SYSTEMATIC ASSESSMENT OF CLIMATE RISK AND SUSTAINABILITY-RELATED DISCLOSURE STANDARDS

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Dedication

I wish to dedicate this work to my family, who have been there for me throughout this journey and have provided their unconditional support. It would not have been possible for me to accomplish this work if my parents did not have confidence in my capabilities. My wife has always given her encouragement throughout this journey. I would like to acknowledge my kids, who have been very understanding and supportive of my endeavor.

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ABSTRACT

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Sustainability reporting is evolving significantly in light of growing climate change concerns. The research examines sustainability-related disclosure across major frameworks and standards and their usage by stakeholders, including disclosing companies, regulators, investors, and assurance providers. The research evaluates the alignment and effectiveness of major reporting frameworks across dimensions of size, emission level of sectors, and the market context and identifies the theoretical motivations.

The research utilizes a mixed-methods approach that includes quantitative analysis, surveys, statistical analysis, and interviews. The approaches include content analysis of reporting frameworks, analysis of sustainability reports from various sectors, surveys, and in-depth interviews with key stakeholders.

The research identifies two primary themes for sustainability disclosure. The first theme, referred to as the sustainability theme, focuses on the companies' sustainability practices consisting of environmental, social, and governance (ESG) areas, and the Global Reporting Initiative (GRI) is based on this theme. The second theme, referred to as the climate theme, focuses on the impact of climate-related changes on the financials of firms, and the International Financial Reporting System (IFRS) S2 is based on this theme.

There is very little overlap between the two themes, although there are ongoing efforts to make these reporting frameworks and standards interoperable. While ISSB creates a global baseline, ISSB emphasizes financial materiality and climate risk disclosures, which makes this popular among investors. GRI focuses on broader sustainability materiality relevant to multiple stakeholders.

The research concludes that metrics and targets are comparable within a sector. However, the requirements related to governance, strategy, and risk management and the interconnectedness of the four pillars under ISSB lack clarity and comparability. The assurance

mechanism requires robustness except for the metrics and targets pillar and linkages to sustainable finance. The research concludes that size, sector, and market context have a clear impact on the maturity of disclosures and assurance-related practices.

In terms of theoretical and practical implications, this research contributes to legitimacy and stakeholder theory by demonstrating regulatory pressure and stakeholder expectations driving framework adoption.

The research highlights ongoing challenges in framework harmonization and concludes that sustainability-related disclosures still require a clear definition and measurement to achieve the required objectives.

Keywords: sustainability, sustainability reporting, sustainability framework, climate risk, physical risk, transition risk, sustainability reporting standards, materiality assessment, sustainability assurance.

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CHAPTER I:

INTRODUCTION

1.1 Introduction

Sustainability was first defined by the Brundtland Commission of the United Nations (Brundtland, 1987) as meeting the needs of the present without compromising the ability of future generations to meet their own needs. Since the term sustainability first came into existence, disclosures relating to sustainability have changed in several ways (Kaur *et al.*, 2023). To aid investors in making decisions, sustainable reporting has evolved from optional Corporate Social Responsibility (CSR) to being a required component of non-financial reporting. As noted by (Wendt, 2015), sustainability considerations have evolved from optional corporate social responsibility components to essential factors for accessing funding and managing risks. A new specialized branch of climate risk has emerged in the broader concept of sustainability, and climate risks are now recognized as crucial across economies (Batten, 2018).

The Paris Agreement was a turning point in the fight against climate change and served as the standard for nations as they became obligated to determine their Nationally Determined Contributions (NDCs) (Agreement, 2015). The Paris Agreement helped corporations build various multinational coalitions, including coalitions of various investors and other financial interests (Morgan and Northrop, 2017). Principles for Responsible Investment (PRI), Climate Action 100+, Principles for Responsible Banking (PRB), Net Zero Banking Alliance (NZBA), Net Zero Asset Owners Alliance (NZAOA), and Net Zero Asset Managers Initiative are a few of these coalitions. Corporates communicate their commitments and achievements to these alliances through corporate sustainability filings (Tajunnisa *et al.*, 2023). Consequently, sustainability reporting has strongly shaped current sustainability practices across numerous enterprises and financial institutions (Bhat and Abdullah, 2023).

The emergence of climate risk as a topic of importance has led to the development of climate risk reporting as a specialized area of interest for different stakeholders, particularly investors, who want to integrate the climate-related information in their valuation models (Clapp *et al.*, 2017). The emergence of Task Force on Climate-related Financial Disclosures (TCFD) (Board, 2017) in 2015 marked the evolution of the integration of climate risk in sustainability reporting. Prior to 2015, the inclusion of a climate-related focus was optional, even in the optional Environmental, Social, and Governance (ESG) disclosures. Some investors, who were covering companies related to oil and gas, coal, thermal power, etc., used to track stranded assets in these sectors, but they did so without any reference to climate risk or transition risk (Basu *et al.*, 2022). The TCFD disclosures brought climate risk-related disclosures to the forefront, and their endorsement by various industry bodies mainstreamed them. After 2021, the integration of various reporting standards like TCFD, Sustainability Accounting Standards Board (SASB), Climate Disclosure Standards Board (CDSB), and the Integrated Reporting framework and the formation of International Sustainability Standards Board (ISSB) with separate disclosures for climate risk in IFRS S2 and the adoption of these disclosures by various regulators made this mainstream (Brenner, 2023). This evolution reflects the growing importance of climate risk disclosures in the decision-making process. TCFD has been referred to as a climate-related reporting framework, and GRI, SASB, and the latest IFRS S1 and S2 are being called standards. However, we are using the terms "framework" and "standard" interchangeably.

As pointed by (Hay *et al.*, 2023), the role of different players in sustainability, such as rating agencies, regulators, data aggregators, indices, and assurance providers in using sustainability reports has been a research focus. The study of various reports, including ESG reports, sustainability reports, Integrated Reports (IR), Global Reporting Initiative (GRI), SASB, TCFD, and reporting requirements at the national level by (Jean and Grant, 2022) to understand

the sustainability disclosures concluded that the disclosures have evolved since CSR became mainstream at the beginning of the 1990s.

The different requirements related to sustainability reporting for different categories of investors was studied by (Ficco *et al.*, 2023). The investors who are not based on any specific theme of sustainability use sustainability reports to collate and integrate sustainability metrics with their traditional financial forecasting valuation models. This integration helps the investors in assessing the impact of sustainability and climate risk and opportunities on the firms' businesses and cash flows. On the other hand, sustainability-themed investors follow disclosures holistically, including their social and environmental dimensions so that the information is in line with the theme being followed by the investors (Paulsy, 2024).

The disclosure practices vary significantly across various sectors and have different priorities and challenges (Ji, Chen and Chen, 2023). The study of energy, transport, and materials sectors by (Leisin and Radgen, 2023) concluded that these sectors are emission, energy, and resource-intensive respectively and are important for a balanced transition with minimum impact on socio-economic conditions. The energy & utilities sector focuses on emissions reporting complexities and transition strategy requirements and resource usage disclosures. As stated by (Raabe, 2023), metals, minerals, and petrochemicals have infrastructural importance and therefore need tracking performance improvements. The parameters for this tracking can be across energy, circularity, and process enhancements, and the source can be comprehensive disclosures. The major considerations for the materials & mining sectors are environmental impact reporting, biodiversity considerations, and community engagement disclosures (Smith and Wentworth, 2022). The transportation sector uses fleet emission tracking and infrastructure transition planning as key reporting requirements (Frey, 2018). In the transportation sector, the aviation sector is already under urgent abatement pressure due to the ongoing demand for sustainable travel (Detsios *et al.*, 2023). The nexus of energy, climate, and manufacturing is studied by (Kucukvar *et al.*,

2016) and concluded that the manufacturing sector requires process emissions tracking, supply chain considerations, and technology transition planning as a part of disclosure. Hence, key high-impact industry diagnostics highlight coordination opportunities of reporting frameworks and standards to achieve proactive and reliable disclosures (Van der Lugt, van de Wijs and Petrovics, 2020).

The evolution of sustainability reporting affects high-impact sectors through major channels like regulatory focus, investor demands, and stakeholder expectations (Du Toit, 2024). The regulatory focus includes enhanced scrutiny of emissions-intensive industries, followed by sector-specific reporting requirements and mandating transition risk disclosure. On the basis of study of investors demands, (Hope and Sargiacomo, 2024) pointed that investor requirements influence sector-specific disclosures through portfolio decarbonization pressures and requires companies to develop transition plans for climate risk assessment needs. The stakeholders' expectations through community environmental concerns and social license considerations are other factors that shape sector-specific reporting requirements.

Assurance requirement is an important dimension to the sustainability reporting. The assurance mechanisms require more granular examination, given the relatively uneven adoption patterns observed globally (Caglio, Melloni and Perego, 2020). As discussed by (Nordhaug, 2017), the assurance process is often motivated by sustainability financing access compulsions and demonstrates green signaling intents. The larger multinationals are likely to go for assurance over small and medium enterprises, and entities in developing countries are behind their developed counterparts for assurance (Al-Qudah and Houcine, 2023). By studying the capacity building requirements for sustainability assurance, (Yan *et al.*, 2022) indicated that the potential for material assurance process infrastructure expansion exists through interventions targeting reviewer skills development, attitudinal changes, cultural realignments, and incentivization of reliability. These steps would lead to an increase in transparency across the disclosures made by companies.

1.2 Research Objective

While sustainability reporting practices have evolved considerably, significant research gaps exist regarding the systematic assessment of prevailing disclosure frameworks, standards, and regulatory requirements in the context of sustainability and climate risk (Dye, McKinnon and Van der Byl, 2021). Limited literature compares disclosure guidelines like TCFD, SASB, and GRI to examine overlaps and differences in focus areas (H Stolowy and Paugam, 2023) (Ibrahim *et al.*, 2024). Assurance and verification mechanisms for sustainability disclosures also require further scrutiny regarding adoption challenges and improvement opportunities (Martin-Rios, Poretti and Derchi, 2021). Moreover, the literature examining shareholders' and regulators' disclosure needs is fragmented, with limited evidence from emerging economies outside North America and Europe (Farah *et al.*, 2021). There are also gaps in analyzing reporting by specific high-impact sectors (Behram, 2015). Therefore, this research aims to conduct a systematic and comprehensive evaluation of climate risk and sustainability disclosure landscapes. The research attempts to particularly address the following research questions (RQ):

RQ1: Framework analysis and integration

Primary question:

How do major sustainability reporting frameworks align and differ in their approach to climate risk and broader sustainability disclosures?

Sub-questions:

1.1 Content and structure

- What are the key overlaps and gaps in content coverage across ISSB, TCFD, and GRI frameworks?
- How do materiality definitions and approaches differ across frameworks?
- What are the primary areas of terminology inconsistency?

1.2 Implementation requirements

- How do reporting requirements vary across frameworks for similar sustainability topics?
- What are the key challenges in framework implementation across different market contexts?
- How do data definitions and measurement methodologies align across frameworks?

1.3 Framework evolution

- How are frameworks adapting to emerging sustainability challenges?
- What drives changes in framework requirements?
- How do regional variations influence framework development?

RQ2: Stakeholder needs and market context

Primary question:

How do sustainability disclosure requirements and expectations vary across different stakeholder groups and market contexts?

Sub-questions:

2.1 Stakeholder requirements

- How do information needs differ between mainstream and values-driven investors?
- What are the key disclosure priorities for different stakeholder groups?
- How do assurance expectations vary across stakeholder groups?

2.2 Market development impact

- How do sustainability reporting practices differ between developed and emerging markets?
- What specific challenges exist in implementing frameworks in developing markets?
- How do regulatory requirements vary across different market contexts?

2.3 Implementation Capabilities

- What resources and competencies are required for effective sustainability reporting?
- How do implementation capabilities vary by organization size?
- What role does technology play in meeting stakeholder expectations?

RQ3: Sector-Specific Analysis

Primary question:

How do sustainability reporting practices and challenges differ across sectors, particularly in high-impact industries?

Sub-questions:

3.1 Framework adoption

- How do framework adoption patterns vary across sectors?
- What drives framework selection in high-impact sectors?
- How do sector-specific requirements influence reporting practices?

3.2 Implementation maturity

- What characterizes mature sustainability reporting in high-impact sectors?
- How do reporting practices differ between high-impact and low-impact sectors?
- What are the key success factors for effective reporting in high-impact sectors?

3.3 Assurance practices

- How do assurance requirements and practices vary by sector?
- What specific assurance challenges exist in high-impact sectors?
- How does sector classification influence assurance provider selection?

RQ4: Assurance and verification

Primary question:

How are assurance and verification mechanisms evolving to support reliable sustainability reporting?

Sub-questions:

4.1 Assurance standards

- What drives the choice between limited and reasonable assurance?
- How do assurance standards vary across frameworks?
- What determines the scope of assurance engagement?

4.2 Market development

- How are assurance practices evolving in different market contexts?
- What challenges exist in developing markets for assurance provision?
- How do assurance costs influence adoption patterns?

4.3 Technical requirements

- What technical competencies are required for effective assurance?
- How is technology changing assurance practices?
- What role do different assurance providers play?

RQ5: Theoretical foundations

Primary question:

How do theoretical frameworks explain variations in sustainability reporting practices and adoption patterns?

Sub-questions:

5.1 Theoretical integration

- How do legitimacy and stakeholder theories explain reporting choices?
- What role does institutional theory play in framework adoption?
- How do resource-based views explain implementation variations?

5.2 Practical applications

- How do theoretical frameworks inform reporting strategies?
- What theoretical models best explain assurance adoption?

- How do theories explain market-context variations?

5.3 Future development

- How are theoretical frameworks evolving with reporting practices?
- What new theoretical perspectives are emerging?
- How do theories inform future framework development?

1.3 Purpose of Research

The purpose of this research is to advance understanding of sustainability reporting system through knowledge development. The research enhances understanding of how sustainability reporting frameworks evolve and interact by identifying patterns in framework adoption and implementation across markets. The research develops insights into assurance mechanisms' effectiveness and builds a theoretical understanding of reporting behavior.

In terms of market context, the research examines reporting variations across markets by understanding adoption drivers and identifying market-specific challenges. The research aims to inform future developments by identifying emerging trends in sustainability reporting, anticipating future framework development needs by guiding capacity building requirements, and informing future research directions.

The research aims to improve sustainability reporting practices by enhancing the assurance mechanism, improving the quality of reporting, and optimizing stakeholder engagement. The research will support standardization by providing guidance in policy development, aligning frameworks, and identifying best practices.

1.4 Research Novelty

The significance of the research lies in the fact that the field of sustainability disclosure is expanding. Over the course of the past decade, a variety of sustainability frameworks and standards have emerged, and new criteria are continuing to emerge at regional levels. The research will be of assistance in determining the objectives, overlaps, originality, and efficacy of these frameworks

and standards from the point of view of a variety of stakeholders. This research makes several unique contributions to the existing work on sustainability reporting literature.

This research is the first of its kind as it compares ISSB standards with different reporting requirements and identifies the motivation for multiple frameworks. The research clearly identifies the overlaps and gaps in the frameworks and standards, and discuss the motivations behind them. Materiality plays a crucial role in the comparison of sustainability reporting frameworks and standards, and the research has pinpointed its impact on the creation of sustainability reporting requirements. The research acknowledges the different maturity levels of sustainability disclosures for different sectors and uses the sectoral lens to assess the effectiveness of sustainability reporting. The sectoral analysis is also used to explain the adoption of sustainability disclosures and levels of assurance by different sectors depending on the materiality of topics.

The research has analyzed the evolution of sustainability reporting from the perspective of different markets. The research examines the development of requirements, the differences in assurance adoption, and the identification of material topics in developing and developed markets. This research is the first to have a multi-stakeholder perspective of reporting standards and requirements. The research identifies material topics for different stakeholders and assesses the level of adoption and the requirement of assurance.

The research is unique because it covers different dimensions of sustainability reporting together in one study. This is the first attempt to acknowledge the interconnectedness of different stakeholders, levels of economies, sectors, and assurance adoption with the development of sustainability-related reporting standards and frameworks. This research will pave the way for the future evolution of sustainability reporting, considering the perspectives of different stakeholders and different development dimensions.

CHAPTER II:

REVIEW OF LITERATURE

2.1 Literature review framework

The literature review was conducted by identifying various themes related to sustainability reporting and their linkages with the various objectives of this research. The themes identified for the literature review are also in line with various stakeholders involved in the sustainability reporting process. The various topics for the review include the evolution of sustainability reporting from CSR to the development of sustainability reporting frameworks and standards, comparing these frameworks and standards, examining the role of different stakeholders, the evolution of the assurance process, and reporting practices among high-impact sectors.

2.2 Evolution of sustainability reporting and frameworks

Sustainability reporting has undergone a significant transition, evolving from early CSR disclosures to comprehensive and structured sustainability frameworks. Initially driven by environmental concerns highlighted in the Brundtland Commission report (Brundtland, 1987), sustainability reporting served as a voluntary practice for organizations to communicate their environmental and social impact (Herremans, Nazari and Mahmoudian, 2016). Hence, sustainability reporting initially prioritized transparency over accountability. However, (Idowu *et al.*, 2016) argued that over the past three decades, it has shifted towards a blend of voluntary and mandatory disclosures as a result of regulatory pressures and stakeholder demands. This transition invites detailed investigation into whether regulatory and stakeholder pressure or genuine environmental commitment is the primary driver of modern sustainability reporting.

The shift from CSR to sustainability reporting marked a paradigm shift from philanthropy-focused activities to integrating sustainability into core business strategies. While (Du, Bhattacharya and Sen, 2010) argue CSR emphasizes societal benefits, (Hariram *et al.*, 2023) and

(Hajian and Kashani, 2021) point towards sustainability reporting now encompassing economic, social, and environmental dimensions, addressing global challenges such as climate change and social equity. This transition was attributed by (Alsayegh *et al.*, 2023) to globalization, increased stakeholder expectations, and regulatory developments, highlighting the growing recognition of sustainability as integral to business performance. This transition from reporting to strategy underscores the need to investigate how firms balance stakeholder expectations with genuine sustainability commitments.

