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Climate Risk Disclosure in Mining: Transparency and Corporate Accountability

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Abstract

The mining industry is both a major contributor to climate change and highly exposed to climate-related risks, making climate risk disclosure (CRD) a critical tool for enhancing corporate transparency and accountability. However, despite increasing reporting practices, the quality and consistency of climate disclosures remain uneven. This study aims to analyze how CRD contributes to transparency and accountability in the mining sector. The research employs a qualitative approach using a systematic literature review and document analysis of relevant academic studies and reporting frameworks such as TCFD and GRI. Data were collected through structured stages of identification, screening, eligibility, and inclusion, and analyzed using thematic and content analysis. The findings indicate that while climate disclosures are increasingly adopted, many remain symbolic and lack integration with financial impacts and strategic decision-making. High-quality disclosures—characterized by comprehensive emission reporting, governance involvement, and adherence to international standards—enhance transparency and accountability. However, challenges such as greenwashing, inconsistent standards, and weak market responses persist. In conclusion, climate risk disclosure has significant potential to strengthen transparency and accountability in the mining industry, but its effectiveness depends on the depth, consistency, and substantive integration of disclosed information.

Keywords : *Climate Risk Disclosure, Transparency, Accountability, Mining Industry, Sustainability*

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1. Introduction

The increasing urgency of climate change has significantly reshaped the expectations placed on high-impact industries, particularly the mining sector, which is both a major contributor to greenhouse gas emissions and highly vulnerable to climate-related risks. As global stakeholders including regulators, investors, and civil society demand greater environmental responsibility, *climate risk disclosure (CRD)* has emerged as a critical mechanism for enhancing corporate transparency and accountability. In the context of the mining industry, CRD is not only a reporting requirement but also a strategic tool that reflects how firms identify, assess, and manage climate-related risks and opportunities. The integration of climate considerations into corporate reporting frameworks such as the Task Force on Climate-related Financial Disclosures (TCFD) and Global Reporting Initiative (GRI) further underscores the importance of standardized, reliable, and decision-useful information. However, despite growing awareness and regulatory pressure, the quality and comprehensiveness of climate risk disclosure in the mining sector remain highly inconsistent, raising concerns about the credibility and effectiveness of such disclosures in supporting sustainable decision-making.

Empirical evidence indicates that although there has been a notable increase in the volume of climate-related disclosures, their depth and relevance often fall short of stakeholder expectations. A global study of extractive companies reveals that climate risk disclosures in annual reports are generally inadequate, with limited incorporation of climate scenarios and minimal consideration of the impacts on reserves, assets, and potential *stranded assets* (Baboukardos et al., 2021). Notably, only a small proportion of companies explicitly link climate risks to asset impairment testing, and none adjust asset useful lives in response to climate considerations. This suggests that climate risks are frequently treated as peripheral issues rather than integral components of financial and operational decision-making. Similarly, studies in Australia and Indonesia show that while companies often mention emissions, carbon footprints, and climate change in their reports, such disclosures are frequently symbolic and lack substantive evidence of commitment or action, indicating potential practices of *greenwashing* (Miklošík & Evans, 2021; Agung et al., 2023).

The issue of disclosure quality is further complicated by inconsistencies in reporting standards and practices. While frameworks such as GRI and TCFD provide guidance for climate-related disclosures, their adoption and implementation vary significantly across firms and jurisdictions. Research on GRI-based reporting indicates that mining companies tend to provide relatively more transparent information on high-risk environmental issues compared to sectors such as finance; however, these disclosures are still far from balanced or comprehensive (Zharfpeykan, 2021). This imbalance suggests that companies may selectively disclose information that aligns with their reputational interests while omitting or downplaying more critical risks. Consequently, the lack of standardization and comparability undermines the reliability of climate disclosures and limits their usefulness for stakeholders.

