypotheses. Exploratory research is foundational, setting the stage for future investigations by developing hypotheses and establishing research priorities based on newly discovered information.

Methodologically, the study employs a systematic literature review, descriptive statistics, and Student t-tests. The systematic literature review ensures a thorough and structured exploration of existing literature, providing a solid foundation of the current knowledge and identifying gaps that justify the need for further exploration (Hiebl, 2023). Descriptive statistics are used to summarize and describe the key features of the quantitative data collected, making it easier to understand and interpret trends, patterns, and central tendencies within the data. Lastly, the application of Student t-tests enables the comparison of means between two groups, crucial for identifying significant differences or effects. This statistical analysis is instrumental in supporting or refuting hypotheses about relationships or variations between groups, thus providing a strong statistical underpinning for the exploratory nature of the study (Hair et al., 2019).

To undertake the systematic literature review, we employed the following research string: Results for "governance" (Topic) AND "sustainability" (Topic) AND "developing countries" (Topic) and Article (Document Types) and Environmental Studies or Green Sustainable Science Technology or Management or Business or Economics or Environmental Sciences (Web of Science Categories) and English (Languages) and 2024 or 2023 or 2022 or 2021 or 2020 or 2019 or 2018 or 2017 or 2016 or 2015 or 2014 (Publication Years). This searh resulted in 344 articles. They were exported in to an Excel file, that was analyzed through the bibliometrix package in R (Dervis, 2019).

To conduct the quantitative analysis, data were sourced from the World Bank Data reports (World Bank, 2024), chosen by their impact in people's day-to-day lives, encompassing the Sustainability the variables "Access to Clean Fuels and Technologies for Cooking (% of Population)." This metric quantifies the percentage of the total population that predominantly utilizes clean fuels and technologies for cooking. According to World Health Organization (WHO) guidelines, kerosene is not considered a clean cooking fuel. Additionally, data on patent applications were analyzed. These applications pertain to worldwide patent submissions filed

either through the Patent Cooperation Treaty process or with national patent offices, seeking exclusive rights for inventions—either products or processes that introduce novel methods or provide new technical solutions to existing problems. Patent protection is granted to the inventor for a limited duration, typically 20 years.

Further variables studied include the Gini index, which measures the degree of income or consumption disparity among individuals or households within an economy relative to a perfectly equitable distribution. A Gini index of 0 denotes absolute equality, whereas an index of 100 signifies complete inequality. Moreover, CO2 emissions (metric tons per capita) were evaluated, encompassing emissions generated from the combustion of fossil fuels and the production of cement, inclusive of carbon dioxide emitted during the consumption of solid, liquid, and gaseous fuels, as well as from gas flaring. The life expectancy at birth, total (years), was examined. This indicator estimates the average number of years a newborn infant is expected to live if prevailing mortality rates at the time of birth remain constant throughout the infant's life.

The governance variables analyzed include "Voice and Accountability: Estimate," which quantifies perceptions regarding the extent to which a nation's citizens can participate in selecting their government. This includes aspects such as freedom of expression, freedom of association, and media freedom. The estimate assigns a score to the country on an aggregate indicator, expressed in units of a standard normal distribution, typically ranging from approximately -2.5 to 2.5. Another variable, "Control of Corruption: Estimate," measures perceptions related to the degree to which public power is utilized for private benefit. This encompasses both minor and major forms of corruption, as well as the capture of the state by elites and private interests. The country's score on this aggregate indicator is also quantified in units of a standard normal distribution, with a similar range. Additionally, "Government Effectiveness: Estimate" assesses perceptions of the quality of public services, the competence and political independence of the civil service, the quality of policy development and implementation, and the credibility of the government's commitment to these policies. The estimate reflects the country's score on this aggregate indicator, standardized in the range of approximately -2.5 to 2.5. Lastly, the "Political Stability and Absence of Violence/Terrorism: Estimate" evaluates perceptions regarding the likelihood of political instability and/or politically-

motivated violence, including terrorism. The estimate provides the country's score on the aggregate indicator, which is similarly expressed in units of a standard normal distribution, spanning approximately-2.5 to 2.5.

4. RESULTS

4.1 Scenario of existing knowledge

Initially, we investigated the intelectual strucure of the existing knowledge about the relationship between Governance and Sustainability. Figure 1 depicts the evolution of the tipics interplay.

Figure 1. Evolution of the topics interplay

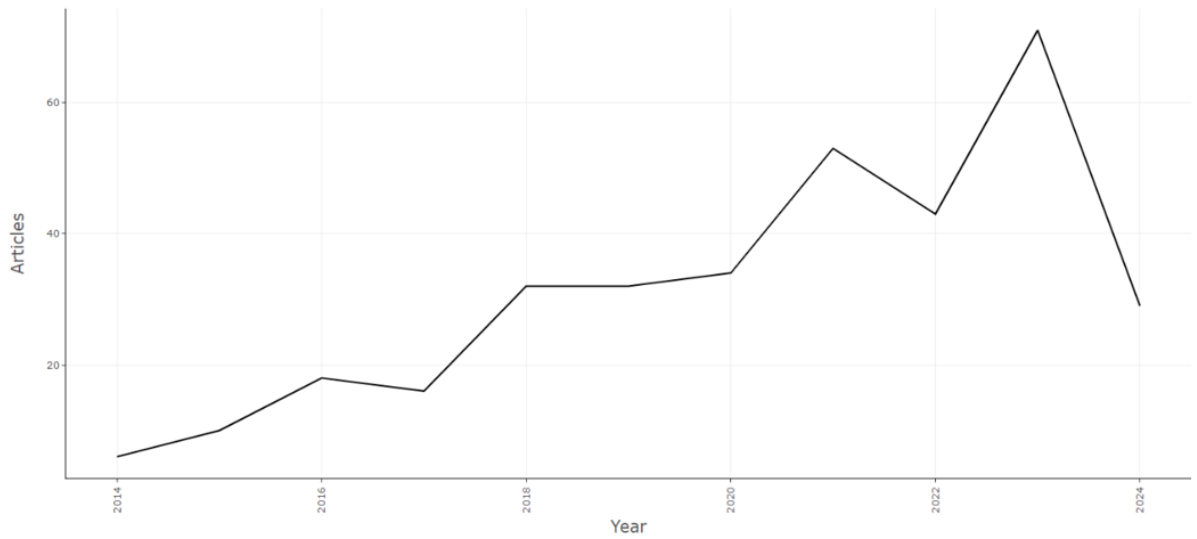


Figure 1 shows the trend of articles published annually from 2014 to 2024.