The evolution of sustainability frameworks and standards further reflects this transition. Frameworks and standards like TCFD and GRI have introduced structured guidelines to enhance transparency and comparability and represent a continuous effort to standardize sustainability reporting (Bose, 2020). Despite significant progress, gaps remain in the literature regarding the interoperability of emerging frameworks, especially between ISSB and legacy standards like GRI. On the contrary, (Amel-Zadeh and Serafeim, 2018) argue that while standardized data facilitates consistency, it may overlook sector-specific nuances, limiting its relevance for in-depth analyses. Furthermore, the increasing adoption of ESG reporting frameworks, as noted by (Diwan and Amarayil Sreeraman, 2023), indicates the shift from traditional CSR to data-driven, investor-oriented sustainability disclosures. This divergence highlights a crucial gap: whether the push for standardized frameworks truly advances the sustainability agenda or merely aligns with market-driven imperatives.

There is limited research on the practical challenges of implementing these frameworks in developing economies, particularly concerning assurance mechanisms and materiality assessments. Furthermore, the dynamic relationship between stakeholder expectations and reporting practices remains underexplored, highlighting the need for continuous research to address these evolving complexities. This gap in stakeholder-related insights represents a key area for further investigation.

2.3 Theories explaining sustainable reporting

The increasing sustainability-related disclosures show response from companies on the changing climate and sustainability-related practices and increasing stakeholders' expectations. These changes can be explained through multiple theoretical lenses. In addition to the main theories for sustainability reporting—specifically, legitimacy, stakeholder, and institutional—the emerging applications of ideas to the field of sustainability reporting include agency, signaling, discourse, attribution, social movement, and structuration theories. (Bartolacci *et al.*, 2022) critically assessed the numerous theoretical frameworks, the relationship between them, and their ability to explain businesses commitment to sustainability reporting. However, their analysis raises questions about whether these theories sufficiently address the dynamic and complex interplay between pressure from various stakeholders and other motivations for sustainability disclosure.

The variations in sustainability reports are often attributed to numerous institutional and stakeholder influences. The role of institutional players was investigated by (Dagilienė and Nedzinskienė, 2018) concluding that the regulatory environment significantly shapes sustainability reporting. Furthermore, (Herold, 2018) concluded that institutional and stakeholder theories, which are based on institutional and stakeholder conceptions, offer a theoretical platform for looking at the influences on sustainability reporting but could not explain the regional disparities in reporting standards. This suggests a gap in the literature concerning how localized institutional pressures influence global sustainability practices.

Theoretical models continue to shape the evolution of integrated reporting, with (Mancini *et al.*, 2022) developing a framework known as the RA/RP Matrix whose results demonstrate that even if new theories have emerged, Agency Theory and Legitimacy Theory are still considered the basis for integrated reporting. However, (Abeywardana, Azam and Low, 2021) through their work on integrated reporting literature and related theories, concluded that integrated reporting uses the institutional, legitimacy, stakeholders, shareholder, agency, signaling, and resource-based

theories to provide more insights. On the contrary, (Mahmud, 2020) argued that while none of the above-mentioned theories can fully describe sustainability reporting independently, combined, they can explain and anticipate its various characteristics. By working on similar lines, (Tarquinio and Xhindole, 2022) examined sustainability reporting features from a meta-theoretical perspective and concluded that one can better comprehend the causes, effects, and other facets of sustainability reporting.

Despite the proliferation of theories, there is limited integration of them with sustainability reporting frameworks. The interlinkages of theoretical models across sectors and regions can further be explored. Dynamic regulatory influences, regional and market variations, stakeholder perceptions, and assurance mechanisms need to be examined comprehensively to fill the gaps in understanding sustainability reporting practices.

2.4 Materiality assessment for sustainability reporting

Materiality serves as a strategic tool for businesses to align sustainability disclosures with stakeholder expectations, though its subjective interpretation often leads to inconsistent reporting practices, limiting comparability within and across industries. The role of GRI standards and stakeholder involvement in the materiality assessment in the reporting process was highlighted by (Torelli, Balluchi and Furlotti, 2020). The study emphasized the significance of materiality assessment to ensure a high level of materiality analysis and quality reporting for stakeholders. While their findings underscore the importance of robust materiality frameworks, they overlook the challenges businesses face in balancing regulatory compliance with stakeholder demands.

While materiality has evolved as a critical determinant of disclosure relevance, its inconsistent application raises questions about comparability across industries. Using regression analysis, (Dewi *et al.*, 2023) concluded that the relative quantity disclosure is significantly positively influenced by materiality disclosure. However, the quality aspects, such as correctness and management orientation of the organizations, are not significantly impacted. This suggests a

quantitative bias in current reporting practices. Similarly, (Farooq *et al.*, 2021) investigated the volume of materiality assessment disclosures in sustainability reports and their contributing factors. The study highlighted that corporate governance quality and financial performance (measured by Return on Assets) positively affect materiality disclosures, whereas market-to-book ratios and firm size do not. These findings point to a critical gap that businesses are focusing on disclosure volume rather than the depth and relevance of reported material issues, and no key trend has emerged that can predict the quality of materiality assessment.

The growing emphasis on materiality reflects its role in shaping sustainability narratives, yet divergent interpretations across frameworks hinder its effectiveness in ensuring transparency. Different approaches to materiality studied by (Jørgensen, Mjøs and Pedersen, 2022) found to be conflicting in real-world settings, which may lead the readers to infer incorrect conclusions from materiality assessments. Materiality is crucial in sustainability reporting, and hence firms should recognize, prioritize, and provide information on these issues. The development of the notion of materiality in the European accounting environment was studied by (Baumüller and Sopp, 2022) who argued for the redevelopment of the materiality assessment framework and suggested that a new perspective is required on the purpose and goals of conducting such reporting. This divergence between practical application and theoretical frameworks signals a pressing need for harmonization.

The assessment of divergence between regulatory mandates and actual practices in materiality disclosures is an important area, and (Ruiz-Lozano *et al.*, 2022) identified this gap and suggested a need for stronger enforcement mechanisms and clearer guidelines to enhance compliance. The materiality of information disclosed depends on the industry to which the company belongs, and (Sepulveda-Alzate, Garcia-Benau and Gómez-Villegas, 2022) concluded that companies that operate in sensitive industries are particularly interested in topics like water management, climate change, and occupational health and safety. However, these sector-specific

focuses highlight the broader challenge of achieving cross-industry comparability in materiality disclosures.

The significance of materiality in non-financial reporting and its impact on stakeholders is critical (Suarez and Vargas, 2021). The various perspectives on materiality that may result in disputes and misunderstandings in sustainability reports were examined by (Setia *et al.*, 2024) and highlighted the necessity for a new outlook on reporting objectives and intentions. While identifying the drivers for materiality, (Huq and Mohammadrezaei, 2024) emphasized that organizational context, rather than structural similarity, significantly influences materiality determinations. These findings emphasize the importance of materiality in shaping sustainability reports, underscoring the need for standardized materiality assessments to meet stakeholder expectations and enhance the quality of sustainability reporting.

Despite the growing recognition of materiality's importance, there is limited research on standardizing materiality assessment methods, leading to inconsistent disclosures across industries. Conflicting materiality approaches create reporting ambiguities, undermining stakeholder expectations from sustainability reports. Additionally, the influence of regulatory environments on materiality disclosure practices is an area that is still being explored, particularly in emerging economies where enforcement mechanisms are weak. This highlights an urgent need for comparative studies that assess how global and local regulatory frameworks shape materiality disclosures and their effectiveness.

2.5 Comparison of TCFD, GRI, SASB, and ISSB

Materiality, reporting standards, and sustainability reporting are ongoing discussion and research subjects. The study by (Pizzi, Principale and de Nuccio, 2022) delves into the adoption of standards like GRI and SASB, highlighting a fundamental gap in aligning financial and sustainability materiality. The results of their research indicate that mechanisms of sustainable governance impact the adoption of GRI and SASB adoption is predominantly influenced by

financial considerations. Interestingly, when integrated, sustainability materiality appears to overshadow financial materiality, raising questions about the balance and prioritization of these dual focuses in reporting practices.

Sectoral comparison is a critical area that needs to be explored. In the banking sector, (Al Dabbagh, 2022) highlight the significance of GRI and SASB standards reveals differences between the two and notes that SASB provides consistent and comparable reports that assist investors. However, the comparative analysis of different reporting standards is an evolving area and needs further exploration.

Companies generally use the International Integrated Reporting Council (IIRC) IR format, which was reviewed by (Ogata *et al.*, 2018) wherein they identified that although there is a shift in IIRC's focus toward sustainability, it fails to address divergent stakeholder expectations. This gap underscores the need for stakeholder-centric reporting research that addresses these conflicting priorities. While IIRC primarily aligns with investor-oriented guidelines, GRI remains inclusive of diverse stakeholder interests, creating potential tensions in integrated reporting. ISSB is a new standard, and the literature available on ISSB is limited. The prerequisites for ISSB adoption and its alignment with existing frameworks were studied by (Avetisyan, 2023). However, as the literature on ISSB is still to develop, the findings related to TCFD can be used for ISSB due to the similarities between both these frameworks.

Collectively, these studies underscore the urgent need for an integrated approach that bridges the gap between financial and sustainability materiality (Mio, Fasan and Costantini, 2020). While frameworks like GRI and SASB facilitate harmonization, their divergent focuses highlight the complexity of achieving uniform reporting standards (Afolabi, Ram and Rimmel, 2022). Sector-specific adaptations, such as those in the banking industry, enhance the relevance of disclosures but risk undermining comparability across industries. These insights contribute to the

evolving discourse on materiality, suggesting that a balance between sector-specific precision and global standardization is critical for effective sustainability reporting.

Despite the growing body of research on materiality and framework adoption, significant gaps persist in understanding the interoperability between emerging standards like ISSB and established frameworks such as GRI. The absence of empirical research on sector-specific reporting challenges increases these issues, particularly in highly regulated sectors like finance, where rapid regulatory changes demand adaptable yet consistent reporting standards. Furthermore, inconsistent definitions of materiality across frameworks continue to hinder cross-industry comparability, underscoring the need for standardized guidelines that balance market-specific and sector-specific applicability.

2.6 Effectiveness of GRI

While GRI has promoted global sustainability reporting, its effectiveness needs to assessed in view of regional disparities, particularly in developing economies where inconsistent adoption limits the comparability and transparency of disclosures. Several studies have examined the impact and effectiveness of the GRI in shaping sustainability accounting and reporting frameworks. The persistent gaps in sustainability disclosures across developing nations were identified by (Mougenot and Doussoulin, 2023), emphasizing the need for tailored regulatory frameworks to address region-specific challenges. This finding emphasizes the need for increased awareness and support for sustainability practices in developing countries to bridge the gap. Additionally, (Bilbao-Terol *et al.*, 2018) argue that the GRI's adaptability lies in its potential to transfer best practices from developed to developing contexts. However, this assumption is contested because replicating frameworks across divergent socio-economic environments can lead to superficial compliance rather than meaningful sustainability improvements. This raises questions about the GRI's capacity to remain both globally standardized and locally relevant.

The examination of environmental disclosure based on GRI standards by (Ordóñez-Castaño *et al.*, 2021) emphasizes the positive impact of high-quality and open information on stakeholder satisfaction. However, this research also draws attention to the potential lack of transparency regarding their environmental efforts by larger and more indebted enterprises. This highlights the need for enhanced transparency mechanisms within GRI disclosures, particularly in addressing environmental impacts in high-risk industries.

Collectively, these studies highlight the effectiveness of the GRI in promoting sustainability reporting and shaping sustainable practices. However, there is a need for greater adoption of sustainable practices, particularly in developing nations. Despite GRI's global influence, gaps persist in ensuring uniform adoption across developing nations, with inconsistent disclosure quality and limited stakeholder engagement. Moreover, insufficient empirical studies assess GRI's effectiveness in region-specific and sector-specific contexts.

2.7 Effectiveness of TCFD

While TCFD adoption has enhanced climate-related transparency, its effectiveness is limited by inconsistent application across industries, indicating a need for sector-specific guidelines to ensure uniform climate risk reporting. Continuing the sectoral emphasis, (Siew, 2020) observes that certain sectors are responsible for most global emissions, emphasizing the importance of addressing their environmental footprint, and compliance with the TCFD guidelines is crucial in achieving this goal.

TCFD compliance has a positive impact on risk identification, management, and mitigation, particularly in energy-intensive industries (Achenbach, 2021). Although organizations following TCFD recommendations report improvements in climate risk management, there is limited empirical evidence on the long-term effectiveness of these disclosures in mitigating financial risks. This gap suggests that while TCFD fosters robust risk management practices, its influence on sustained financial resilience remains uncertain, warranting further investigation.

In evaluating the adoption of TCFD standards, (Auzepy *et al.*, 2023) utilized a novel text analysis method to assess climate-related disclosures of TCFD-supporting banks. Their findings revealed significant disparities in adoption levels, highlighting the inadequacy of a one-size-fits-all approach within the financial sector. The study emphasizes the need for sector-specific disclosure frameworks and clearer guidelines to ensure consistent reporting across institutions. Furthermore, these inconsistencies complicate assurance processes, indicating that improvements in TCFD standardization could enhance both reporting reliability and third-party verification.

A study on listed Indian companies' climate change disclosures (Maji and Kalita, 2022) found a positive correlation between financial disclosure related to climate change and corporate performance. This also raises questions about whether this relationship is driven by actual risk mitigation or simply by improvement in investor perceptions. This ambiguity highlights the need for further research to understand the genuine financial impacts of climate-related disclosures.

Despite TCFD's widespread adoption, inconsistencies in implementation across sectors hamper comparability, especially in non-financial industries. Also, there is a lack of empirical evidence on TCFD's long-term impact on corporate risk mitigation and performance.

2.8 Assurance mechanism for sustainability disclosures

The role of sustainability assurance has garnered significant scholarly attention, yet its practical application reveals critical gaps. A comprehensive literature review was conducted by (Hazaea *et al.*, 2022) that identified the value of sustainability reporting assurance to organizations. While their study emphasizes transparency and adherence to frameworks like TCFD, it also exposes the limited uptake of TCFD guidelines in sectors such as real estate and construction. This sector-specific discrepancy suggests that existing assurance frameworks may not adequately address industry-specific challenges, a gap that requires further investigation, particularly concerning developing sector-specific assurance models.

Examining the factors influencing sustainability reporting assurance, (Achenbach, 2021) focused on publicly traded corporations across various sectors. The study revealed that organizations that follow the TCFD's recommendations make greater progress in identifying, managing, and mitigating risks by adopting assurance. However, the study predominantly focuses on energy-intensive industries, leaving gaps in understanding how assurance impacts less-regulated sectors like technology and services. In contrast, (Yan *et al.*, 2022) contributed to the conceptual development of sustainability reporting assurance and provided a decision-making roadmap for assurance providers and reporting companies. While both studies underscore the importance of assurance, their differing scopes highlight the need for a more comprehensive understanding of assurance mechanisms across diverse sectors and markets.

The impact of sustainability reporting assurance on capital limitations was examined by (García-Sánchez *et al.*, 2019) and concluded that higher-quality and externally assured CSR disclosure leads to better access to capital. On the worldwide assurance practices in sustainability reporting, (Alsahali and Malagueño, 2022) revealed disparities in the growth of sustainability reporting and assurance. By investigating the major players in the sustainability assurance space, (O'Dwyer, 2011) concluded that big accounting firms dominated the market as assurance providers and identified a shift towards consulting firms for assurance. However, this shift towards consulting firms has introduced questions about potential conflicts of interest and assurance quality. Collectively, these findings highlight the pressing need for standardized frameworks and rigorous oversight related to assurance to ensure the credibility of sustainability-related disclosures.

The reviewed literature emphasizes the vital role of sustainability assurance in enhancing sustainability reporting by improving accountability, reputation, and financial access. While organizations can benefit from assurance mechanisms, challenges persist in some sectors (Simnett and Huggins, 2015). Future research is required to improve assurance practices by exploring

stakeholder perspectives. The gap between sustainability reporting and assurance can be bridged by addressing these aspects, leading to more robust and reliable sustainability disclosures.

2.9 Sustainability disclosures and investors

Shareholder groups exhibit diverse expectations for sustainability disclosures, driven by accountability for environmental stewardship, transparency, and governance practices (George, 2018); (De Villiers and Van Staden, 2010). Shareholder activism and engagement, particularly through institutional investors, significantly influence corporate sustainability strategies, fostering responsible ownership and driving voluntary climate-related disclosures (Flammer, Toffel and Viswanathan, 2021); (Cotter and Najah, 2012). These stakeholders often demand detailed environmental information, with preferences for dedicated sections in annual reports and corporate websites to enhance transparency and accountability.

Corporate governance and stakeholder pressures enhance the quality of sustainability reports, with board effectiveness and independent oversight positively influencing disclosure standards (Rudyanto and Veronica Siregar, 2018); (Gond and Piani, 2013). However, (Neville *et al.*, 2019) argue that shareholder pressure alone is insufficient to drive meaningful disclosure improvements unless these are complemented by robust governance mechanisms and regulatory frameworks. This suggests that corporate governance acts as an important factor by amplifying or dampening the effects of shareholder activism. The interplay between governance structures and stakeholder demands shows the complexity of sustainability reporting and highlights the need for further research into how these factors vary across industries and regions.

Institutional investors leverage their influence through strategic engagement, fostering corporate responses to ESG issues (Gond and Piani, 2013). Collaborative shareholder actions, such as coordinated voting and policy advocacy, have been effective in advancing sustainability goals. However, shareholder resolutions may face limitations in driving substantial corporate change due to political, economic, and managerial constraints (Neville *et al.*, 2019). This raises questions

regarding the effectiveness of shareholder activism in sectors where sustainability practices may conflict with short-term financial goals. Furthermore, the extent to which these collaborative actions translate into substantive changes in corporate strategy versus merely a compliance exercise remains an area requiring empirical investigation.

Despite increased shareholder activism, gaps remain in understanding how specific reporting frameworks influence investor decisions. The lack of standardized disclosure metrics hampers comparability, limiting shareholders' ability to drive consistent sustainability practices across industries. Additionally, there is limited research on the interplay between shareholder activism and the specific sustainability frameworks that lead to such activism, which creates opportunities for future exploration. Addressing these gaps could provide valuable insights into aligning investor expectations with corporate sustainability practices.

2.10 Sustainability reporting: Value creation and emissions reduction

Sustainability reporting plays a pivotal role in reshaping corporate value creation and promoting environmental accountability. It challenges traditional financial accounting models by integrating social and environmental considerations, fostering long-term value beyond mere financial performance (Gray, 2006). Studies reveal that sustainability practices positively influence capital costs, investment returns, and strategic decision-making, underscoring their alignment with ESG considerations (Almansoori and Nobanee, 2019). However, the impact of this influence can be overstated and hugely dependent on the sectors. This divergence suggests that the relationship between sustainability reporting and value creation is complex and highly sector-dependent, warranting further investigation into industry-specific impacts.