Despite these challenges, there is growing recognition of best practices in climate risk disclosure within the mining industry. Leading companies increasingly adopt comprehensive reporting approaches that include Scope 1, Scope 2, and Scope 3 emissions, detailed climate risk assessments, scenario analysis, and integrated sustainability strategies. Such practices not only enhance transparency but also build investor confidence by demonstrating a proactive approach to climate risk management (Ukhova & Pinaev, 2024; Gustafsson et al., 2021; Finucane & Bibby, 2023). Moreover, the integration of environmental, social, and economic dimensions into corporate reporting

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reflects a shift toward more holistic and accountable governance models. However, the adoption of these best practices remains uneven, particularly in emerging economies where regulatory enforcement and institutional capacity may be limited.

The variability in climate risk disclosure is also influenced by a range of internal and external factors. Governance structures, such as the presence of independent and diverse boards or risk committees, have been shown to positively influence the extent and quality of disclosures (Ojeyinka & Matemane, 2025). Similarly, firms with strong environmental performance and certifications, such as ISO 14001, are more likely to provide transparent and comprehensive climate-related information (Kurniawan et al., 2024). External pressures, including government ownership, creditor demands, and public attention—as reflected in digital indicators such as Google Trends—also play a significant role in shaping disclosure practices (Octavio & Setiawan, 2025). In addition, regulatory frameworks and ESG standards contribute to the standardization and deepening of disclosures by requiring firms to report not only environmental impacts but also the financial implications of climate risks (Baboukardos et al., 2021; Sulik-Górecka, 2025; Nyakuwanika & Panicker, 2025).

From a theoretical perspective, improved climate risk disclosure is often associated with enhanced corporate performance and value creation. Empirical studies suggest that firms with higher levels of climate transparency tend to exhibit better financial performance indicators, such as earnings per share (EPS), economic value added (EVA), and return on equity (ROE), particularly in developing economies (Matemane & Graca, 2023). This supports the argument that transparency reduces information asymmetry, enhances investor confidence, and contributes to more efficient capital allocation. However, this relationship is not universally observed. In some contexts, particularly in Indonesia, the market does not fully reward climate-related disclosures, as investors continue to prioritize traditional financial metrics and governance factors over environmental considerations (Yolifiandri et al., 2025; Siswati & Sumayyah, 2025). This indicates a gap between the theoretical benefits of climate transparency and its practical valuation in financial markets.

Furthermore, recent studies highlight the evolving nature of climate-related narratives within corporate disclosures. For example, analyses of mining companies in South Africa reveal a shift in climate-related sentiment from a focus on risks to an emphasis on opportunities, such as innovation, efficiency, and sustainable growth (Stander, 2025). While this shift may reflect genuine strategic adaptation, it also raises concerns about the potential for narrative manipulation and selective disclosure. The consistency and clarity of information are therefore critical in distinguishing between authentic disclosures and greenwashing practices. In this regard, high-quality and consistent reporting can mitigate reputational risks and enhance long-term market performance (Nyakuwanika & Panicker, 2025).

Despite the growing body of literature on climate risk disclosure, several research gaps remain. First, existing studies often focus on specific aspects of disclosure, such as environmental performance or governance factors, without providing an integrated analysis of transparency and accountability within the mining sector. Second, there is limited research that critically examines the alignment between disclosed information and actual corporate practices, particularly in relation to financial implications and long-term risk management. Third, the role of external pressures and institutional contexts in shaping disclosure quality is not sufficiently explored, especially in emerging economies. Finally, inconsistencies in reporting standards and the lack of comparability across firms hinder the development of a unified framework for evaluating climate risk disclosure.

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The novelty of this study lies in its comprehensive and integrative approach to analyzing climate risk disclosure in the mining industry. Unlike previous studies that focus on isolated dimensions, this research examines CRD through the dual lenses of transparency and accountability, considering both the content and the context of disclosures. By synthesizing insights from multiple empirical studies and frameworks, this study aims to provide a more holistic understanding of how climate risk disclosure is practiced and how it contributes to corporate governance and stakeholder trust. Additionally, the study emphasizes the importance of aligning disclosure practices with substantive climate risk management, thereby addressing the gap between symbolic reporting and actual accountability.

Based on the foregoing discussion, the primary objective of this study is to analyze the extent to which climate risk disclosure in the mining industry enhances corporate transparency and accountability, as well as to evaluate the factors influencing its quality and effectiveness. Through this objective, the study seeks to contribute to the development of more robust reporting practices and to support the advancement of sustainable governance in high-impact industries.