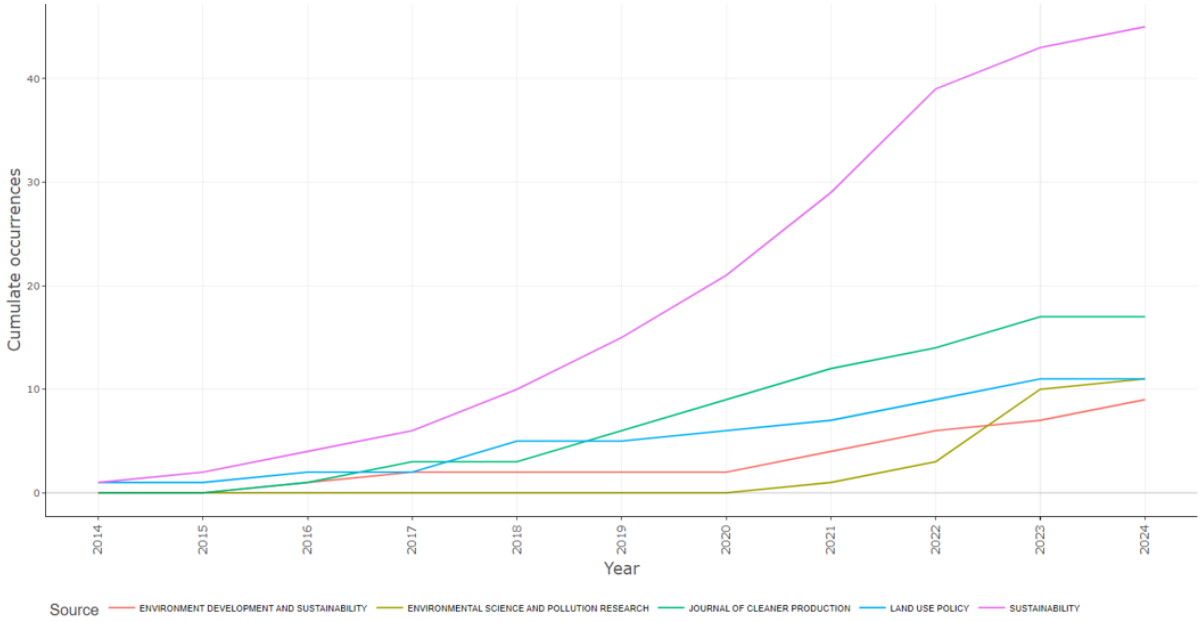
Initially, there's a gradual increase in publications from 2014, starting at around 20 articles, and progressing steadily upward. This growth indicates a rising interest or developments in the subject matter covered by these articles. From 2017 to 2019, the growth in publication volume appears to slow down, suggesting a stabilization in the field or possibly the maturation of certain research topics that were previously trending. Despite the slower growth, there is no significant drop, indicating sustained. A notable surge occurs between 2020 and 2021, where the number of articles peaks sharply. This spike could be attributed to specific

events or breakthroughs in the field, driving an increased output of research and discussions. This peak is the highest point on the graph, showing over 60 articles published in 2021. However, post-2021, there is a dramatic fall in the number of articles by 2022, followed by a minor recovery in 2023, and another steep decline in 2024, descending to levels similar to those in the early years of the graph. This fluctuation could reflect changes in the external environment affecting the field, such as funding cuts, shifts in research priorities, or global events impacting academic output.

Overall, the data from 2014 to 2024 reflects a field that is dynamic, with periods of rapid growth and sharp declines, highlighting the responsive nature of academic publishing to both internal developments and external pressures. This analysis provides a macroscopic view of the publishing trends over a decade, suggesting periods of significant activity and adjustment within the field covered by these articles.

The discussion has been more pronounced in some vehicles. tracks the cumulative occurrences of publications across several sources from 2014 to 2024, focusing on environmental and sustainability issues. Figure 2 depicts these implicarions.

Figure 2. More active journals



Each line represents a different journal or publication source, illustrating the growth in publications over the years. The "Journal of Cleaner Production" shows a pronounced upward

trajectory, starting from approximately five cumulative occurrences in 2014 and soaring to over 40 by 2024. This steep increase highlights the journal's growing focus and contribution to research in cleaner production and environmental sustainability. Its leading position suggests significant influence and engagement within the academic and environmental sectors. "Environment Development and Sustainability" and "Sustainability" both exhibit moderate but steady growth over the decade. They start near the bottom of the graph and gradually rise, indicating a consistent accumulation of research contributions over time.

By 2024, both have recorded about 10 to 15 cumulative occurrences, reflecting ongoing, albe it less rapid, interest and publication activity compared to the "Journal of Cleaner Production." The lines for "Environmental Science and Pollution Research" and "Land Use Policy" display slower growth, maintaining lower profiles on the graph.