Corporate sustainability disclosures contribute significantly to emissions reduction efforts. Transparent reporting enhances environmental accountability, with frameworks like Carbon Management Accounting (CMA) driving measurable environmental performance improvements (Abhishek *et al.*, 2024). Stakeholder engagement and external pressures, including regulatory

mandates, also influence the depth and effectiveness of sustainability disclosures, particularly in high-emission sectors (Nazari, Herremans and Warsame, 2015). This suggests that the interplay between voluntary disclosures and external pressures needs further exploration to understand the true drivers of emissions reduction.

Despite advancements, gaps persist in harmonizing sustainability reporting frameworks, ensuring consistent metrics, and understanding the causal link between disclosures, financial performance, and environmental outcomes. Furthermore, there is limited empirical evidence examining how variations in reporting frameworks (e.g., GRI vs. TCFD) influence environmental outcomes in different regulatory contexts. Addressing these gaps will be critical in enhancing the comparability and reliability of sustainability disclosures.

2.11 Sustainability disclosures among high-emission industries

The sustainability landscape across diverse industrial sectors; ranging from energy, transport, and aviation to materials, metals, minerals, and petrochemicals; is marked by a complex interplay of ESG challenges and opportunities. For instance, the minerals and metals sector faces significant sustainability hurdles, given its extensive environmental footprint and societal impact. (Petrie, 2007) highlighted the usage of networks and partnerships in increasing the sustainability of these sectors. Similarly, (Azapagic, 2004) proposes a comprehensive framework for sustainable development indicators tailored to the mining and minerals industry, aiming to enhance transparency and performance assessment in sustainability practices. However, the exploration of the energy sector by (Raquiba, 2020) reveals a dismal level of sustainability reporting, albeit influenced by factors such as ownership structure and media visibility. In contradiction, the scrutiny of the energy sector and the basic materials sector by (Surjati and Yanti, 2023) identifies a significantly positive relation between profitability and the level of disclosures. This suggests that financial performance, rather than regulatory or stakeholder pressures, may be the primary driver of sustainability reporting in the energy and basic materials sectors. This contrast raises

questions about the true motivations behind disclosures in high-emission industries and indicates a potential gap in understanding of the connection between financial incentives and genuine environmental accountability.

In contrast, the aviation sector's approach to sustainability, as discussed by (Lin, 2013), focuses on the adoption of green technologies to mitigate its environmental impact, reflecting a sector-specific strategy towards achieving sustainability goals. Similarly, the process industries, encompassing oil and petrochemicals, bulk and specialty chemicals, pharmaceuticals, and consumer products, demonstrate varied sustainability focuses. By working on commonalities, (Te Liew, Adhitya and Srinivasan, 2014) identified factors such as health and safety, human rights, and energy efficiency as top priorities, alongside sector-specific issues like oil spill prevention and access to medicine. Similarly, the analysis of the GRI's sustainability reporting across economic sectors by (del Mar Alonso-Almeida, Llach and Marimon, 2014) reveals a nuanced spectrum of sustainability reporting practices. This suggests that while frameworks like GRI provide a foundation, sector-specific adaptations are necessary to ensure meaningful reporting. The varied approaches across sectors underscore the need for a more nuanced understanding of how industry-specific challenges shape sustainability practices.

Despite the widespread adoption of sustainability reporting across high-emission industries, significant gaps persist in assessing the comparability of disclosures and the consistency of sector-specific metrics. Variations in regulatory frameworks and differing industry practices make the efforts to standardize sustainability practices very complex. For example, while the energy sector may focus on emissions reduction, the aviation and process industries prioritize technological innovation and resource efficiency. This divergence highlights the need for future research to explore how regulatory environments, stakeholder priorities, and financial incentives interact to shape sustainability disclosures across sectors.

2.12 Sufficiency of sustainability disclosures for ESG rating

The evaluation of ESG scores has gained significant attention from academia, regulators, and businesses. However, the influence of sustainability strategy disclosure on ESG scores has received relatively less focus. Recognizing this gap, (Santamaria *et al.*, 2021) conducted a study that investigated the link between disclosure practices and ESG scores using a configurational analysis approach. Their findings, based on an examination of listed Italian corporations, revealed that integrated reporting was one of the key contributors to ESG scores. This confirms the significance of thorough disclosure standards in influencing ESG assessments. Therefore, it is important to develop more detailed ESG evaluation frameworks that integrate both quantitative disclosure metrics and qualitative assessments of actual sustainability outcomes.

In exploring the relationship between ESG disclosure and quality, (Lopez-de-Silanes, McCahery and Pudschedl, 2020) compared disclosure laws and stewardship standards across nations. Their research demonstrated a significant correlation between a firm's disclosure quality and the volume of its ESG reporting. However, the study demonstrated that ESG rankings had minimal influence on risk-adjusted financial performance. This contradiction underscores the need for further research to reconcile these findings and to better understand the true financial implications of ESG disclosures.

Addressing the growing demand for transparent ESG information, (Kimbrough *et al.*, 2022) examined US companies' voluntary release of ESG reports. The study determines the causal impact of disclosures in reconciling discrepancies across ESG rating organizations about the ESG performance of specific enterprises. The study found a more significant relationship between ESG disclosure and reduced disagreement among ESG rating providers when reports are lengthier and contain third-party attestations, especially from accounting firms. This emphasizes the value of robust reporting practices and external validation in improving the alignment and consistency of ESG ratings. Similarly, (Eng, Fikru and Vichitsarawong, 2022) delve into the relationship between sustainability disclosures, ESG ratings, and firm value and reveal that ESG scores, and

sustainability disclosures provide valuable information that positively impacts market value and stock prices. Metric-based and company-specific narratives in sustainability disclosures offer additional insights into market value and price. However, generic disclosures that lack specificity can lead to a decrease in market value. Further exploring the incentives for voluntary non-financial information disclosure, (Rezaee and Tuo, 2017) emphasizes that managerial intentions and the informational content of sustainability disclosures significantly influence their causes and effects. This underscores the need for further research to reconcile these findings and to better understand the true financial implications of ESG disclosures.

Specific and informative sustainability disclosures have the potential to enhance a company's reputation and financial performance (Oncioiu *et al.*, 2020). Additionally, (Ortiz-Martínez, Marín-Hernández and Santos-Jaén, 2023) studied the dynamic nature of non-financial disclosures and their correlation with sustainability performance and the importance of long-term sustainability strategies. The studies conclude that ESG ratings and sustainability disclosures play a critical role in driving firm value and meeting stakeholder expectations. The studies highlight the positive relationship between ESG scores, sustainability disclosures, and market value.

The sufficiency of sustainability disclosures for ESG rating plays a crucial role in bridging the gap between ESG performance and evaluation. The studies reviewed highlight the significance of comprehensive disclosure practices, such as integrated reporting, in shaping ESG scores. Moreover, the research emphasizes the positive correlation between disclosure quality and the volume of ESG reporting, underscoring the importance of robust and transparent information. The voluntary release of ESG reports reduces disagreement among ESG rating organizations, particularly when accompanied by detailed and validated disclosures. However, it is essential to recognize that ESG ratings should not solely focus on assessing a company's sustainability performance. Despite the growing emphasis on ESG disclosures, gaps persist in understanding how non-financial information and managerial intentions influence ESG ratings. Current research

lacks comprehensive insights into the consistency of ESG assessments across different rating agencies and fails to address how disclosure quality impacts long-term sustainability performance and investor decision-making.

2.13 Literature review summary

The literature study sheds light on the development of sustainability reporting, demonstrating how the shift from CSR to sustainability successfully placed sustainable theories, practices, and reporting in the spotlight. Researchers used a variety of ideas, but none proved to be particularly helpful on their own. Instead, they served their purpose best when combined.

The efficacy of GRI and TCFD is clearly demonstrated by the new language of communication used in sustainability reporting between firms and stakeholders. While many stakeholders have used the GRI, investors who are concerned about the climate and its impact have paid particular attention to the TCFD framework.

Sustainability reporting and value creation go hand in hand. It can be observed that sustainability reporting not only tilts organizations towards stewardship responsibility but also makes them accountable. It was observed that there is a bidirectional association between non-financial disclosures and sustainability performance.

We need objective, clear, and succinct ESG reporting mechanisms to see how businesses contribute to sustainable practices. Frameworks for reporting, standards, and related criteria are constantly changing. Due to the substantial overlap between frameworks and standards, there is a compelling need for increased consistency, comparability, and coherence between corporate reporting frameworks, standards, and related requirements (Monciardini, Mähönen and Tsagas, 2020). The comparability of reporting frameworks and standards is an area that needs to be investigated. There are different stakeholders towards which sustainability reports are intended. Also, there are various theories that can be used to explain the need for sustainability reporting. However, the relation between the origin of various theories, the needs of various stakeholders,

and the requirement of different reporting standards is an area where further investigation is required. There is a lot of literature covering the impact of sustainability reporting for high-impact sectors. However, there is still work required to assess this impact from the lens of different reporting frameworks and standards. The assurance-related ecosystem for sustainability reporting is still a work in progress and needs further research.

2.14 Hypothesis formation and research model development

Based upon the objectives and aim of the research and the conclusion of literature review, the hypothesis has been developed with a view to test the assumptions related to sustainability reporting overlap, alignment, theories, expectations of various stakeholders, and the usefulness of reporting standards and frameworks. The hypothesis has been created so that the entire depth and breadth of sustainability reporting is covered from the point of view of different stakeholders, theoretical perspectives, economic development stages, and practical implementation. To remove any overlap in hypothesis formation and properly test the hypothesis, the high-level hypothesis area is broken into multiple smaller hypotheses.

Hypothesis Formation and Research Model Development

H1: Framework content and structure

The hypothesis tests the overlap in focus areas and terminology between ISSB, TCFD, SASB, and GRI frameworks. This assesses consistency in framework terminology alignment in data definitions and metrics. The hypothesis is relevant as there is a market need to reduce the reporting complexity, improve comparability, and enhance efficiency. The hypothesis impacts stakeholders in different ways, like simplified reporting for companies, better comparison for investors, and easier enforcement for regulators. The hypothesis uses quantitative approaches (terminology frequency analysis, content overlap analysis) and qualitative approaches (framework document review, expert interviews). The expected outcomes from this hypothesis include

framework alignment opportunities, standardization recommendations and implementation guidance. The hypotheses under the framework content and structure include the following:

H1a: There is a measurable overlap in core sustainability topics across ISSB, TCFD, and GRI frameworks.

H1b: There is a high degree of terminology consistency across major sustainability reporting frameworks.

H1c: There is alignment in data definitions and metrics across frameworks, evaluated through comparative analysis of key reporting metrics.

H2: Framework implementation

The hypothesis tests the level of standardization in reporting requirements, including consistency in materiality approaches and alignment in assurance requirements. The hypothesis is relevant due to its practical application in implementation effectiveness, resource optimization, and quality consistency. The hypothesis uses implementation metrics and implementation challenges for testing. The hypothesis is expected to aid in developing implementation frameworks, best practice guides, and assessing resource requirements.

H2a: Reporting requirements exhibit measurable standardization across major frameworks, assessed via a framework comparison matrix.

H2b: Materiality assessment approaches demonstrate consistency across frameworks, evaluated through comparative analysis of materiality principles.

H2c: Assurance requirements are aligned across frameworks, assessed by comparing assurance standards and practices.

H3: Investor information preferences

The hypothesis tests different investor type preferences, assesses quantitative vs. qualitative needs, and identifies information usage patterns. This is relevant for investors in their investment decision-making process, portfolio allocation and evaluation, and developing products,

services, and strategies. The hypothesis uses results of surveys and interviews of different investors. The hypothesis is expected to provide reporting requirements for investors and develop investor needs profiles.

H3a: Mainstream investors show a statistically significant preference for quantitative ESG metrics in financial modeling, based on survey data.

H3b: Values-driven investors exhibit a higher preference for qualitative sustainability disclosures, measured through survey responses.

H3c: Investor type has a statistically significant impact on the preferred level of assurance.

H4: Market context impact

The hypothesis tests differences between developed and developing markets, identifies regional reporting variations, and assesses the influence of market maturity. The hypothesis is very relevant as the frameworks are required to be globally implemented with regional adaptation needs and identify capacity-building requirements. The hypothesis is expected to help in policy development through market-specific regulations. The hypothesis uses market comparison, regional practices review and implementation challenges. The hypothesis is expected to aid in developing market-specific frameworks and implementation roadmaps.

H4a: Developed market stakeholders demonstrate a higher emphasis on climate risk disclosures in their sustainability reports.

H4b: Developing market stakeholders place greater emphasis on governance disclosures in their sustainability reports.

H4c: Reporting requirements between developed and developing markets are statistically significant.

H5: Company size impact

The hypothesis tests the relationship between size and reporting quality and assesses the impact on resource availability and implementation capabilities. The hypothesis is relevant as its

outcome can be used in implementation planning including resource allocation and capacity requirements. The implications of this hypothesis can be in policy development while fixing proportional requirements and compliance thresholds. The hypothesis can use size based correlation approach and have qualitative assessment for size based challenges. The results of the hypothesis will be useful in developing size-based requirements and support frameworks.

H5a: Larger companies show a higher adoption rate of comprehensive sustainability reporting frameworks.

H5b: Larger companies have a higher likelihood of obtaining reasonable assurance.

H5c: Company size positively correlates with the quantum of sustainability disclosures.

H6: Sector impact

The hypothesis tests sector-specific reporting practices and understanding industry challenges and implementation variations. The hypothesis is very relevant as this identifies sector materiality, unique challenges, and their best practices. This can aid in future framework development by developing sector guidance and industry standards. The hypothesis uses sector comparison analysis and studies industry challenges. The hypothesis expected outcomes can be sector-specific guidance, industry benchmarks, and implementation frameworks.

H6a: High-emission sectors demonstrate more comprehensive reporting practices, evaluated based on the breadth and depth of ESG disclosures.

H6b: High-emission sectors have a higher adoption rate of external assurance practices.

H6c: Sector classification significantly affects the choice of reporting framework.

H7: Assurance adoption

The hypothesis tests assurance adoption patterns and identifies market variations. The hypothesis is relevant as it ensures quality control through reporting reliability and market credibility. The hypothesis assesses assurance standards, provider capabilities, and service offerings. The testing approaches include adoption statistics and qualitative assessment of decision

factors and selection criteria. The results of the hypothesis will help in developing assurance framework standards and selection criteria for assurance providers.

H7a: Assurance adoption is positively correlated with company size.

H7b: The level of assurance varies significantly by sector.

H7c: The choice of assurance provider differs significantly across market development stages.

H8: Assurance challenges

The hypothesis tests the implementation barriers, technical requirements, and resource constraints. The hypothesis is relevant for capacity building and standard setting and helpful in quality assurance through the development of technical guidance. The testing approach for this hypothesis includes identifying barriers for the assurance and analysis of resource requirements. The expected outcomes of the hypothesis shall be useful for developing support frameworks and implementation guides for assurance.

H8a: Smaller organizations report more barriers to obtaining assurance.

H8b: Technical competency limitations negatively impact assurance quality in developing markets.

H8c: The cost of assurance has a statistically significant impact on assurance adoption rates.

H9: Reporting motivations

The hypothesis tests drivers of reporting decisions, stakeholder influences, and market pressures. The hypothesis is relevant for strategic planning and decision factors for implementation priorities. The testing approaches include assessment of decision metrics and influence factors. The outcomes of the hypothesis shall be useful for developing frameworks and policy recommendations.

H9a: Regulatory pressure is the most influential factor in framework adoption.

H9b: Stakeholder demands have a statistically significant influence on voluntary disclosures.

H9c: Peer pressure positively correlates with the level of sustainability disclosure.

H10: Market context

The hypothesis tests the impact of institutional pressure, regional differences, and implementation contexts. The hypothesis is relevant for regional adaptation of global frameworks and development of regional frameworks. The testing approaches include implementation statistics and context analysis. The outcomes of the hypothesis will be useful for development of regional frameworks and implementation guides.

H10a: Institutional pressures differ significantly between developed and developing markets.

H10b: The effectiveness of sustainability reporting frameworks varies by market context.

H10c: The implementation of sustainability reporting differs significantly by regional context, based on comparative analysis of implementation practices.

The relationship between the theoretical foundations, reporting frameworks, stakeholder interactions and various research hypotheses is given below:

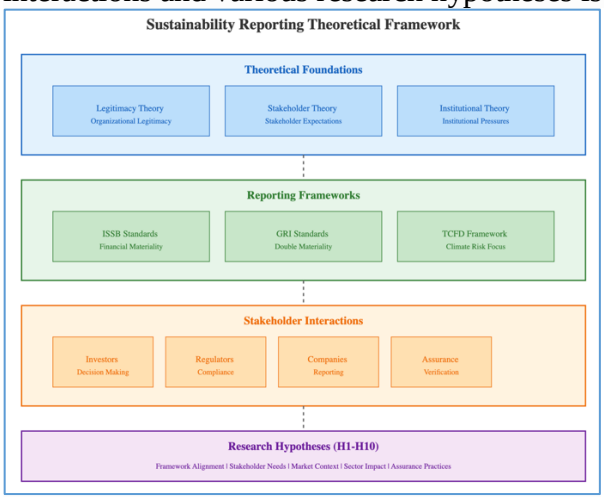


Figure 2.1

Sustainability reporting theoretical framework

2.15 Alignment of hypotheses with theoretical models

1. Legitimacy theory linkages

The legitimacy theory primarily explains the decisions for framework adoption, choices for disclosure quality, and assurance level selection. The primary hypotheses influenced by legitimacy theory are as follows:

H1: Framework alignment

The organizations adopt standardized frameworks to maintain legitimacy, and framework alignment demonstrates commitment to accepted practices. The standardization efforts reflect legitimacy-seeking behavior.

H5: Company size impact

The larger companies face greater legitimacy pressures. The size of a company influences the level of disclosure for maintaining legitimacy. The availability of resources also affects legitimacy-seeking capabilities.

H9: Reporting motivations

The companies use disclosures to demonstrate legitimacy. The adoption of frameworks by companies is driven by legitimacy considerations, and voluntary disclosures reflect legitimacy-seeking behavior.