2. Method

This study employs a normative juridical approach combined with a qualitative research design to examine climate risk disclosure (CRD) practices in the mining industry, with a focus on transparency and accountability. The research relies on secondary data sources, including peer-reviewed journal articles, sustainability reports, annual reports of mining companies, and international reporting frameworks such as TCFD, GRI, and ESG guidelines. The data collection process is conducted through a systematic literature review, following structured stages of identification, screening, eligibility, and inclusion. Relevant literature is retrieved from reputable academic databases such as Scopus, Web of Science, and Google Scholar using keywords including “climate risk disclosure,” “mining industry,” “transparency,” “accountability,” and “ESG reporting.” Inclusion criteria prioritize recent publications, high-quality indexed journals, and studies directly مرتبط with CRD practices, while exclusion criteria remove duplicate, irrelevant, or non-scholarly sources. In addition, document analysis is applied to selected corporate reports to capture practical disclosure patterns and align them with theoretical frameworks.

The data analysis utilizes a combination of qualitative thematic analysis and content analysis. Thematic analysis is employed to identify recurring patterns, themes, and relationships related to the quality, drivers, and implications of climate risk disclosure, particularly in terms of transparency and accountability. Meanwhile, content analysis is used to systematically evaluate the depth, consistency, and relevance of disclosed information, including aspects such as emission reporting (Scope 1, 2, 3), climate risk scenarios, and financial impact disclosures. The analytical process involves data coding, categorization, comparison, and interpretative synthesis to generate comprehensive insights. Furthermore, a comparative analytical approach is applied to examine differences across geographical contexts and regulatory environments, highlighting how institutional pressures and governance structures influence disclosure practices. Through this integrated analytical framework, the study aims to provide a robust and nuanced understanding of climate risk disclosure in the mining sector.

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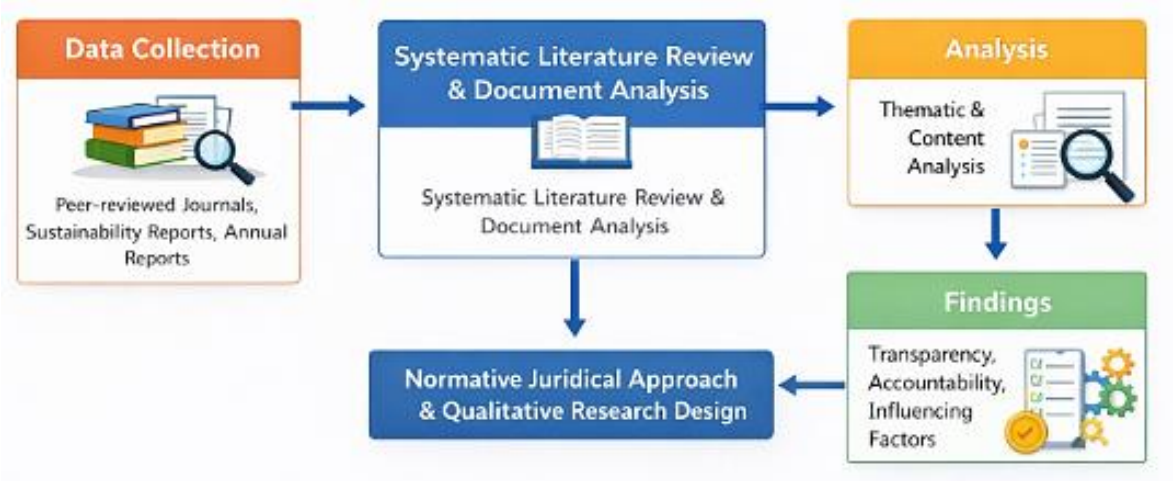

Figure 1. Conceptual Framework This Research

3. Results and Discussion

Based on the systematic literature review and qualitative analysis conducted, this study synthesizes key findings regarding the quality, drivers, and implications of climate risk disclosure (CRD) in the mining industry. The results are organized to highlight the relationship between disclosure dimensions, influencing factors, and their impact on transparency and accountability.