This could suggest either a narrower scope of topics covered, less frequent publication schedules, or possibly a smaller output of papers deemed impactful in their respective fields. Despite the slower growth, the steady upward trend for both indicates a sustained commitment to publishing research in these areas. The graph is indicative of a growing academic interest in environmental and sustainability issues, particularly evident in the surge of publications from the "Journal of Cleaner Production." The overall upward trends across all sources reflect the increasing importance of environmental and sustainability research, driven by global challenges and policy shifts towards more sustainable practices. This data helps illustrate not only the focus areas of specific journals but also the broader shifts in research priorities within the academic community related to environmental concerns.

The discussion on these topis has been more pronounced within some regions, despiote their vast distribution over the world. Not just the developing countries are the more productive countries to develope the discussion. Figure 3 delineates this aspect.

Figure 3. More productive countries

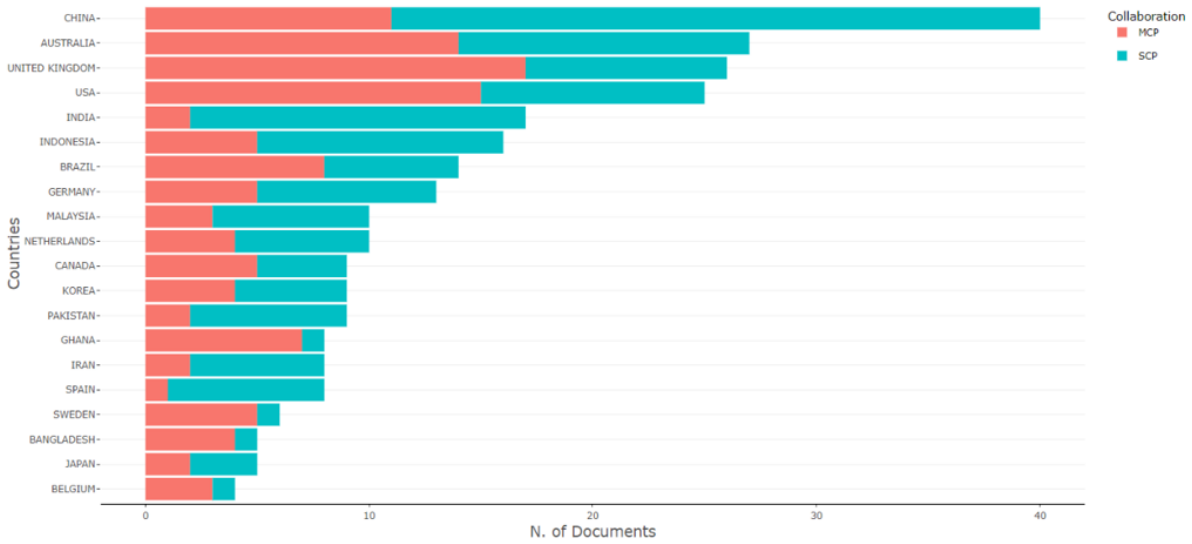


Figure 3 illustrates the number of research documents produced by various countries, categorized into multi-country publications (MCP) and single-country publications (SCP). This showcases the dynamics of domestic versus international collaboration in research. China emerges as the leader, producing the highest number of research documents. It has a significant proportion of MCP, demonstrating strong international research collaboration, alongside a robust number of SCP, indicating a vigorous internal scientific community.

Following closely are Australia and the United Kingdom, both displaying a balanced mix of MCP and SCP. This balance suggests that they not only maintain active domestic research environments but also engage extensively in international collaborations. The USA and India exhibit a similar pattern with a prominent volume of SCP, pointing to a strong national focus in their research activities, yet they also maintain a considerable amount of international collaborations. Meanwhile, Germany, Brazil, and Indonesia present moderate levels of both SCP and MCP, indicating their active participation in both domestic and international research spheres.

Interestingly, countries like Ghana, Iran, and Bangladesh, despite having relatively fewer documents, show a substantial proportion of MCP compared to SCP. This may reflect a strategic emphasis on international collaborations to boost their research capabilities and global integration.

4.2 Emerging topics and trends

Figure 4 illustrates the evolving trends in the ongoing discussion surrounding the interplay between Governance and Sustainability. This visualization captures how the dialogue between these two critical areas has developed over time, highlighting key moments when the conversation has intensified. The scenario serves as a compelling graphical representation of the increasing importance of integrating sustainable practices within corporate governance frameworks. It showcases periods of heightened focus, possibly triggered by regulatory changes, shifts in public awareness, or notable corporate initiatives that have pushed sustainability to the forefront of governance discussions. By tracking these trends, Figure 4 provides valuable insights into how the relationship between corporate governance and sustainability has become increasingly significant in shaping business practices and policy decisions aimed at fostering a more sustainable and responsible corporate landscape.