2. Stakeholder theory linkages

The stakeholder theory primarily explains the choices for information content, stakeholder engagement practices, and reporting format decisions. The primary hypotheses influenced by stakeholder theory are as follows:

H2: Integration gaps

The needs of different stakeholders create framework variations, and reporting choices are influenced by stakeholder preferences. The demand for framework integration reflects stakeholder requirement to balance the reporting.

H3: Investor information preferences

The different investor types have distinct information needs, and the demands for information shape the reporting practices. The power of stakeholders influences the disclosure quality.

H4: Market context impact

The stakeholder expectations vary by market context, and the regional stakeholder needs influence the regional reporting practices.

H7: Assurance Adoption

The demand by stakeholders drive assurance choices and assurance level reflects stakeholder expectations. The trust of stakeholder influences verification needs and the level of assurance.

3. Institutional theory linkages

The institutional theory primarily explains market-level variations, sector-specific practices, and regional differences. The primary hypotheses influenced by institutional theory are as follows:

H6: Sector impact

The industry norms shape reporting practices, and sectoral pressures influence framework adoption. The institutional context affects disclosure patterns.

H8: Assurance challenges

The institutional capacity affects assurance quality, and institutional pressures shape assurance practices.

H10: Market context

The institutional environment affects reporting practices. The market maturity influences framework adoption. The regional institutions shape reporting requirements at the regional level.

The summary of various hypotheses supported by various theories as primary, secondary and minimal is given below:

Table 2.1

Hypothesis supported by theories

Hypothesis	**Legitimacy**	**Stakeholder**	**Institutional**
H1	Primary	Secondary	Secondary
H2	Secondary	Primary	Secondary
H3	Minimal	Primary	Minimal
H4	Secondary	Primary	Secondary
H5	Primary	Secondary	Secondary
H6	Secondary	Minimal	Primary
H7	Secondary	Primary	Secondary
H8	Minimal	Secondary	Primary
H9	Primary	Secondary	Primary
H10	Secondary	Secondary	Primary

The summary of mapping hypothesis with theoretical foundations is given below:

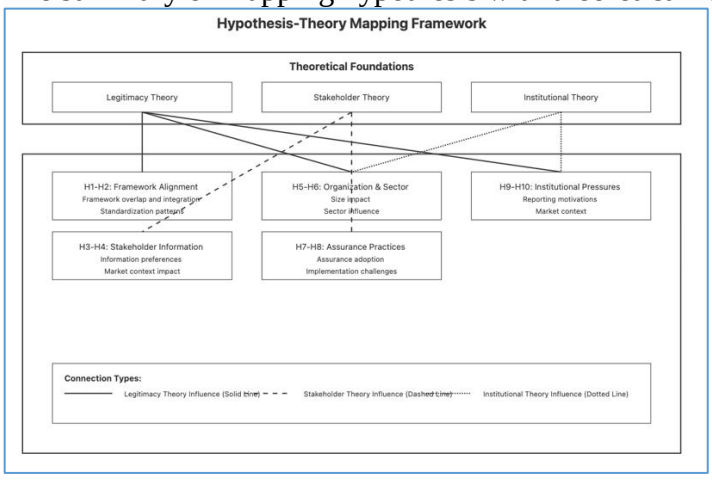


Figure 2.2

Mapping hypothesis with theoretical foundations

CHAPTER III:

METHODOLOGY

3.1 Overview of the research problem

With climate change leading to financial stability risks and net zero transitions gaining momentum, transparency through consistent and robust sustainability disclosures emerges as a crucial pivot (Monciardini, Mähönen and Tsagas, 2020). This mandates systemic assessments, which this research undertakes by analyzing the disclosure landscape and ecosystem, including studying interlinkages covering stakeholder usage, assurance reliability, and high-emission sectors. The primary objectives are:

- Compile and compare major climate risk and sustainability disclosure frameworks, standards, and regulatory requirements.
- Examine disclosure needs and expectations of diverse shareholder groups, regulatory agencies, and other stakeholders.
- Analyze disclosure practices of high-impact sectors and identify adoptable lessons.
- Critically analyze assurance and verification mechanisms adopted for sustainability reporting.
- Examine theories to explain what drives differences in companies' sustainability reporting fully.

3.2 Operationalization of Theoretical Constructs

Sustainability reporting is increasingly being widely accepted, and more governments are embracing global reporting frameworks and standards, as well as implementing local legislation for sustainability reporting. The study topic necessitates the use of qualitative, quantitative, and mixed method approaches to assess sustainability frameworks and standards and covers the numerous aspects associated with sustainability reporting.

The objective of the research is to identify the gaps in various aspects of sustainability reporting. The research starts with the identification of various reporting frameworks and standards and compares their content. This helps in identifying their intersections and distinctiveness. The various stakeholders are identified in the sustainability reporting ecosystem, and these stakeholders are interviewed to assess their priorities and apprehensions. The research further employs a questionnaire to poll diverse stakeholders in order to collect their perspectives on factors connected to sustainability reporting. The survey is tailored to meet the specific needs and interests of various stakeholders and sectors, particularly high-emision sectors. The survey findings are analyzed using several statistical techniques to identify patterns in sustainability reporting. The interviews with different stakeholders further consolidate the findings. Finally, the research also uses actual sustainability reports published by companies in different sectors and economies to have a practical understanding of the various theoretical aspects reached through standards content analysis, interviews, and surveys.

3.3 Research aims

The research aims to assess the level of alignment and integration among major climate risk and sustainability disclosure frameworks (e.g., ISSB, TCFD, SASB, GRI) by conducting a comprehensive comparative analysis of their focus areas, terminologies, and data definitions. This aim seeks to identify gaps, overlaps, and opportunities for standardization in the current disclosure landscape.

The research investigates the varying sustainability disclosure needs, expectations, and practices across different stakeholder groups, markets, and sectors. This includes a) Comparing the disclosure preferences of mainstream institutional investors versus values-driven investors. b) Analyzing the differences in sustainability reporting practices between developing and developed markets. c) Examining the unique disclosure characteristics and maturity levels of high-impact sectors.

The research develops a comprehensive theoretical framework that explains the drivers behind companies' sustainability disclosure practices and the variations in reporting across different contexts. This aim seeks to integrate concepts from legitimacy theory, stakeholder theory, and institutional theory to provide a holistic understanding of sustainability reporting motivations and practices.

3.4 Research design

The design of the research is a mixed approach using a combination of quantitative, qualitative, and mixed-method approaches. The research methodology and the philosophy are in line with the research objectives of reporting frameworks and standards overlaps, effectiveness of assurance in sustainability reporting, stakeholders' expectations, and sectoral implications of sustainability reporting.

The ontological position adopts constructivism by recognizing sustainability reporting-related frameworks and standards constructed through the interaction of various stakeholders and evolving societal expectations. The development of frameworks involves negotiations between investors, companies, regulators, and other stakeholders, resulting in clearly documented frameworks.

Epistemologically, this research takes a practical approach by acknowledging that the understanding of sustainability reporting requires both objective measurement and subjective assessment. This position justifies combining quantitative framework comparison with qualitative exploration of stakeholder perspectives.

The research applies tools like content analysis of sustainability disclosures, survey questionnaires distributed among key ecosystem stakeholders, and in-depth semi-structured interviews with relevant stakeholders for generating integrated multi-perspective insights to meet the study objectives.

By using tools like systematic content analysis, the study maps technical overlaps between frameworks, studies framework adoption trends, analyzes disclosure patterns across high-emission sectors, and assesses assurance coverage. The study uses qualitative approaches to examine stakeholder expectations through semi-structured interviews and assurance providers' methodologies and challenges. The qualitative analysis also helps in understanding the reporting narratives and organizational rationales and identifying the theoretical explanations for reporting behavior. The mixed methods integration provides complementarity between statistical patterns and explanatory insights and helps in comprehensive coverage of technical and social dimensions. The methodological triangulation helps in strengthening the validity of research and iterative development, where findings from each method inform the other. The mixed-method design also enables examination through multiple theoretical lenses. The explanation includes institutional theory explaining framework adoption patterns, stakeholder theory analyzing varied expectations and influences, and signaling theory examining corporate reporting choices. This methodological framework supports both theoretical understanding and practical application in the harmonization of frameworks, setting of standards, development of assurance, and development of sector-specific best practices.

Rationale for mixed-methods approach

This research employs a mixed-methods approach to capture both the breadth and depth of sustainability-related disclosures. The quantitative analysis provides measurable data on disclosure practices, enabling pattern identification across sectors and geographies. In contrast, qualitative interviews offer nuanced insights into stakeholder motivations, regulatory pressures, and organizational strategies. This combination allows for data triangulation, enhancing the validity and robustness of findings, and is particularly suitable given the complex, multi-dimensional nature of sustainability reporting.

3.5 Research design justification

The sustainability reporting process is complex and involves perspectives from multiple stakeholders. There are various sustainability reporting frameworks, including international and national standards. The sustainability reporting also varies with the market context. The data requirements for the study are complex. The research requires quantitative data to understand framework adoption patterns and reporting metrics using large-scale survey deployment, statistical pattern identification, hypothesis testing, and framework comparison metrics. The research requires qualitative analysis of implementation challenges and stakeholder perspectives using in-depth interviews, context exploration, pattern explanation, and challenge identification. The integration of qualitative and quantitative analysis requires comprehensive analysis. The integration benefits include pattern validation, context understanding, and comprehensive insights.

The study involves the data source triangulation method. The data source triangulation involves multiple stakeholder groups, different market contexts, and various frameworks. The method triangulation involves survey data, interview insights, document analysis, and statistical testing. The analytical triangulation involves statistical analysis, thematic analysis, content analysis, and cross-method validation.

Research design framework

The research design follows an explanatory sequential mixed-methods framework. The study began with a quantitative phase, analyzing sustainability reports from 12 companies across diverse sectors (energy, finance, technology, and manufacturing). This phase established baseline trends in disclosure practices. The qualitative phase involved 15 semi-structured interviews with stakeholders, including investors, regulators, assurance providers, and sustainability officers from companies. Purposive sampling was employed to select participants with extensive knowledge of sustainability reporting frameworks. Interview questions were designed to explore key themes identified in the quantitative analysis, ensuring methodological alignment.

3.6 Reporting frameworks and standards review

The different sustainability-related reporting frameworks and standards are identified. These include international frameworks and standards like TCFD, IFRS S1, IFRS S2, SASB, and GRI, and national or regional standards like SEC, CSRD, SFDR, CSDDD, etc. However, the national level standards are still a work in progress and can be taken as future work based upon the current research.

The content analysis of the international frameworks and reporting standards is conducted by analyzing various themes developed based upon the hypothesis, the role of different stakeholders, their viewpoints, and their priorities. The comparison revolves around the objective of these frameworks and standards towards different stakeholders, different data points, the role of assurance, high-impact sectors, and motivation for disclosures.

3.7 Interviews and survey questionnaires

Structured survey questionnaires distributed among around 85 stakeholders elicited perspectives across investors, regulators, stock exchanges, disclosing companies, assurance providers, ESG rating providers, and independent directors regarding current sustainability disclosures quality, assurance mechanics, usage drivers, and scope improvements opinions. This has facilitated 360-degree holistic diagnostic assessment through mixed-methods triangulation. The findings of the surveys were supplemented through interview inputs.

Justification for including stakeholders:

Investors: The investors are the primary users of sustainability reports. They use reports for their investment decisions and are in the best position to assess their effectiveness. The market in which investors operate also shapes the reporting requirements, framework development, and assurance practices. The investors bring diverse perspectives from different investment strategies with varied sustainability focus and market perspective.

Regulators: The regulators are involved in the standard-setting process. They play an important role in framework development and implementation guidance. The regulators are in best

position to understand market-specific needs. The regulators understand the implementation challenges and bring the clarity to bridge the adoption gaps. The benchmark for the level of assurance is set by the regulators.

Assurance provider: The assurance provider ensures the quality control of sustainability reports. They ensure reporting reliability and manage framework effectiveness through implementation verification. The assurance providers can identify the implementation challenges and success factors for any reporting framework.

Disclosing companies: These are the main stakeholders who provide sustainability reports that are used by other stakeholders. Hence, it becomes very important to seek their feedback to understand their perspective and their challenges for adopting reporting frameworks, providing the data, and interacting with different stakeholders. By bringing in the sectoral variation and the market context, the disclosing companies can provide feedback on these factors in shaping their sustainability report.

Respondent Profile:

A total of 15 respondents are interviewed for this process. The respondents are identified from four major categories, which included investors, regulators, assurance providers, and disclosing companies. The mix of these stakeholders is identified to cover different aspects of sustainability reporting from different viewpoints and across different sections, including developed and emerging economies and high- and low-emission intensity sectors. The profile of the respondents who were interviewed is given below:

Investor 1: The respondent is a return-focused investor from a large asset management firm. The firm belongs to the developed market, and its primary focus was on financial returns.

Investor 2: The respondent is an impact investor managing a sustainable investment fund from a developed market. The guiding principles include environmental and social impact.

Investor 3: The respondent is a pension fund manager from a developed market. The investment horizon of the investor is long-term, with focus to manage systemic risk.

Investor 4: The respondent is an ESG-focused investor managing an ESG thematic fund from a developing market. The focus of the fund is to identify sustainability themes and take the social impact of the investment into consideration.

Regulator 1: The respondent is an international standard setter working on global framework development. The focus of the respondent is framework adoption by different jurisdictions and leading the harmonization efforts.

Regulator 2: The respondent is from a national regulator for the securities market from a developing market with focus on implementation guidance of ESG disclosure rules.

Regulator 3: The respondent is a national regulator from an emerging market with focus on the development of sustainability disclosure, capacity development, and market adaptation.

Regulator 4: The respondent is from a global body working with multiple international and national sustainability framework developers. The key focus of the respondent is on cross-border standards and regional harmonization.

Assurance provider 1: The respondent is from a global assurance firm with a multi-market presence. The firm works in both developed and emerging markets and has wide sectoral coverage.

Assurance provider 2: The respondent is an assurance provider from an emerging market and has worked mainly with the high-emission industries.

Assurance technical specialist: The respondent is working with an organization developing technical standards for assurance. The respondent has expertise in standards development and has cross-market experience.

Company 1: The respondent is heading the sustainability vertical of a high-emission energy sector from a developed market. The company has adopted multiple frameworks and was featured in industry best practices for reporting.

Company 2: The respondent is from the sustainability team of a high-emission manufacturing company from an emerging economy. The company has started disclosing sustainability-related information and developing reporting-related capabilities.

Company 3: The respondent is from the sustainability team of a technology company that is based in a developed market. The company has matured reporting disclosure practices and has integrated sustainability in their internal decision-making processes.

Company 4: The respondent is head of sustainability in a leading financial services firm from an emerging market. The firm is in the sustainability reporting adoption phase.

3.8 Sustainability report analysis

The sustainability report is the final document, which acts as a way of communication between companies and different stakeholders in the sustainability space. The study of sustainability reports helps in comparative benchmarking of disclosure quality, material issues discussed, assurance incorporation, and adoption of standards across companies from sectors with different levels of sustainability impacts. The selection of companies for the analysis of sustainability reports is based upon the status of the economy to ensure that assessment takes the economic development dimension into consideration.

3.9 Data types and collection tools

This study utilizes both primary and secondary data sources. Primary data were collected through surveys and semi-structured interviews with key stakeholders. Secondary data comprised sustainability reports from companies, regulatory documents, and existing literature on sustainability frameworks (ISSB, TCFD, GRI). The integration of primary and secondary data enabled comprehensive triangulation, enhancing the reliability of the findings.

The various data collection methods include content analysis, survey and interview with different stakeholders. The content analysis is used for framework comparison, reporting practice analysis and implementation pattern identification. The advantages include systematic analysis,

objective comparison and identification of pattern. The applications of content analysis include framework document analysis, sustainability report review, implementation guide assessment and identification of best practices.

Survey methodology

The survey methodology is used to assess broad stakeholder perspective, pattern identification, hypothesis testing and practice mapping. The advantage of survey is its wide reach and the standardized data as output which is useful for statistical analysis and pattern identification. Its applications include identification of stakeholders' preferences and preference challenges.

The survey targeted more than 300 stakeholders, including corporate sustainability executives, ESG analysts, investors, and policymakers. A structured questionnaire was distributed via Google Forms, focusing on key dimensions such as reporting framework adoption, assurance practices, and stakeholder expectations. The survey achieved an 28% response rate. Data collection spanned more than two months, and responses were anonymized to ensure confidentiality.

Interview methodology

The interviews method is used to get understanding of the context and deep insights into the topic. The interviews are useful for flexible understanding of the topic.

Semi-structured interviews were conducted with 15 sustainability professionals, lasting between 45–60 minutes each. Interviewees were selected using purposive sampling to ensure diversity in sectoral representation and expertise. Interviews explored themes such as the effectiveness of sustainability frameworks, challenges in assurance, and regulatory pressures. Transcripts were analyzed using thematic coding to identify recurring patterns.

3.10 Guiding questions for the interview

The guiding questions for each of the stakeholders interviewed are provided. The questions have been pre-mapped with each of the hypotheses so that the responses can be used to accept or refute the hypotheses. Also, wherever possible, the questions are followed up with further probing

questions to have a better understanding of the view of the stakeholder. The questions are provided in Appendix D.

3.11 Data triangulation

Comparing literature themes, interview narratives, survey results, and disclosure patterns facilitates triangulated, multi-perspective insights into what constitutes reliable, decision-useful sustainability reporting. The feedback from one approach helps to reinforce the other approach. The study of different literature helped to clearly identify different themes on sustainability reporting and the role of different stakeholders. The structured interview with different stakeholders helps to identify the priorities and challenges from their viewpoints. The survey questionnaire was an extension of the interview process to get the response in a structured form for analysis and validation of various hypotheses used in this research. The analysis of sustainability reports of different companies belonging to diverse sectors from different geographies and following different reporting frameworks and standards gives practical insights into the response collected from different methods, including literature, interviews, and surveys.

3.12 Population and Sample

The research is conducted by having interviews and surveys from the different stakeholders in the sustainability space. These stakeholders have been identified based upon the purpose for which these stakeholders interact. Hence, we can say that the purposive sampling method is used as the purposive sampling method is a judgment sampling method that uses researcher skill to select the appropriate respondents for the study. This sampling method helps to identify respondents who have relevant knowledge and skill sets to respond to the research-related questions.