Table 1. Climate Risk Disclosure Dimensions, Drivers, and Implications in the Mining Industry

No	Disclosure Dimension	Key Indicators	Influencing Factors	Implications for Transparency & Accountability	Supporting Studies
1	Emission Disclosure	Scope 1, 2, 3 emissions reporting	Environmental performance, ISO certification	Enhances transparency of carbon footprint and operational impact	(Kurniawan et al., 2024; Ukhova & Pinaev, 2024)
2	Climate Risk Reporting	Climate scenarios, physical & transition risks	Regulatory frameworks (TCFD, GRI), governance structure	Improves risk awareness and accountability in decision-making	(Baboukardos et al., 2021; Finucane & Bibby, 2023)
3	Financial Impact Disclosure	Asset impairment, stranded	Board oversight, risk committee effectiveness	Strengthens linkage between climate risk	(Baboukardos et al., 2021; Ojeyinka &

		assets, capital allocation		and financial performance	Matemane, 2025)
4	Sustainability Integration	ESG strategy, environmental-social-economic alignment	External pressure (investors, public attention)	Builds stakeholder trust and long-term accountability	(Octavio & Setiawan, 2025; Gustafsson et al., 2021)
5	Narrative Disclosure	Climate-related narratives, opportunities vs risks	Public sentiment, corporate communication strategy	Influences perception and potential greenwashing risks	(Stander, 2025; Nyakuwanika & Panicker, 2025)
6	Governance Disclosure	Board diversity, independence, risk committees	Corporate governance quality	Enhances oversight and credibility of disclosures	(Ojeyinka & Matemane, 2025)
7	Compliance with Standards	Adoption of TCFD, GRI, ESG frameworks	Regulatory pressure and global standards	Improves comparability and standardization of reporting	(Sulik-Górecka, 2025; Baboukardos et al., 2021)

The interpretation of Table 1 indicates that climate risk disclosure in the mining industry is multidimensional and influenced by both internal governance mechanisms and external pressures. Disclosure practices that include comprehensive emission reporting, scenario-based risk analysis, and financial impact integration tend to enhance transparency and strengthen corporate accountability. However, the findings also reveal that inconsistencies in disclosure quality—particularly in narrative reporting and financial linkage—can undermine credibility and increase the risk of greenwashing. Moreover, the role of governance structures and regulatory frameworks is critical in ensuring the reliability and comparability of disclosed information. Overall, effective climate risk disclosure requires not only compliance with standards but also a substantive commitment to integrating climate considerations into corporate strategy and decision-making processes.

Discussion

The findings presented in Table 1, derived from a systematic literature review and qualitative analysis, provide a comprehensive understanding of how climate risk disclosure (CRD) operates within the mining industry and its implications for transparency and accountability. In line with the research objective—to analyze the extent to which climate risk disclosure enhances corporate transparency and accountability—the discussion reveals that CRD in the mining sector is characterized by a paradox: while disclosure practices are increasing in frequency, their quality, depth, and decision-usefulness remain uneven and often insufficient. This inconsistency reflects broader structural and institutional

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challenges in aligning corporate reporting practices with the growing demands for climate accountability.

One of the most critical issues identified in the findings is the persistent gap in the quality of climate risk disclosure. Although companies increasingly report climate-related information, much of this disclosure remains superficial and lacks substantive integration into financial and operational decision-making. Empirical evidence shows that many mining companies fail to incorporate climate scenarios, assess the impact of climate risks on reserves and assets, or consider the implications of *stranded assets* in their reporting (Baboukardos et al., 2021). As highlighted in Table 1, the dimension of financial impact disclosure is particularly weak, with limited linkage between climate risks and key financial indicators such as asset impairment and capital allocation. This suggests that climate risks are often treated as peripheral issues rather than core strategic concerns, undermining the credibility and usefulness of disclosures for investors and other stakeholders.