Figure 4. Trends and emeging topics

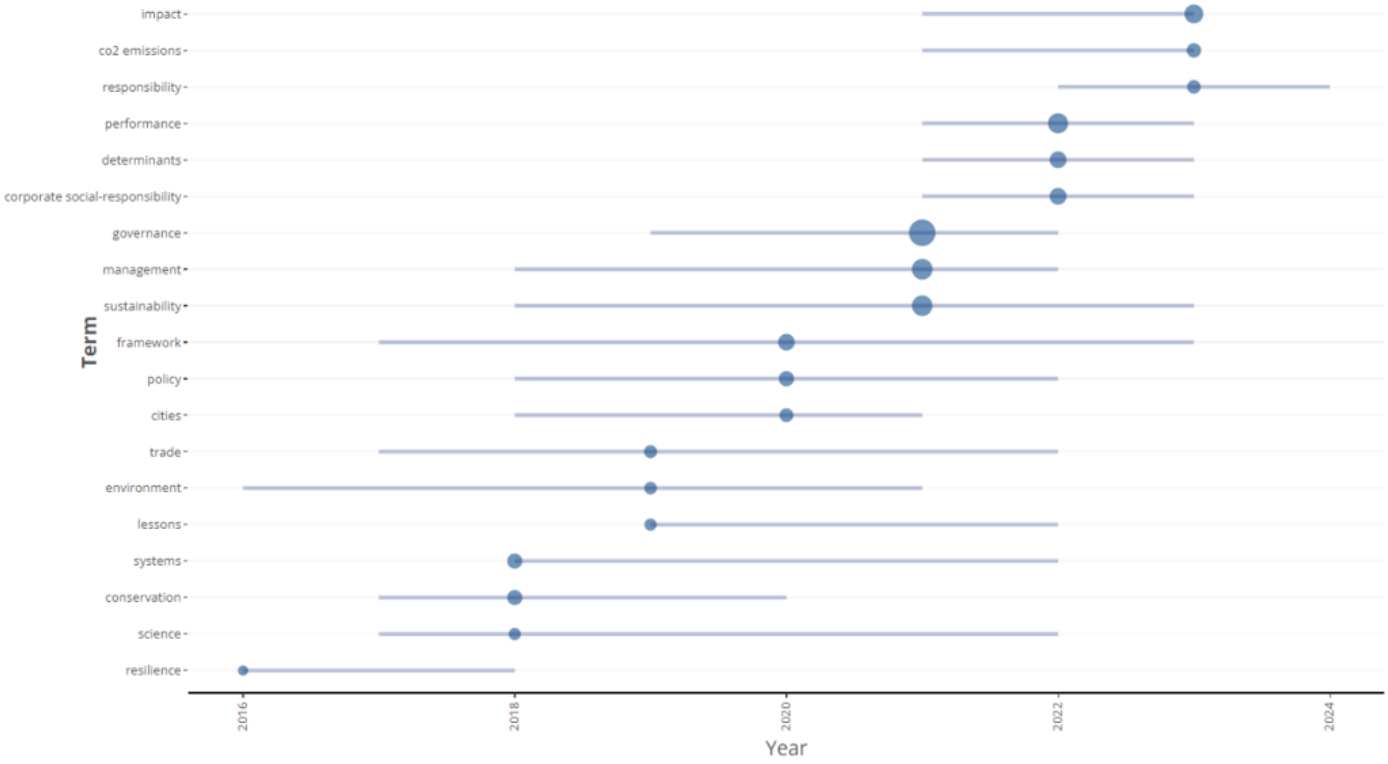


Figure 4 presents a detailed timeline landscape that meticulously maps out the usage or discussion intensity of various terms connected to environmental impact and corporate governance spanning the years 2015 to 2024. Key terms such as "CO2 emissions," "environment," "conservation," and "science" are emphasized during specific years, notably 2018 and 2022. These markers suggest that these years were critical for advancing discussions on environmental challenges and the scientific underpinnings of ecological conservation. The apparent spikes in the dialogue during these years might correlate with significant environmental events or international policy changes demanding heightened attention to these issues. In the domain of corporate responsibility, terms like "corporate social responsibility," "governance," and "management" not only follow an upward trajectory but also seem to gather particular strength as they approach the year 2022. This trend underscores an evolving dialogue that increasingly focuses on how businesses implement sustainable practices and the role of corporate governance in fostering ethical and environmentally sound strategies.

It also further delineates the development of policy-related discourse through terms such as "sustainability," "framework," and "policy." These terms appear prominently around the years 2018 and 2022, indicative of key phases in policy development or significant adjustments in existing frameworks. This pattern may reflect global or national policy shifts that aim to address the pressing issues of climate change and sustainability challenges, suggesting a responsive or preemptive policy environment. Moreover, other terms like "trade" and "cities" are also featured, with "trade" notably marked in the year 2022. This could indicate a crucial year for trade policies that directly impact environmental regulations and corporate responsibilities concerning ecological issues.

The term "cities" captures attention in the year 2018, hinting at a focus on urban development strategies that prioritize sustainability. This could relate to the increasing emphasis on making cities more sustainable through innovative urban planning and development policies aimed at reducing environmental footprints and enhancing the quality of urban life.