The current study identifies persons working in the sustainability field who are fairly familiar with the sustainability reporting landscape and its evolution. The study further classifies the sample into different buckets based upon the stakeholder group to which these respondents

belong. This makes the purposive sampling more accurate by posing specific questions to the interest group.

The content analysis of the sustainability report was conducted by taking companies from both high-emission as well as low-emission sectors and developed as well as developing economies.

3.13 Participant Selection

The participants for the interview and the survey are various stakeholders in the sustainability space. The different types of stakeholders include investors, regulators, stock exchange representatives, disclosing company representatives, assurance providers, sustainability rating providers, independent directors, sustainability consultants, sustainability product developers, ESG data providers, and academics. The interviews were conducted in two rounds. In the first round, the stakeholders were asked questions related to various hypotheses and the role of the stakeholders with respect to those hypotheses. Based upon the interview with stakeholders, the questions along with the options were finalized. Afterwards, the survey was conducted. The questions for the survey were specific to these stakeholders, and all participants had to provide a response to the questionnaire specific to their stakeholder group as well as the questionnaire for the other stakeholder group. By asking questions from the different interest groups on their views on the priorities of other interest groups, we can have an outside-in perspective on the reporting frameworks and standards. After getting substantial response and once the trend was available for the questions, the interview process was again conducted to analyze the result of the survey and understand the response in more detail.

3.14 Data Collection Procedures

The survey for the participants was conducted using Google Forms. The link for the survey was sent to participants using different channels like sustainability-focussed Whatsapp groups, Linkedin connections, Linkedin groups, personal messages, and calls. The data collection process

was conducted for about a month. During the process, it was ensured that the survey is filled out by respondents working in the sustainability domain only so that the output is not diluted. Special requests were made to regulators to fill out the survey as their response was crucial to understanding the regulatory view on reporting frameworks and standards and the future direction of the same. Similarly, assurance providers were also targeted to get their views on the effectiveness of the current sustainability reporting landscape and their expectations to make it more effective. The response was received from a total of 85 persons.

The interviews were conducted with different stakeholder group members. The interview process was conducted in two phases. Firstly, during the preparation of the survey questionnaire, clearly identify the themes for questions and the options for those questions. After getting a response from the survey, the interviews were conducted to get deeper insights into the response provided and interpret the results of the survey. A total of 15 persons belonging to these different stakeholder group were interviewed.

For comparing the sustainability reports, total of 12 companies belonging to 6 sectors listed in devloped and emerging markets were studied.

3.15 Data Analysis

The data from the surveys was analyzed using various tools. The response to the surveys was generated using the in-built graphs in the Google Form utility. The response of different stakeholders was analyzed using Python. The chi-squared test was used for the analysis. The chi-squared test is used to evaluate the independence of response distributions. The analysis also used simulated p-values computed where applicable for greater accuracy in cases with small expected frequencies. The key metrics used included frequencies and percentages of responses, test statistics, degrees of freedom, and p-values.

For qualitative analysis, NVivo tool is used. The tool is used to identify themes and draw clear conclusion. The process for stattistical analysis is given below:

Hypothesis Testing:

Pearson's Chi-Squared Test is applied to evaluate the statistical independence of responses. Contingency tables were constructed for each hypothesis to analyze the association between variables.

Principal Component Analysis (PCA):

PCA was employed to reduce the dimensionality of responses and identify key underlying components driving variability.

For each hypothesis:

- Questions are transformed into numerical data through response mapping.
- Data is standardized to ensure equal contribution from all variables.
- PCA outputs included the proportion of variance explained by each principal component (PC) and the variable loadings on PCs.

Interpretation:

The importance of each PC was determined by the variance it explained, with the first few PCs typically capturing the majority of variability. Variable loadings are analyzed to identify which questions strongly influenced each PC, offering insights into stakeholder perspectives.

Statistical Significance:

A near-zero p-value suggests rejecting the null hypothesis (H_0) in every case. This means there is a strong association between the variables in the contingency tables, implying that the observed distributions differ significantly from the expected ones.

3.16 Reliability and validity of research

This research implements comprehensive measures to ensure reliability and validity across all methodological components. The approach combines multiple validation techniques along with quality control procedures. For content analysis, standard coding procedures were used to ensure coding consistency. A standardized data collection template was used for the surveys. The

stakeholders were identified and interviewed based upon a standard set of questions unique to the stakeholder. The method triangulation was ensured by using primary stakeholder data and secondary framework documentation. combining surveys, interviews, and content analysis. The source triangulation is ensured using primary stakeholder data and secondary framework documentation. The analyst triangulation is ensured through multiple researcher involvement. Hence, the research uses cross-validation of findings across different methods and sources. This multi-layered approach to reliability and validity ensures robust research findings while maintaining methodological rigor. The combination of quantitative and qualitative validation techniques, supported by systematic documentation and expert verification, provides a strong foundation for the research conclusions.

Ensuring reliability and validity

To ensure reliability, the study employed multiple strategies:

- Pilot testing of the survey with 10 sustainability experts to refine question clarity and relevance.
- Inter-rater reliability checks during content analysis to minimize subjective bias.
- Consistency checks in coding qualitative interview data using the required tools.

Validity was enhanced through data triangulation (comparing findings from reports, surveys, and interviews), member checking (validating interview findings with participants), and cross-validation of secondary data sources.

3.17 Research design limitations

The research is limited to understanding the existing sustainability reporting using different techniques like literature review, interviews, surveys, reports, and study of sustainability reports. The research design has its own limitations in arriving at certain empirical numbers in terms of the effectiveness or usefulness of the reporting frameworks and standards. The research is not

designed to quantify the power of sustainability-related reporting in terms of profitability or financial performance.

In terms of survey design, the sample is skewed towards representatives from certain sectors. The sample also has geographic concentrations and fewer representations from small and medium enterprises. There can be potential self-selection bias from respondents. The survey may be biased due to regulatory changes during the survey period. For interviews, there can be limitations due to focus on specific stakeholder groups leading to missing the broader perspectives.

The research acknowledges these limitations and uses multiple data collection methods, including in-depth interviews and content analysis, to mitigate their impact on the overall findings.

3.18 Conclusion

The analysis uses literature review, structured interviews, surveys, content analysis, and sustainability report analysis to identify the trends in sustainability-related reporting. The concept of different stakeholders views gives dimensions of an outside-in perspective. The interviews with sustainability practitioners also allow to understand the priorities and challenges in sustainability reporting and its expected evolution. The combination of various approaches helps to understand the existing sustainability-related reporting standards and frameworks, their overlaps and uniqueness, assurance-related practices and the adoption by different companies, especially from high-emission sectors. The adoption of different approaches for the research reinforces the learnings of each approach from the other approaches and helps to fill the gaps and have a holistic approach.

CHAPTER IV:

RESULTS

4.1 Survey results, feedback from interviews and content analysis

The result section is divided into 5 parts for each of the 10 hypothesis.

Part A: This section compares each hypothesis with the content of the reporting frameworks and standards. Each hypothesis is broken down with an explanation of the framework's relevant features and their alignment with the hypotheses.

Part B: This section contains an analysis of the interviews conducted with the major stakeholders in the context of each hypothesis.

Part C: This section contains the conclusion of sustainability report analysis of the companies mapped to each hypothesis.

Part D: For each of the granular hypotheses, the list of survey questions mapped to the granular hypotheses is provided. This section provides the survey results based on the mapped questions.

Part E: For each of the granular hypotheses, the results of the statistical analysis based on survey questions mapped to the granular hypotheses are provided.

4.2 Hypothesis Group 1: Framework alignment and integration

This hypothesis group focuses on evaluating the consistency and integration across major sustainability reporting frameworks, such as ISSB, TCFD, SASB, and GRI. The hypotheses examine overlaps in focus areas, alignment in terminology, and standardization in reporting practices. The hypotheses explore whether frameworks share common core sustainability topics, use consistent terminology, and align on data definitions and metrics. Additionally, it assesses the standardization of reporting requirements, materiality assessment approaches, and assurance

alignment across these frameworks. The goal is to identify opportunities for reducing reporting complexity, improving comparability, and enhancing efficiency, ultimately benefiting companies, investors, and regulators alike.

H1: Framework content and structure

The hypothesis tests the overlap in focus areas and terminology between ISSB, TCFD, SASB, and GRI frameworks. This assesses consistency in framework terminology alignment in data definitions and metrics. The hypothesis is relevant as there is a market need to reduce the reporting complexity, improve comparability, and enhance efficiency.

Part A: Framework analysis

IFRS S1 features:

The IFRS S1 covers general sustainability disclosures that are focused on financially material risks and opportunities across ESG topics. The framework integrates SASB industry-specific metrics, promoting alignment across sectors. The IFRS S1 focuses mainly on investor needs, fully overlapping with TCFD's financial materiality concepts. IFRS S1 demonstrates strong integration with existing financial reporting mechanisms, facilitating standardized implementation.

IFRS S2 features:

The IFRS S2 draws fully from TCFD, adopting its four-pillar structure: governance, strategy, risk management, and metrics/targets. The framework is very specific by incorporating climate-related financial risks, emissions metrics, transition planning. IFRS S2 provides comprehensive guidance for climate-related financial disclosure standardization across industries.

GRI features:

The GRI uses a double materiality approach, addressing both financial impacts (aligned with ISSB) and broader societal impact. The framework includes a wide range of ESG topics beyond climate, including human rights, labor, and community impacts. GRI standards offer the

most comprehensive coverage of sustainability topics while maintaining alignment with financial reporting needs.

Part B: Feedback from interview and content analysis

The hypothesis assumes that stakeholders identify significant overlaps but highlight different priorities based on their roles. Common themes emerged around harmonization needs and implementation challenges.

The investors highlighted the overlap in the framework and expressed a need for standardized financial metrics. The financial investor community prefers to refer to the ISSB/TCFD approach. One prominent investor from developed market informed that while they primarily use ISSB for financial analysis, they also require GRI data for client ESG screening. The investor community generally uses TCFD data for climate risk assessment and supplements it with GRI for social metrics. One of the investors has developed a tool for mapping frameworks, which aids in the overlapping of metrics. The investors highlighted data standardization challenges and increased costs due to multiple frameworks.

The regulators are working toward harmonization, with a focus on baseline standards and regional adaptation needs. The international regulators noted that TCFD serves as the foundation for ISSB, which also incorporates metrics from SASB. The regulators pointed to the current work on the interoperability of GRI and ISSB.

The assurance providers pointed out that framework differences affect assurance costs, and there is a need for standardized verification approaches. One of the assurance providers shared an instance where they had to provide assurance for an energy firm, and efforts related to the reconciliation of multiple frameworks led to increased costs.

For the disclosed companies, the resource burden from multiple frameworks necessitated the need for practical implementation guidance. The companies also highlighted the need for sector-specific challenges to be addressed. The discussion identified overlaps in common metrics

such as carbon emissions, water usage, energy consumption, and governance structures. The differences include materiality definitions, scope boundaries, calculation methodologies, and reporting timeframes. One manufacturing company provided an example of the differences between ISSB and GRI, stating that ISSB only considers financially material water risks, while GRI considers all water impacts, regardless of their financial materiality.

The content analysis of the framework alignment level found that it was high for basic environmental metrics, medium for governance structure, and low for impact measurements. There are persistent gaps for materiality definitions, scope boundaries, and measurement methodologies.

Part C: Sustainability report analysis

Approach:

The frameworks explicitly referenced in the sustainability reports and the focus areas they emphasized were reviewed. The review involved analysis of key words used in the sustainability reports.

Analysis:

Developing economies:

Reliance and Vedanta from India use GRI, SASB, and the United Nations SDGs for materiality assessments. The key focus areas include decarbonization, water management, and social impact. SASB is referenced for sector-specific material issues, particularly in the metals and energy sectors.

Developed economies:

Apple (USA) aligns with TCFD for climate-risk disclosures, emphasizing emissions, renewable energy integration, and climate resilience. Similarly, JPMorgan Chase references SASB and TCFD for governance and risk reporting.

Overlap in terminology:

Common terms like net-zero, circular economy, and climate resilience appear consistently in the sustainability reports. Reporting differences are evident in data granularity, with developed countries providing more precise quantitative data points and developing countries disclosing broader ESG topics like financial transparency and anti-corruption.

Conclusion:

There is an overlap in focus areas (climate risks, emissions, water, and energy), but significant differences in terminologies and detail levels exist.

Part D: Survey H1a

H1a: Content overlap

Mapped Questions:

Q24 (Regulators): How consistent is terminology across different frameworks?

Q25 (Regulators): Rate the level of integration between framework pairs

Q79 (ESG Rating Providers): What improvements are needed in current reporting standards?

Q18 (Investors): What improvements would enhance sustainability disclosure usefulness?

Q45 (Stock Exchanges): What improvements would enhance reporting quality?

Analysis from survey

The survey presents a mixed picture regarding content overlap across sustainability frameworks. While certain aspects show alignment, significant challenges exist in achieving complete harmonization.

Framework integration status

The survey highlights varying levels of framework integration within sustainability reporting. Strong integration is observed between the ISSB and TCFD frameworks, reflecting their close alignment in structure and reporting requirements. Partial integration is evident between GRI and TCFD/SASB frameworks, suggesting some commonalities but also notable differences in focus and scope. Limited integration exists between national and international standards,

highlighting the challenges of harmonizing regional regulations with global frameworks. Additionally, there is only moderate consistency in terminology across frameworks, indicating discrepancies that complicate full alignment.

Key challenges identified

Definitional issues

Definitional issues present significant challenges to the harmonization of sustainability reporting frameworks. Different measurement methodologies across frameworks create inconsistencies in data reporting, making direct comparisons difficult. Varying scope definitions further complicate alignment efforts, as frameworks may emphasize different aspects of sustainability, leading to gaps in coverage. Regional variations also affect standardization, as local regulations and priorities influence the way sustainability is reported, limiting global consistency. Moreover, differences in the definition of materiality cause interpretation challenges, as stakeholders may prioritize different factors depending on the framework, leading to divergent reporting practices.

Implementation barriers

Implementation barriers hinder the effective harmonization of sustainability reporting frameworks. A lack of clear guidelines contributes to confusion and inconsistent application of reporting standards across organizations. The need for enhanced capacity-building programs is evident, as many entities lack the expertise and resources necessary to implement complex reporting frameworks effectively. Furthermore, inadequacies in enforcement mechanisms weaken the accountability of organizations, allowing for variability in the quality and completeness of disclosures. Lastly, regulatory coordination gaps between national and international bodies create fragmented reporting landscapes, making it difficult to achieve comprehensive, standardized sustainability disclosures.

Conclusion on H1a

The hypothesis of significant overlap in core sustainability topics across frameworks is partially supported. While there is substantial alignment in basic data points, particularly between ISSB and TCFD where ISSB is built on TCFD, significant gaps exist in broader framework integration. The survey suggests that while core content shows overlap, differences in implementation, measurement methodologies, and regional adaptations create practical challenges in achieving complete harmonization.

Part E: Statistical analysis of H1a

Hypothesis Result:

X-squared = 1044, df = 90, p-value = 0.1667

Conclusion: Fail to reject the null hypothesis as p-value is greater than 0.05

Part D: Survey

H1b: Terminology consistency

There is a high degree of terminology consistency across major sustainability reporting frameworks.

Mapped Questions:

Q26 (Regulators): What are the main challenges in aligning data definitions across frameworks?

Q24 (Regulators): How consistent is terminology across different frameworks?

Q39 (Stock Exchanges): What challenges exist in monitoring reporting standards?

Q74 (ESG Rating Providers): What challenges exist in sustainability report evaluation?

Analysis from survey

Level of consistency

The survey reveals that terminology consistency across sustainability reporting frameworks is moderate to limited. A majority of respondents rated terminology as only "Moderately consistent" or even "Somewhat inconsistent," indicating that significant differences persist across frameworks. One of the primary areas of inconsistency is the definition of

materiality, which varies widely between frameworks and creates confusion in interpretation. Furthermore, even basic terms show limited alignment, reflecting the broader challenges in achieving uniformity in sustainability reporting terminology.

Main alignment challenges

Respondents identified several key challenges affecting the alignment of sustainability reporting terminology across frameworks. A primary issue is the presence of different measurement methodologies, which complicates the process of standardizing data and ensuring consistency. Varying scope definitions across frameworks also create interpretation issues, making it difficult to align reports on similar topics. Additionally, regional variations contribute to terminology differences, as localized adaptations of frameworks lead to discrepancies in language and definitions. Finally, the inherent technical complexity in standardizing diverse frameworks adds another layer of difficulty in achieving seamless integration.

Framework alignment

The survey indicates that most respondents perceive sustainability reporting frameworks to be either "Moderately aligned" or "Neutral," suggesting a lack of comprehensive integration across different standards. To address these discrepancies, companies frequently publish mapping indices that reconcile the varying requirements of multiple frameworks, enabling them to present cohesive reports. Additionally, organizations often adopt a dual-reporting strategy by using both dedicated sustainability reports and integrated reports, allowing them to meet the diverse expectations and guidelines of different sustainability frameworks.

Conclusion on H1b

The hypothesis suggesting significant terminology consistency across frameworks is not supported by the evidence. The findings indicate considerable variation in terminology usage and definitions across frameworks, with challenges in achieving standardization.

Part E: Statistical analysis of H1b

Hypothesis Result:

X-squared = 686, df = 66, p-value = 0.001996

Conclusion: Reject the null hypothesis as p-value is less than 0.05

Part D: Survey

H1c: Implementation approach

There is alignment in data definitions and metrics across frameworks, evaluated through comparative analysis of key reporting metrics.

Mapped Questions:

Q27 (Regulators): What improvements would enhance regulatory effectiveness?

Q54 (Disclosing Companies): How aligned are different reporting frameworks?

Q45 (Stock Exchanges): What improvements would enhance reporting quality?

Q90 (Independent Directors): What improvements are needed in current standards?

Analysis from survey

The analysis of survey responses reveals significant variations in framework implementation approaches, challenging the hypothesis of consistency across organizations. The evidence shows diverse patterns influenced by organizational context, resources, and external pressures.

The survey findings identify the following dimensions of implementation variation:

Implementation challenges

The survey findings highlight that data collection and framework interpretation emerge as primary challenges in the implementation of sustainability reporting frameworks. Organizations reported difficulties in gathering consistent and reliable data that aligns with the varying requirements of different frameworks. Additionally, significant technical complexity in interpreting these frameworks further complicates the implementation process, creating barriers to achieving standardized reporting practices.