Furthermore, the findings reveal that narrative disclosure practices frequently contribute to the problem of *greenwashing*. In contexts such as Australia and Indonesia, companies often include references to emissions, carbon footprints, and climate change in their reports; however, these disclosures are often symbolic and lack concrete evidence of action or measurable targets (Miklošík & Evans, 2021; Agung et al., 2023). This disconnect between rhetoric and reality reduces the reliability of climate disclosures and weakens corporate accountability. As indicated in Table 1, narrative disclosure plays a dual role: while it can shape stakeholder perceptions and communicate corporate intentions, it also carries the risk of being used strategically to enhance corporate image without corresponding substantive action. Therefore, the quality and consistency of narrative disclosures are critical in determining whether they contribute to genuine transparency or merely serve as tools of impression management.

Despite these challenges, the mining sector demonstrates some progress in adopting best practices for climate risk disclosure. The findings highlight that leading companies increasingly report comprehensive emission data, including Scope 1, Scope 2, and Scope 3 emissions, and integrate climate risk assessments into their strategic planning processes. Such practices enhance transparency by providing stakeholders with detailed and comparable information on environmental performance and risk exposure (Ukhova & Pinaev, 2024; Finucane & Bibby, 2023). Moreover, the integration of sustainability dimensions—environmental, social, and economic—into corporate reporting reflects a shift toward more holistic and accountable governance models (Gustafsson et al., 2021). As shown in Table 1, sustainability integration is a key dimension that strengthens stakeholder trust and supports long-term value creation. However, the adoption of these practices remains uneven, particularly in regions where regulatory frameworks and institutional pressures are less developed.

The role of governance structures and external pressures emerges as a significant determinant of disclosure quality. The findings indicate that internal governance mechanisms, such as board composition, independence, and the presence of risk committees, positively influence the extent and depth of climate risk disclosure (Ojeyinka & Matemane, 2025). Companies with strong governance frameworks are more likely to provide comprehensive and reliable information, reflecting a higher level of accountability. In addition, environmental performance and certifications, such as ISO 14001, are associated with increased transparency in emission reporting (Kurniawan et al., 2024).

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These findings underscore the importance of organizational capacity and commitment in shaping disclosure practices.

External pressures also play a crucial role in driving climate risk disclosure. As shown in Table 1, factors such as government ownership, creditor influence, and public attention significantly affect the extent of disclosure. In particular, heightened public scrutiny and digital visibility—measured through indicators such as internet search trends—encourage companies to disclose more comprehensive climate-related information (Octavio & Setiawan, 2025). Regulatory frameworks and international standards, including TCFD, GRI, and ESG guidelines, further contribute to the standardization and deepening of disclosures by requiring firms to report not only environmental impacts but also the financial implications of climate risks (Baboukardos et al., 2021; Sulik-Górecka, 2025; Nyakuwanika & Panicker, 2025). However, the effectiveness of these frameworks depends on their consistent implementation and enforcement, which varies across jurisdictions.

Another important dimension of the discussion relates to the relationship between climate risk disclosure, transparency, and corporate value. The findings suggest that improved disclosure practices are associated with enhanced financial performance in certain contexts, supporting the argument that transparency can create value by reducing information asymmetry and increasing investor confidence (Matemane & Graca, 2023). This aligns with stakeholder theory, which posits that transparent and accountable practices strengthen relationships with stakeholders and contribute to long-term sustainability. However, the evidence also indicates that this relationship is not uniform across all markets. In Indonesia, for example, investors often prioritize traditional financial indicators and governance factors over climate-related disclosures, resulting in a weak or insignificant impact on firm value (Yolifiandri et al., 2025; Siswati & Sumayyah, 2025). This suggests that the market valuation of climate transparency is contingent on the maturity of financial markets and the level of environmental awareness among investors.

The evolving nature of climate-related narratives further complicates the relationship between disclosure and accountability. Recent studies indicate a shift in corporate discourse from emphasizing climate risks to highlighting opportunities, such as innovation and efficiency gains (Stander, 2025). While this shift may reflect genuine strategic adaptation, it also raises concerns about selective disclosure and narrative bias. As indicated in Table 1, narrative disclosure can influence stakeholder perceptions and market behavior, particularly when it is consistent and supported by credible data. However, inconsistent or overly optimistic narratives may obscure underlying risks and contribute to misinformation. Therefore, ensuring the accuracy and balance of climate-related narratives is essential for maintaining transparency and accountability.