Figure 5. Development and relevance of emeging topics

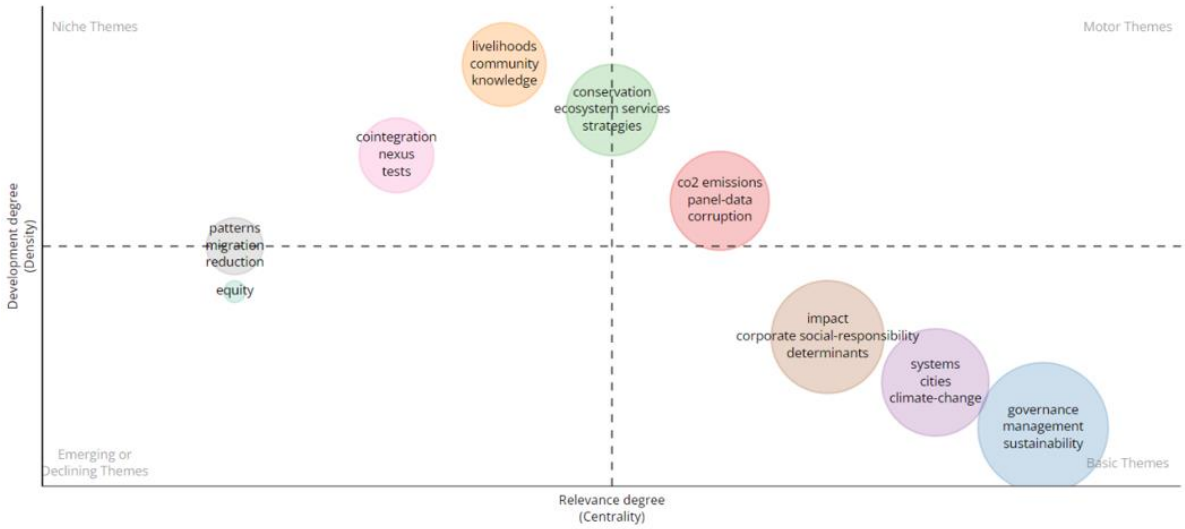


Figure 5 presents a conceptual diagram that categorizes various themes related to environmental and governance issues into four quadrants based on their developmental stage and relevance to current discussions. The diagram is built in two axes, "Developmental Stage" and "Relevance Degree (Centrality)," to position the themes. In the upper-left quadrant, we find the Niche Themes, which include topics such as "livelihoods," "community," "knowledge," "conservation," "ecosystem services," and "strategies." These themes are less central and are in the early stages of development, focusing on specific aspects of sustainability that are still gaining traction in academic and practical applications. The upper-right quadrant hosts the Motor Themes, which are both well-developed and central to the current discourse. These include significant topics like "CO2 emissions," "panel-data," "corruption," "impact," "corporate social responsibility," and "determinants." These themes are driving much of the conversation and research in environmental governance and sustainability, indicating their established presence in these fields.

In the lower-left quadrant, the Emerging or Declining Themes such as "patterns," "migration," "reduction," and "equity" are identified. These themes are considered less central and are characterized by either nascent interest or diminishing relevance, reflecting shifts in focus within the broader environmental and governance discussions.

Finally, the lower-right quadrant contains the Basic Themes, which include "systems," "cities," "climate change," "governance," "management," and "sustainability." These topics are highly relevant and form the foundation of environmental and governance discourse.

Although they are continually pertinent, they are not currently experiencing significant developmental changes or innovations.

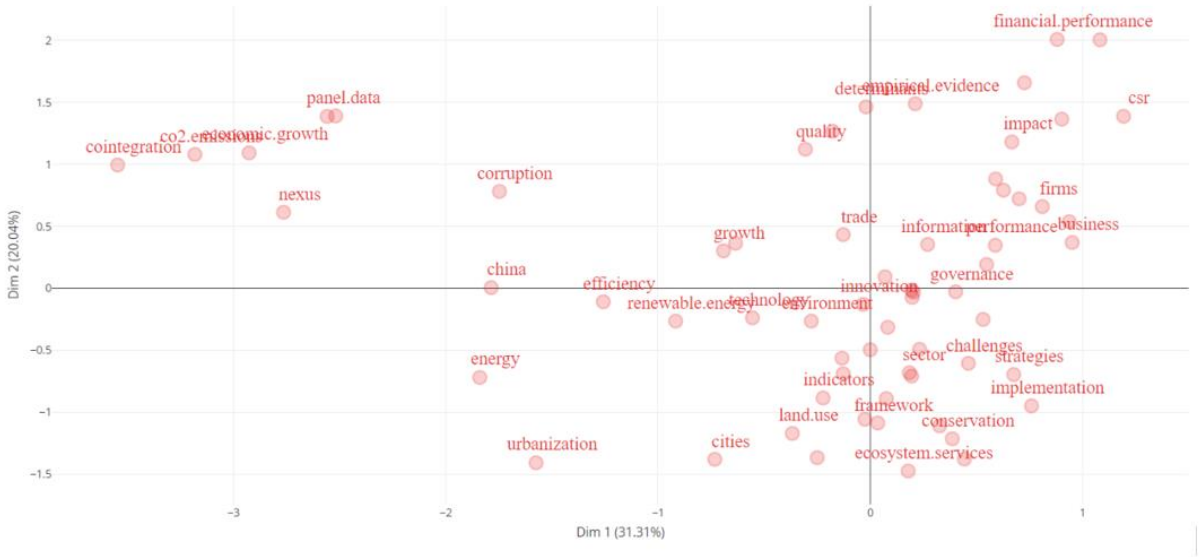
Complementary to Figure 4, Figure 5 delineates the grouping of some aspects that are more closely related to each other. It was used a Principal Component Analysis (PCA) where both variables and cases are plotted on the same axes. The axes represent the principal components that explain the most variance in the data, with the first dimension (Dim 1) on the x-axis and the second dimension (Dim 2) on the y-axis (Hair et al, 2019).

The top left cluster includes terms like "CO2," "economic growth," and "cointegration," suggesting a focus on the statistical relationships between carbon dioxide emissions and economic activities within environmental and economic studies. At the center of the plot, terms such as "efficiency," "renewable energy," "innovation," "technology," and "environment" converge. This central positioning indicates a possibly interdisciplinary focus encompassing technology, environmental impact, and efficiency.

To the right, the plot clusters terms including "financial performance," "CSR" (Corporate Social Responsibility), "firms," "business," "governance," and "impact." This area reflects a strong emphasis on how businesses influence and are influenced by various factors, including CSR and financial performance.

The lower central area groups terms like "land use," "indicators," "conservation," "ecosystem services," and "framework," indicating a thematic concentration on environmental management and sustainability frameworks. Lastly, some terms such as "China," "urbanization," and "cities" stand relatively isolated from the central clusters, highlighting them as specific case studies or unique contexts within the broader research space.