Adoption drivers

The survey indicates that regulatory requirements have emerged as the primary driver for the implementation of sustainability reporting frameworks. Organizations are motivated to comply with these regulations to meet legal obligations and avoid potential penalties. Investor demands were ranked as the second major influence, reflecting the growing importance of sustainability disclosures in investment decision-making. This highlights how external pressures, particularly from regulators and investors, play a crucial role in shaping sustainability reporting practices.

Strategic impact

Organizations report significant strategic changes and moderate operational adjustments in response to the implementation of sustainability reporting frameworks. These strategic shifts often involve integrating sustainability goals into broader corporate strategies, aligning business operations with ESG criteria. While operational adjustments are moderate, they typically include refining reporting processes, enhancing data accuracy, and ensuring compliance with evolving standards. This highlights the transformative impact of sustainability frameworks on organizational practices and decision-making.

Resource requirements

Technical expertise and system support are identified as critical components for successful implementation of sustainability reporting frameworks. Organizations have reported significant investments in capacity-building and the adoption of technology solutions to streamline the reporting process. However, the evidence does not support the hypothesis of consistent implementation approaches. Instead, implementation patterns vary significantly based on organizational size and capability, available resources and expertise, external pressures and requirements, and the existing technical infrastructure. These variations underscore the complexity and diversity of approaches organizations adopt to meet sustainability reporting standards.

Part E: Statistical analysis of H1c

Hypothesis Result:

X-squared = 944, df = 69, p-value = 0.001248

Conclusion: Reject the null hypothesis as p-value is less than 0.05

H2: Framework integration

The hypothesis tests the level of standardization in reporting requirements, including consistency in materiality approaches and alignment in assurance requirements. The hypothesis is relevant due to its practical application in implementation effectiveness, resource optimization, and quality consistency.

Part A: Framework analysis

IFRS S1 features:

The IFRS S1 uses financial materiality, that can create gaps with GRI's broader stakeholder-oriented approach. There is limited emphasis on qualitative social and governance disclosures compared to GRI. IFRS S1 structurally focuses on integration with financial statements. IFRS S1 implementation requires sophisticated reporting infrastructure designed for integrated financial reporting.

IFRS S2 features:

The IFRS S2 is purely climate-specific in focus and it does not address broader social and governance themes in depth. The climate risk assessment differs from GRI, which covers broader environmental impacts. IFRS S2 requires specialized climate reporting capabilities and expertise for effective implementation.

GRI features:

The GRI emphasis on double materiality leads to inconsistent overlap with ISSB standards. The broader scope and terminology inconsistencies create gaps when aligning with ISSB frameworks. GRI standards offer more flexible implementation pathways accommodating different organizational capabilities.

Part B: Feedback from interview and content analysis

Stakeholders identify significant integration gaps in framework implementation, with varying perspectives on standardization barriers and practical challenges. The investors pointed out that integration gaps affect data quality, and they need standardized metrics for comparison. The investors pointed out that market context influences data reliability. One of the investors pointed to the need to maintain multiple data models for different frameworks and created proprietary integration tools.

The regulators responded with their focus on framework interoperability and maintaining balance between standardization and flexibility. One of the international regulators highlighted the ongoing harmonization efforts, which are based on the ISSB-GRI collaboration, aimed at developing common terminology.

The assurance providers pointed out that the framework integration requirement also affects the assurance approach. There is a need for standardized assurance methodologies, as there are resource implications of multiple frameworks. One of the assurance providers highlighted the use of cross-framework references provided by the disclosing companies to facilitate the assurance process.

The companies pointed out that integration complexity varies by sector and has significant resource implications. The companies also reported having system adaptation challenges. One of the conglomerates pointed to the adoption of integrated reporting. The common integration challenges include technical barriers (data collection systems, metric calculations, and reporting platforms), resource implications (staff training, system upgrades), and quality concerns (data consistency, verification approaches, and reporting accuracy). Among the high-emission sectors, energy companies have implemented a comprehensive integration approach. The developed markets have adopted advanced integration, whereas emerging markets are focusing on basic compliance.

The content analysis of the framework found a high level of integration in basic metrics and a low level of integration for risk assessment methodologies. The key integration areas are environmental metrics and governance structures. The major gaps are found in technical specifications, methodology alignment, and implementation guidance.

Part C: Sustainability report analysis

Approach:

The structure and content across companies and frameworks are compared.

Analysis:

Structural differences: The companies from developed countries (e.g., Apple and Holcim) use highly standardized formats aligned with TCFD pillars, focusing on strategy, risk management, metrics, and targets. Developing countries (e.g., Reliance and Vedanta) emphasize local stakeholder priorities such as community development and job creation alongside sustainability goals, reflecting a broader scope.

Focus areas: High-emission sectors like energy and cement focus extensively on carbon neutrality and decarbonization strategies. The low-emission sectors emphasize broader ESG goals.

Integration gaps: There is an evident difference in the reporting of Scope 3 emissions. For instance, Vedanta partially covers Scope 3 data for upstream suppliers, whereas Apple and ExxonMobil provide more comprehensive data.

Conclusion:

There is a clear difference in the structuring of the reports. The difference also persists in terms of coverage and granularity of data, leading to developing countries often lagging in granular data presentation.

Part D: Survey

H2a: Level of standardization

H2a: Reporting requirements exhibit measurable standardization across major frameworks, assessed via a framework comparison matrix.

Mapped Questions:

H2a: Standardization in reporting requirements

Q22 (Regulators): How effective are current sustainability reporting regulations?

Q31 (Regulators): What mechanisms ensure consistent application of standards?

Q28 (Regulators): How should different regional regulatory requirements be harmonized?

Q41 (Stock Exchanges): What measures ensure compliance with reporting standards?

Analysis from survey

The analysis of survey responses and interview insights does not strongly support the hypothesis of standardized reporting across major frameworks. Instead, the evidence reveals significant variations and challenges in achieving standardization.

Regulatory framework status

The survey findings highlight several key barriers to standardization within sustainability reporting. A majority of respondents view current regulations as neutral to moderately effective, indicating that while some progress has been made, there is still room for improvement. Insufficient regulatory frameworks are identified as a major barrier to implementation, suggesting that existing guidelines may lack the comprehensiveness needed to support standardized practices. Additionally, a lack of regulatory clarity and jurisdiction on climate-related issues is noted as a significant challenge, underscoring the need for more precise and authoritative guidance to facilitate uniform reporting standards across different regions and industries.

Technical implementation challenges:

The survey reveals several technical implementation challenges that hinder standardization across sustainability reporting frameworks. Different measurement methodologies across frameworks contribute to inconsistencies, making it difficult to compare and align data effectively.

Varying scope definitions further complicate the process, creating discrepancies in how sustainability metrics are applied and interpreted. Additionally, regional variations play a significant role in affecting standardization, as localized regulations and reporting practices introduce further complexity. These factors collectively present substantial obstacles to achieving a uniform approach in sustainability reporting.

Consistency mechanisms:

The survey highlights key mechanisms that support consistency in sustainability reporting despite existing challenges. Regular audits and third-party verification are emerging as primary tools to ensure the reliability and uniformity of sustainability disclosures. Additionally, there is an increasing adoption of sustainability assurance practices, which help increase trust in reported data. However, resource limitations significantly affect the effective implementation of these mechanisms, particularly in smaller organizations with fewer resources. Furthermore, technical complexity continues to impede standardization efforts, underscoring the need for streamlined processes and clearer guidelines to enhance reporting consistency.

Conclusion on H2a:

The evidence indicates that while sustainability reporting frameworks strive for standardization, practical implementation reveals significant gaps. These discrepancies stem from an evolving regulatory landscape that varies across regions, complicating uniform application. Additionally, multiple agency objectives introduce conflicting priorities, making cohesive standardization difficult. Technical complexity further complicates efforts, as organizations struggle to align diverse methodologies and data definitions. Resource constraints, particularly in smaller entities, limit the capacity to adopt standardized practices effectively. Finally, regional variations in regulatory requirements and industry norms contribute to inconsistencies, highlighting the need for more harmonized global approaches to sustainability reporting.

This suggests that while the goal of standardization exists, the current state of sustainability reporting is characterized by varying requirements and implementation approaches rather than standardized practices across frameworks. The findings point to a need for greater alignment in regulatory approaches, measurement methodologies, and implementation guidance to achieve meaningful standardization.

Part E: Statistical analysis of H2a

Hypothesis Result:

X-squared = 645, df = 45, p-value = 0.000999

Conclusion: Reject the null hypothesis as p-value is less than 0.05

Part D: Survey

H2b: Materiality assessment consistency

Materiality assessment approaches demonstrate consistency across frameworks, evaluated through comparative analysis of materiality principles.

Mapped Questions:

H2b: Materiality assessment consistency

Q6 (Investors): Which type of sustainability data is most crucial for investment analysis?

Q7 (Investors): How should ESG data be integrated into investment decisions?

Q51 (Disclosing Companies): Which sustainability metrics are most valuable for decision-making?

Q73 (ESG Rating Providers): What methods are most effective for evaluating sustainability disclosures?

Analysis from survey

The analysis of survey responses indicates significant inconsistency in materiality assessment approaches across frameworks, challenging the hypothesis of uniformity in materiality determination.

The survey findings reveal critical dimensions of materiality assessment variation:

Framework terminology and definition:

The survey results reveal that the majority of respondents perceive terminology related to materiality as only "moderately consistent" or "somewhat inconsistent" across different sustainability frameworks. This finding is reinforced by content analysis, which highlights inconsistencies not only in terminology but also in the objectives set by various frameworks. These discrepancies contribute to different interpretations of materiality, complicating the implementation of sustainability frameworks and leading to varied reporting outcomes across organizations.

Metric prioritization and value:

The survey findings indicate that environmental impact data emerges as the most valuable metric category in materiality assessments across sustainability frameworks. However, the practical application of this data varies significantly, influenced by organizational priorities and sector-specific needs. The value assessment of sustainability metrics is not uniform; it varies considerably depending on the stakeholder type and sector involved. This variation suggests that while certain metrics are universally acknowledged as important, their relevance and emphasis differ across industries and stakeholder groups, complicating efforts to standardize materiality assessments.

Data quality and standardization:

The survey highlighted a lack of standardization as the primary challenge in materiality assessments across sustainability frameworks. Respondents noted significant issues with data consistency and reliability, which hinder accurate and comparable reporting. Additionally, concerns were raised about the timeliness and sufficiency of information, indicating that delays and incomplete data further complicate the materiality assessment process.

Conclusion on H2b:

The evidence strongly suggests that rather than consistency in materiality assessment, current practice is characterized by: varying definitions across frameworks, different assessment methodologies, framework-specific interpretations, and sector and context-dependent applications. This indicates a need for greater alignment in materiality assessment approaches to improve the consistency and comparability of sustainability reporting across frameworks and organizations.

Part E: Statistical analysis of H2b

Hypothesis Result:

Pearson's Chi-squared test

X-squared = 839, df = 66, p-value = 0.0646

Conclusion: Fail to reject the null hypothesis as p-value is greater than 0.05

Part D: Survey

H2c: Alignment in assurance requirements

Assurance requirements are aligned across frameworks, assessed by comparing assurance standards and practices.

Mapped Questions:

H2c: Alignment in assurance requirements

Q14 (Investors): What is the preferred level of assurance for sustainability disclosures?

Q55 (Disclosing Companies): What assurance level is most appropriate?

Q64 (Assurance Providers): How do assurance requirements vary by sector?

Analysis from survey

The analysis of survey responses demonstrates limited alignment in assurance requirements across frameworks, with significant variations in approach and implementation.

Assurance level variations

The survey reveals a clear preference for reasonable assurance, particularly for quantitative metrics. However, actual adoption varies significantly based on regulatory requirements and organizational capacity. Companies often adopt a mixed approach, using reasonable assurance for critical metrics while maintaining limited assurance for broader disclosures.

Sector-specific patterns

Assurance adoption shows strong sector-based variation, with high-emission sectors and financial services demonstrating more comprehensive assurance practices. The survey indicates moderate to significant variation in assurance requirements across sectors.

Technical and resource challenges

Implementation faces substantial barriers, primarily due to limited technical expertise and qualified personnel. The challenge is particularly acute for environmental data requiring complex assumptions and calculations. Qualitative disclosures present unique assurance challenges, requiring different methodologies and expertise levels.

Market context influence

Market development stage significantly impacts assurance practices. Developing markets face distinct challenges in technical expertise and cost constraints, leading to capacity-building initiatives. This creates a two-tier assurance landscape between developed and developing markets.

Conclusion on H2c

The evidence does not support the hypothesis of aligned assurance requirements across frameworks. Instead, assurance practices appear highly contextualized, varying by framework requirements, sector characteristics, market development stage, data type and complexity, and available expertise and resources. This suggests a need for greater standardization in assurance approaches while acknowledging sector-specific requirements and market context variations.

Part E: Statistical analysis of H2c

Hypothesis Result:

Pearson's Chi-squared test

X-squared = 774, df = 54, p-value = 0.0710

Conclusion: Fail to reject the null hypothesis as p-value is greater than 0.05

4.3 Hypothesis Group 2: Stakeholder information needs

This hypothesis group investigates the varying information needs of different stakeholders, including investors and market participants from both developed and developing regions. It assesses investor preferences for quantitative versus qualitative ESG data and examines how market context—such as differences between developed and developing markets—affects reporting practices. The hypotheses aim to reveal how information is used in investment decisions, how stakeholder expectations shape reporting, and how market maturity influences the adoption and emphasis of sustainability disclosures. The outcomes are expected to guide the development of tailored reporting strategies that meet diverse stakeholder needs.

H3: Investor information preferences

The hypothesis tests different investor type preferences, assesses quantitative vs. qualitative needs, and identifies information usage patterns. This is relevant for investors in their investment decision-making process, portfolio allocation and evaluation, and developing products, services, and strategies.

Part A: Framework analysis

IFRS S1 features:

The IFRS S1 is primarily quantitative, emphasizing financial metrics tied to ESG risks and opportunities. Examples include metrics on carbon pricing, water usage costs, and financial exposure to climate risks. IFRS S1 prioritizes investor-relevant quantitative metrics enabling direct integration into financial analysis.

IFRS S2 features:

The IFRS S2 has a strong focus on quantitative climate metrics like GHG emissions (Scope 1, 2, and 3. This also uses financial implications of climate scenarios. IFRS S2 provides detailed metrics enabling sophisticated climate risk assessment and financial modeling.

GRI features:

The GRI focuses more on qualitative disclosures, such as community impacts, stakeholder engagement, and human rights policies. Values-driven investors seeking broader societal and ethical considerations are better served by GRI's comprehensive reporting. GRI reporting enables holistic sustainability assessment beyond pure financial considerations.

Part B: Feedback from interview and content analysis

The hypothesis assumes that different investor types show distinct preferences in sustainability data needs, with variations between mainstream and values-driven investors affecting framework usage and data requirements.

The mainstream investors who focus on financially material metrics need quantitative data for modeling. They prefer standardized TCFD/ISSB metrics. Value-driven investors demand broader impact metrics, prioritize qualitative information in addition to quantitative data, and utilize comprehensive disclosures such as GRI. As pointed out by one of the investors who has worked on different investment objectives, large investors require comprehensive data, whereas boutique investors look for focused metrics, and impact funds use broad indicators.

The regulators responded to the development of the framework, taking into account the diversity of investors needs. The regulator strikes a balance between different information needs and market-specific adaptations. The standard-setting process decides financial materiality vs. the dual materiality approach with market-specific considerations. The objective of regulators is tiered disclosure requirements with sector-specific metrics. The basic focus area for the regulators is materiality assessment. For SEC climate disclosure rules, with a financial materiality focus,

quantitative metrics emphasize alignment with investor needs. The EU CSRD development follows the double materiality principle with comprehensive disclosure requirements.

The assurance providers identified distinct assurance requirements based on the type of investor and the different levels of assurance needed. One of the international assurance providers highlighted a significant shift in scope as a result of investor preferences. The assurance providers need sector-specific quantitative information. However, as most assurance providers have pointed out, the quantitative information also relies on certain assumptions, leading to ambiguity in the comparison of numbers.

The disclosing companies expressed their aim to manage multiple investor demands through different information requirements for sustainability disclosure. Therefore, they have developed a multi-framework approach to accommodate a wide range of information requirements. Companies from both developing and developed countries have adopted the integrated reporting approach as their foundation, incorporating additional information into their reports, and publishing references to various reporting frameworks for report readers to utilize.

The mainstream investors adhere to financial materiality, utilize quantitative metrics for risk assessment, and favor standardized data. The values-driven investors want impact measurement using qualitative information and stakeholder consideration and hence require comprehensive disclosure. The companies find common ground in terms of basic metrics, governance information, and performance indicators.

Part C: Sustainability report analysis

Approach:

The quantitative vs. qualitative disclosures in the sustainability reports are analyzed.

Analysis:

Quantitative focus:

High-emission companies like ExxonMobil and Reliance focus heavily on quantitative metrics such as emissions reduction, energy consumption, and waste management. These metrics are tailored to institutional investors who integrate ESG factors into financial forecasts.

Qualitative focus:

Companies like Infosys and Holcim provide extensive narratives about community engagement, social responsibility, and diversity. These disclosures are appealing to ethical, values-driven investors.

Quantitative and Qualitative focus:

Reliance includes quantitative data on renewable energy targets (100 GW by 2035) and GHG emissions reductions, while qualitative sections highlight its Swadesh initiative for promoting Indian artisans.

Conclusion:

Quantitative data dominates high-emission sectors and appeals to institutional investors, whereas qualitative disclosures resonate more with ethical funds. Most companies use a combination of quantitative and qualitative factors, wherein quantitative is focused mainly on environmental factors, whereas qualitative is focused on social and governance factors.

Part D: Survey

H3a: Mainstream investor priorities

Mainstream investors show a statistically significant preference for quantitative ESG metrics in financial modeling, based on survey data.

Mapped Questions:

H3a: Mainstream investors prioritize quantitative metrics

Q9 (Investors): What type of sustainability data analysis is most valuable?

Q51 (Disclosing Companies): Which sustainability metrics are most valuable for decision-making?

Q7 (Investors): How should ESG data be integrated into investment decisions?

Q12 (Investors): Rate the importance of different sustainability metrics

Analysis from survey

The analysis of survey responses and interview insights strongly supports this hypothesis, revealing clear patterns in mainstream investor preferences.