The findings also highlight significant regional disparities in climate risk disclosure practices. In ASEAN countries, for example, disclosure levels remain relatively low and are largely driven by external pressures rather than internal initiatives (Octavio & Setiawan, 2025). This suggests that many companies adopt a reactive rather than proactive approach to climate disclosure, responding to regulatory requirements and stakeholder demands rather than integrating climate considerations into their core strategies. Additionally, many companies focus primarily on business-related risks, such as water scarcity and infrastructure challenges, while neglecting broader social impacts, including community adaptation and resilience (Gustafsson et al., 2021). This narrow focus limits the scope of accountability and undermines the social dimension of sustainability.

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Another critical challenge identified in the findings is the lack of standardization and consistency in reporting practices. Despite the existence of international frameworks, significant variations in disclosure formats, metrics, and methodologies hinder comparability and reduce the reliability of climate-related information. As noted in multiple studies, inconsistencies in reporting standards make it difficult for stakeholders to assess and compare the performance of different companies (Baboukardos et al., 2021; Agung et al., 2023; Matemane & Graca, 2023; Siswati & Sumayyah, 2025). This fragmentation underscores the need for more robust and harmonized reporting frameworks that can ensure the consistency, comparability, and credibility of climate disclosures.

In addressing these challenges, the role of systematic and integrated approaches becomes increasingly important. The findings suggest that improving climate risk disclosure requires not only compliance with existing standards but also a substantive commitment to integrating climate considerations into corporate governance, strategy, and operations. This includes enhancing the linkage between climate risks and financial performance, adopting scenario-based analysis, and ensuring the consistency and reliability of disclosed information. Furthermore, strengthening governance structures and increasing stakeholder engagement can enhance accountability and support more transparent reporting practices.

In relation to the research objective, this discussion demonstrates that climate risk disclosure in the mining industry has the potential to significantly enhance transparency and accountability, but its effectiveness is contingent on the quality, consistency, and integration of disclosed information. While progress has been made in increasing the volume of disclosures, substantial gaps remain in terms of depth, relevance, and comparability. Addressing these gaps requires coordinated efforts from companies, regulators, and stakeholders to develop and implement more robust and standardized reporting frameworks.

In conclusion, the analysis reveals that climate risk disclosure in the mining sector is at a critical juncture, where increasing expectations for transparency and accountability must be matched by improvements in disclosure quality and practice. By addressing the identified challenges and leveraging best practices, the mining industry can enhance its contribution to sustainable development and strengthen stakeholder trust in an era of growing climate uncertainty.

4. Conclusions and Suggestions

This study concludes that climate risk disclosure (CRD) in the mining industry plays a crucial role in enhancing corporate transparency and accountability, yet its effectiveness remains uneven due to significant variations in quality, depth, and consistency of disclosures. While many companies have increased the volume of climate-related reporting, much of the information remains symbolic, lacking integration with financial impacts, scenario analysis, and strategic decision-making. The findings demonstrate that high-quality CRD—characterized by comprehensive emission reporting, robust governance structures, adherence to international standards, and meaningful integration of sustainability dimensions—can strengthen accountability and improve stakeholder trust. However, persistent challenges such as greenwashing, weak standardization, and limited market appreciation in certain contexts hinder the full realization of its benefits. Therefore, climate risk disclosure in the mining sector has the potential to support transparency and accountability, but only when it is implemented substantively rather than merely procedurally.

Based on these findings, it is recommended that mining companies adopt a more integrated and standardized approach to climate risk disclosure by aligning their reporting practices with globally recognized frameworks such as TCFD and GRI, while explicitly linking climate risks to financial performance and long-term strategic planning. Strengthening corporate governance—particularly through independent and diverse boards and effective risk committees—is essential to ensure the credibility and depth of disclosures. Regulators should also enhance enforcement mechanisms and promote harmonized reporting standards to improve comparability and reliability across firms. Furthermore, companies are encouraged to expand their disclosures beyond environmental risks to include social impacts, particularly community adaptation and resilience, to strengthen holistic accountability. Future research should explore empirical measurement models for disclosure quality and examine how market mechanisms can better incentivize meaningful climate transparency.

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