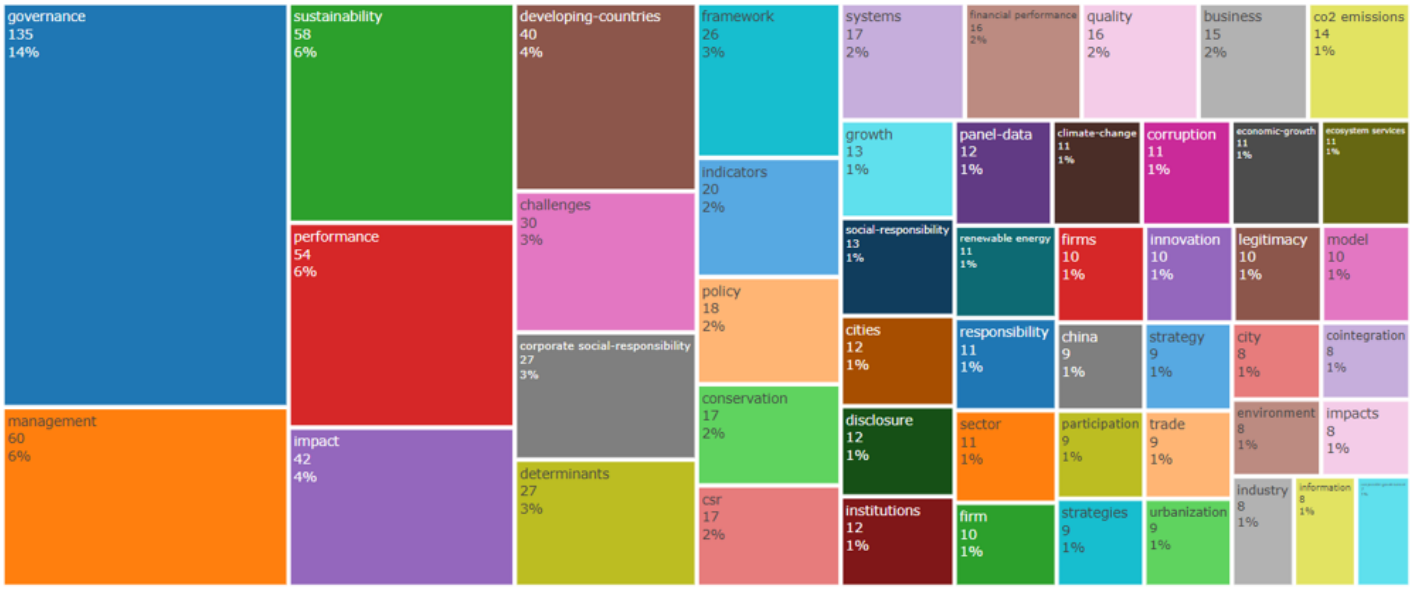
Figure 6. Principal components analysis of key terms



Finally, Figure 7 depicts a tree map, that maps the aspects discussed and their developments. Governance emerges as the most prominent theme, occupying 14% of the treemap, suggesting it's a major area of study possibly encompassing corporate, environmental, or public governance issues. Management and performance, each at 6%, also stand out as significant themes, indicating a strong emphasis on management practices and performance metrics across various sectors. Sustainability, represented by a block taking up 6% of the space, underscores ongoing research into sustainable practices, strategies, and impacts. Other substantial blocks include developing countries, frameworks, challenges, and impact, highlighting active research areas focused on developing country issues, organizational frameworks, operational challenges, and impact assessments.

Corporate Social Responsibility (CSR), along with related topics like responsibility and disclosure, also occupies a notable portion of the treemap. This reflects the dataset's strong orientation towards CSR issues and their management within organizations. Smaller blocks such as those representing climate change, renewable energy, China, urbanization, and ecosystem services, though less dominant, indicate crucial, possibly niche or emerging areas of research. These topics often focus on specific geographic regions or particular aspects of environmental and business studies. The presence of diverse terms like policy, institutions, corruption, and trade reveals the dataset's multidisciplinary nature, connecting governance and management to broader socio-economic and environmental contexts.

Figure 7 – Tree map of key topics



Taken together, these results allow a comprehensive scenario of theoretical discussion on the interplay between Sustainability and Governance's current discussion and emerging topics. A quantitative comparison between major players was also undertaken to complement this analysis.

4.3 Quantitative analysis

To enhance the depth and scope of our theoretical analysis, we conducted a detailed comparison of key governance indicators—Voice, Corruption Control, Government Effectiveness, and Political Stability—and sustainability metrics—Life Expectancy, CO2 Emissions, Gini Index, Patents Issued, and Access to Clean Cooking Fuels—between Brazil and China. This comparison provides a comprehensive overview of the relative performance and policy outcomes in these two significant global economies, shedding light on their governance styles and sustainability practices.

Table 1 and 2 presents the initial comparisons between Brazil in China in terms of Governance.

Table 1. Brazil Governance topics

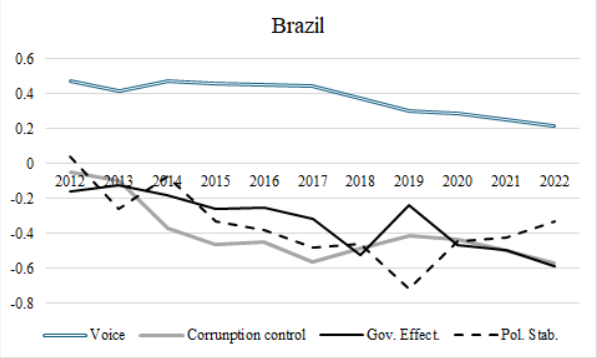
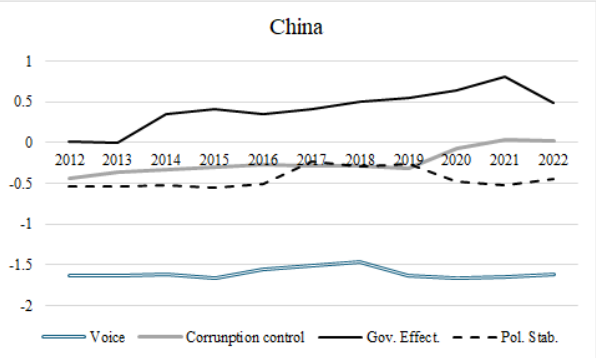