Data type preferences

Survey results show that investors value a combination of quantitative and qualitative data, but with specific preferences. Forward-looking metrics were identified as the most valuable, while industry benchmarks were deemed crucial for comparison purposes. Additionally, environmental impact data was prioritized for decision-making processes.

Integration approaches

Survey responses demonstrated sophisticated methods for integrating ESG data. Investors preferred direct integration of ESG data into financial models, though a combination with separate ESG assessments was also common. Interview evidence further indicated that quantitative metrics were frequently used for assessing cash flow impacts.

Investment strategy impact

Investment motivations revealed dual objectives among mainstream investors: the reduction of portfolio risk and the maximization of returns.

Decision-making Process

The analysis of valuable metrics highlighted that environmental parameters were considered the most important. Carbon emissions emerged as the primary metric, with water management identified as a secondary focus.

Conclusion on H3a

The evidence strongly supports the hypothesis that mainstream investors prioritize quantitative, financially material ESG data. Their approach demonstrates a clear preference for

measurable metrics, a focus on financial materiality, and integration with traditional financial analysis. Emphasis on risk-return considerations further indicates a mature approach to ESG integration, where sustainability metrics are viewed as crucial inputs for investment decision-making rather than as separate considerations.

Part E: Statistical analysis of H3a

Hypothesis Result:

Pearson's Chi-squared test

X-squared = 801, df = 48, p-value = 0.00178

Conclusion: Reject the null hypothesis as p-value is less than 0.05

Part D: Survey

H3b: Values-driven investor information

H3b: Values-driven investors exhibit a higher preference for qualitative sustainability disclosures, measured through survey responses.

Mapped Questions:

Q8 (Investors): What are the primary motivations for ESG investment strategies?

Q17 (Investors): How should sustainability considerations be balanced with financial performance?

Q73 (ESG Rating Providers): What methods are most effective for evaluating sustainability disclosures?

Q6 (Investors): Which type of sustainability data is most crucial for investment analysis?

Analysis from survey

Primary investment motivations

The survey results reveal distinct patterns among values-driven investors. Alignment with ethical values was highlighted as a key driver for their investment decisions, while stakeholder

expectations also played a significant role. Additionally, both financial and non-financial goals were considered important, reflecting a holistic approach to investment.

Data integration approach

The analysis of integration preferences shows that values-driven investors favor a combined approach to data utilization. They place value on separate ESG assessments while also considering broader sustainability metrics, ensuring that both qualitative and quantitative data inform their investment strategies.

Stakeholder consideration

Survey responses indicate that stakeholder feedback is actively incorporated into risk assessments. Furthermore, direct stakeholder considerations are factored into decision-making processes, underscoring the importance of inclusivity in investment strategies.

Data requirements

The analysis of sustainability metrics reveals that values-driven investors desire comprehensive coverage of sustainability issues. While environmental parameters are prioritized, social and governance factors are also integrated into their evaluations, demonstrating a well-rounded approach to ESG considerations.

Conclusion on H3b

The evidence supports the hypothesis but with an important qualification: values-driven investors, while emphasizing qualitative aspects of sustainability disclosures, maintain a balanced approach that incorporates both qualitative and quantitative metrics. They demonstrate broader stakeholder consideration, the integration of ethical values, comprehensive sustainability assessments, and a risk-aware approach. This suggests a more nuanced investment strategy than initially hypothesized, where values and measurable metrics combine to inform well-rounded investment decisions.

Part E: Statistical analysis of H3b

Hypothesis Result:

Pearson's Chi-squared test

X-squared = 601, df = 57, p-value = 0.00375

Conclusion: Reject the null hypothesis as p-value is less than 0.05

Part D: Survey

H3c: Investor type influence

Investor type has a statistically significant impact on the preferred level of assurance.

Mapped Questions

1. Q14 (Investors): What is the preferred level of assurance for sustainability disclosures?

2. Q67 (Assurance Providers): What level of assurance is typically expected?

3. Q68 (Assurance Providers): How is the demand for assurance expected to evolve?

Analysis from survey

Assurance level preferences

The survey results demonstrate clear patterns in assurance level preferences among different investor types. A reasonable assurance or combination approach is generally preferred, with interview insights confirming that "reasonable assurance for quantitative data points" is particularly valued. Assurance expectations vary significantly based on investor type, and a mixed approach is often adopted for different sustainability metrics.

Market context impact

Responses revealed notable differences between developed and emerging markets. Developed markets tend to have higher disclosure expectations and stricter assurance requirements, while emerging markets show more flexibility. Assurance needs are thus influenced by the broader market context.

Decision-making framework

The data requirements highlight that in developing markets, there is a basic focus on governance, whereas financial transparency is prioritized across both developed and emerging markets. Environmental considerations, however, vary widely depending on the market context.

Investment strategy influence

Investment approaches indicate that sustainability considerations are highly context-based. Exclusion criteria are frequently used in the initial stages of investment decisions, and investors strive to balance sustainability priorities with financial performance. Requirements are often adapted to fit specific market conditions.

Conclusion on H3c

The evidence strongly supports the hypothesis that investor type influences assurance preferences but reveals a more complex relationship than initially proposed. Different assurance expectations are evident across investor categories, with market context significantly affecting assurance requirements. Additionally, varying emphasis is placed on different sustainability aspects, and assurance needs evolve alongside market maturity. This suggests that assurance requirements are shaped by a combination of investor type and market context, rather than investor type alone.

Part E: Statistical analysis of H3c

Hypothesis Result:

Pearson's Chi-squared test

X-squared = 581, df = 54, p-value = 0.00245

Conclusion: Reject the null hypothesis as p-value is less than 0.05

H4: Market context impact

The hypothesis tests differences between developed and developing markets, identifies regional reporting variations, and assesses the influence of market maturity. The hypothesis is very relevant

as the frameworks are required to be globally implemented with regional adaptation needs and identify capacity-building requirements.

Part A: Framework analysis

IFRS S1 features:

The IFRS S1 main concept of financial materiality focus may not address regional priorities. The framework is heavily reliant on robust infrastructure for data collection and reporting. IFRS S1 implementation complexity varies significantly between developed and developing markets due to infrastructure requirements.

IFRS S2 features:

The IFRS S2 solely focuses on climate risks, which may not align with the basic governance needs of developing markets. This requires climate-related metrics that are costly and complex to assure. IFRS S2 assumes advanced market capabilities for climate risk assessment and reporting.

GRI features:

The GRI standards provide comprehensive governance disclosures (e.g., anti-corruption, board accountability). This is better suited to meet regional needs in emerging markets. GRI framework offers adaptable reporting approaches suitable for different market contexts.

Part B: Feedback from interview and content analysis

The hypothesis assumes that market development stage significantly influences sustainability reporting practices, with clear differences between developed and emerging markets in framework adoption, implementation capabilities, and stakeholder expectations.

The investors have different assessment approaches to markets by adopting their analysis frameworks for market-specific risk considerations. The developed markets have comprehensive data availability, standardized reporting formats and high assurance levels. The emerging markets have basic disclosure focus, governance emphasis and limited data availability. Investment firms

have significantly different metrics for emerging markets and use regional risk premium calculations.

The regulators pointed to market maturity considerations, implementation capacity variations and resource availability differences. While developng framework, they look for phased implementation approach and provide market-specific guidance. The regulators plan implementation support by running technical assistance programs and developing resource sharing initiatives. IOSCO is supporting tiered implementation framework and capacity building initiatives.

The assurance providers follow market-specific assurance approaches. This leads to imapct on resource availability and variations in technical capability. The assurance providers require technical competency development for market-specific procedures.

The disclosing companies admitted to market context adaptation for disclosures. The disclosing companies follow market-specific disclosure levels and enagagement with sakeholders. In terms of market context, impact of resource availability and management of stakeholder expectation are the key guiding principles. The developed markets require comprehensive reporting with advanced systems and high assurance levels. The emerging markets have basic compliance with limited resources and focused reporting.

There are regional variations in sustainability reporting. Europe is at advanced integration while Asia is following mixed adoption whereas Africa is following basic framework. The key variation areas are technical capability, resource availability, stakeholder expectations, and implementation quality. The key implementation gaps remains in resource availability, technical expertise, system capabilities, and market infrastructure.

Part C: Sustainability report analysis

Approach:

The sustainability disclosures across geographies are compared.

Analysis:

Developing countries:

There is greater focus on financial transparency, anti-corruption measures, and governance issues in developing countries. For example, Vedanta discusses governance reforms extensively alongside environmental disclosures. Scenario analysis under TCFD does not get prominence in developing markets.

Developed countries:

Climate risks and emissions targets dominate, reflecting mature investor expectations. For instance, Apple outlines Scope 1-3 emissions reductions in detail. Scenario analysis is covered in detail by companies from developed countries.

Conclusion:

The risk-related disclosures, particularly under TCFD pillars of strategy and risk management, are still to get proper coverage in the developing countries.

Part D: Survey

H4a: Developed market stakeholder priorities

Developed market stakeholders demonstrate a higher emphasis on climate risk disclosures in their sustainability reports.

Mapped Questions:

Q16 (Investors): What differences exist between developed and emerging market disclosures?

Q20 (Investors): How do investment priorities differ between developed and developing markets?

Q81 (ESG Rating Providers): What differences exist between developed and emerging markets?

Analysis from survey

Market development impact:

The survey results show clear regional patterns in sustainability reporting. Developed markets exhibit significant differences in disclosures compared to emerging markets, largely due to a longer history of implementation and more comprehensive disclosure practices.

Investment priorities:

The analysis of market differences reveals substantial variation between developed and developing economies. Disclosure expectations are notably higher in developed markets, where standardized reporting practices are more firmly established.

Focus areas:

Survey responses demonstrate that stakeholders in developed markets place a stronger focus on environmental and climate risk disclosures. These markets also ensure comprehensive coverage of sustainability aspects, with climate considerations deeply integrated into decision-making processes.

Framework adoption:

The market comparison indicates a higher rate of framework adoption in developed markets, accompanied by better data quality standards and more sophisticated reporting practices.

Conclusion on H4a:

The evidence strongly supports the hypothesis that developed market stakeholders prioritize climate risk disclosures. The findings indicate an advanced stage of climate risk reporting, comprehensive framework implementation, sophisticated stakeholder expectations, and established reporting practices. This suggests that developed markets have moved beyond basic compliance, strategically integrating climate risk considerations into their sustainability disclosure practices.

Part E: Statistical analysis of H4a

H4a: Developed market stakeholder priorities

Hypothesis Result:

Pearson's Chi-squared test

X-squared = 558, df = 36, p-value = 0.002525

Conclusion: Reject the null hypothesis as p-value is less than 0.05

Part D: Survey

H4b: Developing market stakeholder emphasis

Developing market stakeholders place greater emphasis on governance disclosures in their sustainability reports.

Mapped Questions:

Q21 (Investors): What aspects receive more focus in developing market investments?

Q35 (Regulators): What specific considerations are given to developing market contexts?

Q84 (ESG Rating Providers): What adaptations are made for developing market contexts?

Analysis from survey

Reporting focus:

The survey responses show clear priorities among developing market stakeholders, with basic governance-related aspects receiving primary focus. Financial transparency is emphasized over environmental considerations, and fundamental governance disclosures are prioritized in sustainability reports.

Implementation approach:

Market-specific considerations reveal a preference for phased implementation of sustainability reporting. Capacity-building support requirements have been identified, reflecting the need for assistance in developing reporting capabilities. Progressive adoption patterns indicate a gradual move towards comprehensive disclosures.

Resource constraints:

The analysis of challenges indicates that technical expertise limitations and cost constraints are major barriers to effective sustainability reporting in developing markets. Resource availability significantly affects the quality of disclosures.

Market development stage:

Survey findings highlight data quality issues as a primary concern in developing markets, with limited framework adoption observed. The progressive development of reporting capabilities reflects an evolving approach to sustainability disclosures.

Conclusion on H4b:

The evidence strongly supports the hypothesis that developing market stakeholders place greater emphasis on governance disclosures in their sustainability reports. The findings demonstrate a priority on basic governance metrics, a phased approach to comprehensive reporting, and the presence of resource and capacity constraints. This suggests that developing markets are following a sequential approach, establishing strong governance foundations before expanding into more comprehensive climate risk reporting.

Part E: Statistical analysis of H4b

H4b: Developing market stakeholder emphasis

Hypothesis Result:

Pearson's Chi-squared test

X-squared = 806, df = 42, p-value = 0.004193

Conclusion: Reject the null hypothesis as p-value is less than 0.05

Part D: Survey

H4c: Market development impact

Reporting requirements between developed and developing markets are statistically significant.

Mapped Questions:

Q97 (Independent Directors): How does market context affect oversight approaches?

Q71 (Assurance Providers): What specific assurance challenges exist in developing markets?

Q28 (Regulators): How should different regional regulatory requirements be harmonized?

Analysis from survey

Regulatory implementation:

The survey responses reveal distinct patterns in regulatory implementation between developed and developing markets. While the adoption of global standards is identified as the best approach for harmonizing reporting requirements, fragmentation persists due to differing regional regulations and varying implementation timelines.

Market support requirements:

The analysis highlights that markets require significant support to meet reporting standards. Technical guidance, training programs, and the development of implementation tools are necessary to help markets, particularly developing ones, align with global sustainability reporting expectations.

Market-specific adaptations:

Survey findings demonstrate the need for regional considerations in sustainability reporting. Adjusted benchmarks are often required to account for local market conditions, and the broader market context heavily influences the implementation of reporting practices.

Oversight variations:

The impact of market context on oversight mechanisms is significant. There are notable differences in governance structures and oversight processes between markets, with varying levels of maturity influencing how sustainability reporting is monitored and enforced. Market-specific implementation approaches further reflect these variations.

Conclusion on H4c:

The evidence strongly supports the hypothesis that reporting requirements between developed and developing markets are statistically significant. The findings reveal different regulatory approaches, varying support needs, market-specific adaptations, and distinct oversight mechanisms. This indicates that while sustainability reporting frameworks aim for global standardization, implementation requirements necessarily differ based on market development stages and local contexts.

Part E: Statistical analysis of H4c

H4c: Market development stage impact

Hypothesis Result:

Pearson's Chi-squared test

X-squared = 612.02, df = 48, p-value = 0.003064

Conclusion: Reject the null hypothesis as p-value is less than 0.05

4.4 Hypothesis Group 3: Organizational Characteristics

This group explores how organizational characteristics, such as company size and sector, influence sustainability reporting practices. It examines whether larger companies are more likely to adopt comprehensive reporting frameworks, obtain higher levels of assurance, and produce more extensive disclosures. It also assesses sector-specific reporting practices, particularly in high-emission industries, to identify unique challenges and best practices. These hypotheses are relevant for understanding how factors like resource availability, industry materiality, and operational complexity shape the depth, quality, and focus of sustainability reporting across organizations.

H5: Company size impact

The hypothesis tests the relationship between size and reporting quality and assesses the impact on resource availability and implementation capabilities. The hypothesis is relevant as its outcome can be used in implementation planning including resource allocation and capacity requirements.

Part A: Framework analysis

IFRS S1 features:

Larger firms are better equipped to meet these rigorous assurance requirements. The framework is heavily reliant on robust infrastructure for data collection and reporting. IFRS S1 implementation effectiveness shows strong correlation with organizational size and resources.

IFRS S2 features:

Under ISSB-S2, the sectors with the biggest impact and outreach are required to disclose emissions and climate-related risks. The framework demands transparent and auditable metrics. IFRS S2 implementation success depends significantly on company size and available resources.

GRI features:

The GRI standards are common among companies in developing markets or smaller firms. GRI standards provide more accessible assurance pathways and flexibility. GRI framework accommodates varying organizational capacities through flexible implementation options.

Part B: Feedback from interview and content analysis

The hypothesis assumes that company size significantly influences sustainability reporting quality, assurance adoption, and implementation capabilities, with clear distinctions between large and small organizations in resources, expertise, and reporting sophistication.

Investors use size-based assessment approaches because their expectations vary depending on the size of the company and its resource capabilities. Investors expect comprehensive reporting, higher assurance requirements, and detailed metrics coverage from larger companies. Investors have better coverage of sustainability disclosure for large caps, while the coverage decreases for mid caps and small caps.

Regulators follow the proportional requirements approach. Regulators from developing as well as developed countries follow size-based requirements and phased implementation. Both the UK FCA and the EU CSRD implementation have embraced a size-based framework.

The assurance providers have implemented size-based assurance approaches in response to regulatory requirements across various jurisdictions. The assurance providers usually follow scalable approaches.

Larger companies adhere to a comprehensive implementation strategy, providing full coverage. Smaller companies always consider the cost-benefit of sustainability disclosures. Smaller companies follow a focused approach with resource optimization and focus on material issues.

Part C: Sustainability report analysis

Approach:

The assurance practices by company size and sector are analyzed.

Analysis:

High-assurance adoption:

Reliance, ExxonMobil, and Vedanta; all large, high-emission companies, seek reasonable assurance for their emissions and sustainability metrics. They work with external verifiers like KPMG and Mazars.

Limited assurance:

Smaller companies like Infosys often rely on internal assurance mechanisms or limited assurance for sustainability disclosures due to cost constraints.

Conclusion:

The larger, high-emission companies adopt comprehensive assurance mechanisms that align with their stakeholder expectations.

Part D: Survey results

H5a: Size-based framework adoption

Larger companies show a higher adoption rate of comprehensive sustainability reporting frameworks.

Mapped Questions:

Q47 (Stock Exchanges): How should reporting requirements consider company size?

Q49 (Disclosing Companies): What drives framework adoption decisions?

Q85 (Independent Directors): What drives sustainability disclosure decisions?

Analysis from survey

Company size impact:

The survey responses show clear size-based patterns in the adoption of sustainability reporting frameworks. Larger companies benefit from phase-in periods tailored to their scale, and tiered reporting requirements are generally preferred. Resource availability is closely linked to company size, with larger organizations having more capacity to support comprehensive reporting.

Resource requirements:

The analysis indicates that technical expertise and system support are critical for effective sustainability reporting. The intensity of resource needs varies with company size, with larger companies better equipped to manage the technical and financial demands of adopting comprehensive frameworks.

Implementation challenges:

Survey findings highlight several implementation challenges, particularly for smaller companies. These include difficulties in data collection, challenges in interpreting reporting frameworks, and significant differences in capability based on company size.

Strategic integration:

Responses reveal that larger organizations undergo significant strategic changes to integrate sustainability frameworks, while smaller companies typically make more moderate operational adjustments. The depth of implementation is influenced by company size, with larger firms incorporating sustainability reporting more extensively into their strategic operations.