Table 2. China Governance topics



For Brazil, the comparison between Table 1 and 2 illustrates a gradual decline in Voice in terms of poçitical participation and freedom of expression , suggesting diminishing public participation in government over the decade. Corruption Control in Brazil shows fluctuations, with a significant dip around 2016 followed by a partial recovery, indicating inconsistency in anti-corruption efforts. Government Effectiveness in Brazil sees a mild but continuous decline, pointing to a gradual decrease in the government's ability to deliver public services and implement effective policies. Political Stability is marked by notable volatility, with sharp declines particularly around 2016 and 2018, highlighting periods of political uncertainty or turmoil. In contrast, China's indicators display different trends. The Voice parameter remains consistently low throughout the decade, indicating a sustained lack of public accountability in governance. Corruption Control in China shows a slight upward trend, suggesting gradual improvements in handling corruption. Government Effectiveness starts at a higher level and, despite a slight decline, remains relatively high, suggesting a generally effective governmental administration. The Political Stability trend line for China, however, shows a general decline, indicating growing political uncertainties over time.

Comparatively, both Brazil and China exhibit challenges in Voice and Political Stability, albeit in different magnitudes and dynamics. China maintains more consistency but at lower levels of public governance participation, while Brazil experiences more significant fluctuations. In terms of Corruption Control and Government Effectiveness, China demonstrates greater stability and effectiveness compared to Brazil’s more variable performance, reflecting their respective political, cultural, and administrative environments. This analysis underscores the

distinct governance challenges and styles in Brazil and China, highlighting the differences in how each country manages its governance issues over the observed period.]

Table 3 provides a comparison between Brazil and China in terms of some indicators of Sustainability (Life expectancy, CO2 emissions, Gini index, Patent issued, Clean fuel for cooking).

Table 3. Sustainability indicators comaprison, Brazil and China

Indexes	Country	Mean	sd	p-value	Effect (Cohen' d)	LLCI	ULCI
Life exp.	China	77.18	0.663	0.001	4.42	2.09	6.72
	Brazil	74.43	0.579				
CO2 em.	China	7.34	0.25	0.001	23.19	12.06	33.87
	Brazil	2.22	0.188				
Gini.	China	39.01	1,400	0.001	-9.23	-13.74	-4.71
	Brazil	52.56	1,533				
Patent	China	1.05E+06	307,712,874	0.001	4.8	2.3	7.26
	Brazil	5051.22	321,817				
Clean fuel cook	China	72.72	6,298	0.001	-5.13	-7.75	-2.49
	Brazil	95.68	0.583				

Sd = standard deviation; LLCI = low level confidence interval, ULCI = upper level confidence interval

It presents a detailed statistical analysis comparing various socio-economic and environmental indices between China and Brazil. The indices examined include life expectancy, CO2 emissions, income inequality (Gini index), patent registrations, and the usage of clean fuel for cooking. The analysis employs statistical tools to highlight mean values, standard deviations, significance levels (p-values), and effect sizes (Cohen's d) along with confidence intervals (LLCI and ULCI) for each index.

China shows a higher life expectancy at 77.18 years, significantly greater than Brazil's 74.43 years, with a robust effect size of 4.42, indicating a marked difference in life expectancy between the two nations. This suggests better health or social conditions that might contribute to longevity in China compared to Brazil. In environmental metrics, China's CO2 emissions stand at an average of 7.34 units, substantially higher than Brazil's 2.22 units. The effect size is a massive 23.19, which underscores the vast difference in emissions levels, reflecting China's larger industrial base and higher fossil fuel usage compared to Brazil's more mixed energy profile. The Gini index, a measure of income inequality, shows China at 39.01, which is considerably lower than Brazil's 52.56. The negative effect size of -9.23 for China suggests less income disparity compared to Brazil, where higher values indicate greater inequality.

Innovation, measured by patent registrations, presents another stark contrast. China reported a staggering 1.05 million patents, significantly ahead of Brazil, which registered only 5051.22 patents. The effect size of 4.8 highlights China's dominant position in technological advancements and intellectual property. The use of clean fuel for cooking is 72.72% in China, which is lower than in Brazil, where 95.68% of the population uses clean fuel. The negative effect size of -5.13 for China points to potential areas for environmental and health improvement compared to Brazil's higher adoption rate.

5.DISCUSSION

The results of this study must be observed in combination. First, the thoretical discussion of researchers provide a landscape of existing and trendinf topics on the interplay between Sustainability and Governance. These results were complemented by the comparisson of two major developing countries, Brazil and China. The collection of data depicted in the series of discussions from our study provides a basis for discussing the theoretical implications of the evolving relationship between governance and sustainability. This discussion is framed around the patterns observed in publication trends, journal prominence, geographical distribution of research, and the emerging themes within the field. Each aspect contributes to a broader understanding of how governance structures are increasingly interacting with sustainability goals in both policy and practice.

The trends in publication frequency, as shown in Figure 1, provide insights into the academic community’s shifting focus towards governance and sustainability. The initial increase followed by a peak and subsequent declines suggest a theoretical evolution within the field. The peak in publications around 2020-2021 might reflect a response to global events such as the pandemic, highlighting a surge in interest in how governance can adapt to and incorporate sustainability in crisis scenarios. This could imply a theoretical shift towards resilience in governance systems, emphasizing the ability to maintain sustainability goals under stress.

The decline following the peak could indicate that the field is moving towards a new paradigm, potentially focusing on more integrated and holistic approaches to sustainability that require longer periods of research and development before publication. This suggests a maturation within the academic discourse where simple acknowledgments of the importance

of sustainability are giving way to more sophisticated and nuanced theories on how governance can effectively interact with sustainability goals. The dominance of specific journals, such as the "Journal of Cleaner Production," as indicated in Figure 2, suggests that certain research communities are at the forefront of integrating sustainability concepts into practical and theoretical frameworks. The prominence of this journal may reflect an operationalization of sustainability in governance, moving theoretical discussions into practical, measurable outcomes. This could indicate a theoretical shift from abstract conceptualizations of sustainability towards more concrete, application-oriented research that provides clear guidelines and frameworks for implementation in various governance contexts. The geographical distribution of publications, detailed in Figure 3, reveals significant international collaboration and diverse contributions from various countries. The strong performance of countries like China in both single-country and multi-country publications suggests a robust internal and international interest in advancing sustainability governance. This may indicate a theoretical inclination towards comparative studies that explore different governance frameworks across cultural and political contexts, enriching the global understanding of sustainability practices.

Moreover, the substantial engagement of countries with varying degrees of development and different governance systems in sustainability research highlights a theoretical acknowledgment of the universal relevance of sustainability. It suggests a growing consensus on the need for governance systems worldwide to integrate sustainability, regardless of the country's development status. The identification of emerging themes in Figures 4 and 5 suggests that certain topics are gaining theoretical prominence, such as the integration of sustainability in corporate governance and the importance of policy frameworks in supporting sustainable practices. The focus on terms like "CO2 emissions," "corporate social responsibility," and "policy" over time reflects a theoretical evolution towards a more accountability-oriented approach in governance regarding sustainability. These discussions likely stem from a theoretical understanding that sustainability challenges are not just environmental but deeply entwined with economic and social governance structures. This implies a move towards theories that advocate for systemic changes in governance to address sustainability effectively, emphasizing policies that integrate environmental, social, and economic dimensions.

The comparative analysis of governance and sustainability indicators for Brazil and China provides a revealing glimpse into the complex interplay between political systems and their impact on socio-economic outcomes and environmental sustainability. This discussion critically examines the differences highlighted in the governance structures of both countries and the implications of those differences on broader sustainability metrics. Voice and The decline in Brazil's Voice and the consistently low levels in China raise important questions about the role of public participation and freedom of expression in achieving sustainable development. Theoretically, this suggests that sustainability may not necessarily correlate with democratic practices, challenging theories that posit a strong link between democratic governance and environmental management. This could lead to a reevaluation of how political rights and civic engagement influence policy making in different governance frameworks.

The fluctuation in Brazil's corruption control and China's gradual improvements suggest that different approaches to combating corruption could have varying levels of effectiveness on governance outcomes. This underscores theories that link strong institutional integrity and transparency to better governance, but it also suggests that the pathways to achieving these may differ significantly depending on the political and administrative context of the country. The decline in government effectiveness in Brazil compared to relatively high levels in China could imply that different governmental systems (democratic vs. authoritarian) have distinct capacities for policy implementation. This observation might support theories that argue for the efficiency of centralized systems in rapid policy deployment and management, albeit at the potential cost of reduced public scrutiny and participation.

China’s higher CO2 emissions alongside its greater industrialization and higher life expectancy compared to Brazil highlight the complex trade-offs between economic development, environmental sustainability, and health outcomes. This could lead to a nuanced understanding in the sustainability literature regarding the "environmental Kuznets curve," which theorizes that economic development initially leads to environmental degradation before improving as income levels increase. The Gini index results showing less income disparity in China compared to Brazil contrast with expectations based on their political systems. This might challenge existing theories that associate more egalitarian societies with democratic systems and suggest that different forms of governance can achieve reductions in inequality through

varied mechanisms, which in turn may affect sustainability outcomes differently. The stark contrast in patent registrations highlights the role of governmental policies in fostering innovation. This aligns with theories that stress the importance of state-led strategies in technological advancement and environmental innovation. It suggests that proactive policy measures, regardless of the political regime, can significantly enhance a country's innovative capacity and thus its ability to tackle sustainability challenges.

6.CONCLUSION

The comparative analysis of Brazil and China in terms of governance and sustainability reveals critical insights into the interplay between governance structures and sustainability outcomes in developing countries. Key findings from this study underscore the significance of effective governance mechanisms in promoting sustainable development. Brazil demonstrates better sustainable conditions but lags in business aspects, whereas China exhibits robust economic and technological advancements but faces challenges in sustainable practices.

Theoretical contributions from this research highlight the evolving academic interest in governance and sustainability, emphasizing pollutant emissions, corporate responsibility, and country performance. The study also reflects a global trend towards integrating sustainable practices within corporate governance frameworks, driven by policy shifts and heightened public awareness.

Future Studies

Future research should aim to deepen the understanding of the mechanisms that enhance governance and sustainability. Specific areas of interest include:

a) Longitudinal Studies: Conducting long-term studies to observe the impacts of governance reforms on sustainability metrics over extended periods.
b) Comparative Analysis: Expanding comparative studies to include other developing nations with diverse political, economic, and cultural contexts to generalize findings and identify universal governance strategies.
c) Policy Frameworks: Investigating the effectiveness of different policy frameworks in integrating sustainability within corporate and public governance.
d) Technological Innovations: Exploring the role of technological innovations and digital governance in enhancing sustainable practices and reducing environmental impacts.

e) **Stakeholder Engagement**: Examining the role of various stakeholders, including NGOs, civil society, and the private sector, in promoting governance and sustainability.

This research underscores the need for a multifaceted approach that combines empirical data with theoretical insights to foster sustainable development in developing countries. By addressing these areas, future studies can contribute to the development of more effective governance models that promote both economic growth and environmental stewardship.

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