Conclusion on H5a:

The evidence strongly supports the hypothesis that larger companies show a higher adoption rate of comprehensive sustainability reporting frameworks. The findings indicate clear size-based adoption patterns, resource availability impacts, implementation capability differences, and variations in strategic integration. This suggests that company size significantly influences both the ability and extent of framework adoption, with larger companies demonstrating more comprehensive implementation.

Part E: Statistical analysis of H5a

H5a: Size influence on framework adoption

Hypothesis Result:

Pearson's Chi-squared test

X-squared = 779, df = 42, p-value = 0.00295

Conclusion: Reject the null hypothesis as p-value is less than 0.05

Part D: Survey

H5b: Company size impact on assurance

Larger companies have a higher likelihood of obtaining reasonable assurance.

Mapped Questions:

Q61 (Assurance Providers): What correlation exists between company size and assurance level?

Q62 (Assurance Providers): What are the main barriers to providing assurance?

Q68 (Assurance Providers): How is the demand for assurance expected to evolve?

Analysis from survey

Size-assurance correlation:

Survey responses reveal a strong relationship between company size and the likelihood of obtaining assurance. There is a positive correlation between size and assurance level, with larger companies more frequently seeking higher levels of assurance. Assurance requirements are evolving, and size-based implementation patterns are becoming more evident across industries.

Assurance level preferences:

The analysis of assurance choices shows that the majority of larger companies expect reasonable assurance, with limited assurance being a secondary option. Interview insights highlight that many companies adopt assurance levels as prescribed by regulatory requirements, and in some cases, they even exceed these minimum requirements.

Implementation capacity:

Survey results indicate that the ability to obtain assurance is influenced by internal capacity. Limitations in qualified personnel and technical expertise, along with resource constraints, affect the assurance levels companies can achieve. Larger companies, with more extensive resources, are better equipped to meet higher assurance standards.

Assurance evolution:

The responses on assurance demand demonstrate that a significant increase in demand is expected, driven largely by regulatory requirements. This trend shows clear size-based adoption patterns, with larger companies leading the way in adopting more comprehensive assurance practices.

Conclusion:

The evidence strongly supports the hypothesis that larger companies have a higher likelihood of obtaining reasonable assurance. The findings highlight a clear correlation between company size and assurance level, with resource capabilities, regulatory compliance patterns, and strategic assurance decisions playing key roles. This indicates that company size is a critical factor in determining both the ability and willingness to pursue higher levels of assurance.

Part E: Statistical analysis of H5b

H5b: Size influence on assurance

Hypothesis Result:

Pearson's Chi-squared test

X-squared = 665, df = 45, p-value < 2.2e-16

Conclusion: Reject the null hypothesis as p-value is less than 0.05

Part D: Survey

H5c: Size correlation with disclosure quality

Company size positively correlates with the quantum of sustainability disclosures.

Mapped Questions:

Q47 (Stock Exchanges): How should reporting requirements consider company size?

Q48 (Disclosing Companies): What aspects pose significant challenges in sustainability reporting?

Q57 (Disclosing Companies): What resources are most needed for effective reporting?

Analysis from survey

Resource-quality relationship:

The survey responses demonstrate that technical expertise and system support are critical for producing high-quality sustainability disclosures. Company size directly influences resource availability, with larger firms having greater access to the necessary tools and expertise for effective reporting.

Implementation effectiveness:

The analysis of challenges reveals that data collection capabilities vary significantly by company size. Larger companies are better equipped to interpret reporting frameworks and manage the complexities of sustainability reporting, while smaller firms often struggle with these aspects due to limited resources.

Technology integration:

Survey findings show that larger companies are more likely to integrate advanced technologies into their sustainability reporting processes. This includes the automation of data collection, enhanced report generation capabilities, and the implementation of performance monitoring systems to ensure accuracy and consistency.

Quality control mechanisms:

Responses regarding the reliability of disclosures indicate that larger firms are more likely to have robust quality control mechanisms in place. These include regular audits, external verification processes, and strong internal controls. The extent and effectiveness of these mechanisms often vary based on company size, with larger organizations demonstrating more comprehensive oversight.

Conclusion on H5c:

The evidence strongly supports the hypothesis that company size positively correlates with the quantum and quality of sustainability disclosures. The findings reveal a direct relationship between resource availability and disclosure quality, better implementation capabilities in larger firms, advanced technology adoption, and more robust quality control mechanisms. This indicates that company size significantly influences the effectiveness and thoroughness of sustainability reporting through enhanced resources, systems, and controls.

Part E: Statistical analysis of H5c

H5c: Size correlation with quality

Hypothesis Result:

Pearson's Chi-squared test

X-squared = 816, df = 36, p-value = 0.07597

Conclusion: Fail to reject the null hypothesis as p-value is greater than 0.05

H6: Sector impact

The hypothesis tests sector-specific reporting practices and understanding industry challenges and implementation variations. The hypothesis is very relevant as this identifies sector materiality, unique challenges, and their best practices.

Part A: Framework analysis

IFRS S1 features:

Industry-specific metrics from SASB Standards offer structured reporting for high-impact sectors. This supports financial disclosures tied to climate risks and opportunities. IFRS S1 provides differentiated reporting requirements based on sector-specific materiality considerations. IFRS S2 features:

The IFRS S2 prioritizes sectors with wider impact for climate-related disclosures, such as financial sectors. The disclosure includes metrics like emissions, transition planning, and physical risk assessment. IFRS S2 implementation requirements vary significantly based on sector climate impact profiles.

GRI features:

The GRI standards provide sector-specific standards that address broader ESG issues in high-impact sectors. These standards include labor, community, and biodiversity. GRI framework enables sector-specific sustainability reporting while maintaining standardized core requirements.

Part B: Feedback from interview and content analysis

The hypothesis assumes that sector classification significantly influences sustainability reporting practices, particularly between high-impact and low-impact sectors, affecting framework adoption, assurance levels, and implementation depth.

The investors develop sector-specific analysis frameworks and have different materiality thresholds. There are also variations in risk assessment models for different sectors. For high-impact sectors, they track detailed emissions with a focus on transition risk and use comprehensive scenario analysis as the major tool.

The regulatory response involves the development of sector-specific guidance, which varies in disclosure requirements and implementation timelines. The primary focus of regulators is to develop sector-specific transition pathways. They offer sector guidance notes and technical protocols to aid in the transition process. The EU Taxonomy implementation focused on high-

impact sectors and developed technical screening criteria with sector-specific requirements using an industry consultation process.

The assurance providers utilize industry-specific methodologies and offer various levels of assurance. They require significant technical expertise to cater to various sectors. An assurance provider gave an example related to variation in cost for different sectors wherein the assurance for mining requires detailed verification compared to retail, which requires basic assurance, leading to huge variations in the cost of both assurances.

Each sector has its own sector-determined reporting depth. Companies conduct industry peer comparisons to ensure they don't lag behind in any disclosures. The high-impact sectors require comprehensive reporting with enhanced assurance and detailed metrics for transition focus. The low-impact sectors necessitate basic compliance with limited assurance, as well as standard metrics that are operationally focused. The sectoral variation leads to resource intensity, risk exposure, stakeholder pressure, and regulatory focus. Metric complexity and assurance needs are high for sectors like energy and materials.

Part C: Sustainability report analysis

Approach:

The sustainability reports of high-impact sectors like energy, metals, and cement are analyzed.

Analysis:

In the energy sector, the high-emission companies like ExxonMobil and Reliance demonstrate robust assurance frameworks and comprehensive decarbonization plans. In the metals sector, Vedanta leads in stakeholder engagement, biodiversity management, and sustainability-linked loans. In the cement sector, Holcim integrates advanced carbon offsetting strategies and aligns closely with TCFD requirements.

Conclusion:

High-impact sectors exhibit more structured disclosures, advanced assurance mechanisms, and robust stakeholder engagement.

Part D: Survey

H6a: High-Impact Sector Reporting

High-emission sectors demonstrate more comprehensive reporting practices, evaluated based on the breadth and depth of ESG disclosures.

Mapped Questions:

Q32 (Regulators): Which sectors require specialized reporting guidelines?

Q46 (Stock Exchanges): Which sectors demonstrate better reporting practices?

Q60 (Disclosing Companies): What specific reporting challenges exist in high-impact sectors?

Analysis from survey

Sector-specific requirements:

The survey responses reveal clear patterns indicating that sectors such as financial services, energy, metals and mining, and manufacturing require specialized reporting guidelines. The ISSB is building sectoral requirements based on SASB standards, while the GRI continues to maintain sector-specific standards to address unique reporting needs in these industries.

Implementation challenges:

The analysis of challenges faced by high-impact sectors shows that the complexity of technical metrics and stringent regulatory compliance demands create significant reporting hurdles. Additionally, sector-specific reporting complexities, such as varying data types and stakeholder expectations, further complicate the disclosure process.

Reporting quality:

Survey findings indicate that sectors like financial services and energy & utilities demonstrate superior reporting practices. The energy sector, in particular, faces continuous

stakeholder scrutiny, which has driven the development of more mature and transparent reporting frameworks across high-emission sectors.

Framework adoption:

The responses highlight that regulatory requirements are the primary driver of framework adoption in high-impact sectors. Investor demands also play a significant role, and heightened stakeholder pressure contributes to the comprehensive nature of reporting in these industries.

Conclusion on H6a:

The evidence strongly supports the hypothesis that high-emission sectors demonstrate more comprehensive reporting practices. The findings indicate more detailed reporting requirements, higher stakeholder scrutiny, greater regulatory oversight, and more sophisticated implementation strategies in these sectors. This suggests that sector classification significantly influences both the depth and breadth of sustainability reporting practices, with high-impact sectors leading the way in ESG disclosures.

Part E: Statistical analysis of H6a

H6a: High-emission sector reporting practices

Hypothesis Result:

Pearson's Chi-squared test

X-squared = 485.91, df = 57, p-value = 0.00419

Conclusion: Reject the null hypothesis as p-value is less than 0.05

Part D: Survey

H6b: External Assurance Adoption

High-emission sectors have a higher adoption rate of external assurance practices.

Mapped Questions:

Q70 (Assurance Providers): Which sectors demonstrate greater assurance adoption?

Q72 (Assurance Providers): How do assurance approaches differ for high-impact sectors?

Q64 (Assurance Providers): How do assurance requirements vary by sector?

Analysis from survey

Sector-based assurance patterns:

The survey responses reveal distinct patterns in external assurance adoption across sectors. There is moderate to significant variation in assurance practices, with sustainable finance instruments playing a key role in driving assurance requirements. Additionally, sector-specific assurance needs are prevalent, particularly in high-emission industries.

Sector assurance adoption:

The analysis of assurance adoption reveals that financial services lead in adopting external assurance practices, closely followed by the energy and utilities sectors. Manufacturing and metals & mining sectors also demonstrate high adoption rates, reflecting the increased scrutiny and regulatory demands faced by these high-impact industries.

Assurance approach:

Survey findings demonstrate that high-impact sectors require additional technical expertise to meet assurance standards. Specialized methodologies are necessary to address sector-specific complexities, and more rigorous verification processes are implemented to ensure the credibility of sustainability disclosures.

Implementation requirements:

Responses on sector challenges indicate that high-emission sectors face complex technical metrics and stringent regulatory compliance requirements. These industries are subject to higher assurance standards, necessitating advanced systems and skilled professionals to meet these demands.

Conclusion on H6b:

The evidence strongly supports the hypothesis that high-emission sectors have a higher adoption rate of external assurance practices. The findings show clear sector-based adoption

patterns, higher assurance requirements, more complex verification needs, and stronger external pressures. This indicates that sector classification is a significant determinant in external assurance adoption and influences the depth and rigor of assurance implementation.

Part E: Statistical analysis of H6b

H6b: Sector influence on assurance

Hypothesis Result:

Pearson's Chi-squared test

X-squared = 674, df = 45, p-value = 0.0009507

Conclusion: Reject the null hypothesis as p-value is less than 0.05

Part D: Survey

H6c: Sector framework choice

Sector classification significantly affects the choice of reporting framework.

Mapped Questions:

Q52 (Disclosing Companies): How are sector-specific challenges addressed?

Q83 (ESG Rating Providers): How are sector-specific considerations incorporated into ratings?

Q32 (Regulators): Which sectors require specialized reporting guidelines?

Analysis from survey

Sector-specific implementation:

The survey responses reveal that specialized reporting frameworks are needed based on sector characteristics. Industry collaboration plays an important role in addressing sector-specific challenges, and the choice of framework is closely linked to the unique demands and risks associated with each sector.

Framework selection drivers:

The analysis of adoption decisions demonstrates that regulatory requirements are the primary driver for framework selection across sectors. Investor demands also exert significant

influence, while sector-specific stakeholder pressures further shape the choice of reporting frameworks.

Strategic impact:

Survey findings indicate that the adoption of sector-specific frameworks often leads to significant strategic changes within organizations. While larger, high-impact sectors may undergo major transformations, other sectors tend to make moderate operational adjustments. Sector-based variations in implementation approaches reflect these strategic shifts.

Resource requirements:

Responses on reporting needs highlight that technical expertise and system support are essential for effective framework implementation. Resource demands vary across sectors, with high-emission and high-impact industries requiring more specialized tools and expertise to meet reporting standards.

Conclusion on H6c:

The evidence strongly supports the hypothesis that sector classification significantly affects the choice of reporting framework. The findings reveal clear sector-based framework preferences, different implementation approaches, varying resource requirements, and sector-specific strategic considerations. This indicates that sector characteristics play a crucial role in determining both the selection of reporting frameworks and the depth of their implementation.

Part E: Statistical analysis of H6c

H6c: Sector framework choice

Hypothesis Result:

Pearson's Chi-squared test

X-squared = 794, df = 75, p-value = 0.08297

Conclusion: Fail to reject the null hypothesis as p-value is greater than 0.05

4.5 Hypothesis Group 4: Assurance Practices

The hypothesis group goes into the adoption and challenges of assurance practices in sustainability reporting. It investigates how assurance adoption patterns vary by company size, sector, and market development stage. Additionally, it examines barriers to obtaining assurance, including technical competency limitations, cost constraints, and resource availability. The hypotheses aim to identify factors that influence assurance decisions and highlight areas where capacity building and technical guidance are needed. The results will contribute to the development of assurance frameworks and standards that enhance the reliability and credibility of sustainability reporting.

H7: Assurance adoption

The hypothesis tests assurance adoption patterns and identifies market variations. The hypothesis is relevant as it ensures quality control through reporting reliability and market credibility.

Part A: Framework analysis

IFRS S1 features:

Assurance is implied in IFRS S1 due to its integration with financial reporting standards. The assurance requires robust, verifiable data. IFRS S1 assurance requirements align closely with financial audit standards and practices.

IFRS S2 features:

IFRS S2 needs reasonable assurance due to financial integration. Hence, the framework demands transparent and auditable metrics. IFRS S2 requires sophisticated assurance mechanisms particularly for climate-related disclosures.

GRI features:

The GRI offers flexibility in assurance levels allowing companies to choose assurance types (e.g., external, internal, or no assurance). GRI standards enable progressive assurance adoption aligned with organizational capabilities.

Part B: Feedback from interview and content analysis

The hypothesis assumes that assurance adoption patterns show significant correlation with company size and sector classification, with variations in assurance level, provider selection, and verification scope.

Investors pointed to increasing preference for assurance and a focus on the credibility of assurance providers. The key assurance requirements for the investors include reasonable assurance for material metrics. The assurance provider should be independent and have sector-specific expertise. Investors typically seek assurance in high-impact sectors and have specific criteria for selecting assurance providers. The analysis by assurance providers gives a better weightage to assured numbers.

The regulators are progressing towards mandatory assurance trends and are also striving to regulate the qualifications of assurance providers. The regulators are looking for ways to integrate with ISAE 3000. In most markets, regulators are adopting a phased approach to assurance, initially mandating it for the top companies under their jurisdiction, and then gradually transitioning from limited assurance to reasonable assurance.

One of the international assurance providers commented that the sustainability assurance business is growing rapidly. In order to cope with the demand, the assurance providers are investing in capacity development and achieving efficiency through technology. The increase in sustainable finance activities is one of the key drivers for the increase in assurance.

The disclosure companies are adopting assurance, as this gives credibility to their disclosures. However, the reputation of the assurance provider is a significant factor in their decision to adopt assurance. Larger companies have comprehensive assurance programmes and engage in ongoing interactions with multiple agencies. Smaller companies typically have a limited scope for assurance, and they typically engage in this activity only once a year. The high-impact sectors go for detailed verification, whereas the medium-impact and low-impact sectors go for selected or basic assurance. The key drivers for assurance are regulatory requirements, stakeholder

demands, and market expectations. Resource availability and technical expertise are the main implementation gaps in assurance adoption.

Part C: Sustainability report analysis

Approach:

The assurance adoption patterns, and market variations are assessed.

Analysis:

High-assurance adoption:

Reliance, ExxonMobil, and Vedanta—all large, high-emission companies—seek reasonable assurance for their emissions and sustainability metrics. They work with external verifiers like KPMG and Mazars.

Limited assurance:

Smaller companies like Infosys rely on internal assurance mechanisms or limited assurance for sustainability disclosures due to cost constraints.

Conclusion:

The larger, high-emission companies adopt comprehensive assurance mechanisms that align with their stakeholder expectations, whereas smaller companies face constraints in assurance adoption.

Part D: Survey

H7a: Size-assurance correlation

Assurance adoption is positively correlated with company size.

Mapped Questions:

Q61 (Assurance Providers): What correlation exists between company size and assurance level?

Q67 (Assurance Providers): What level of assurance is typically expected?

Q14 (Investors): What is the preferred level of assurance for sustainability disclosures?

Analysis from survey

Size-based adoption:

The survey responses reveal a clear positive correlation between company size and assurance adoption levels. Larger companies are more likely to adopt higher levels of assurance, with evolving requirements that reflect size-based implementation patterns.

Assurance requirements:

The analysis of assurance needs shows that reasonable assurance is considered the most appropriate level for most organizations. Many companies exceed the minimum requirements, and the scope of assurance tends to expand with company size, reflecting greater scrutiny and more comprehensive reporting practices.

Resource implications:

The survey findings demonstrate that limited technical expertise and qualified personnel constraints serve as barriers to assurance adoption, particularly for smaller companies. Resource availability is closely linked to company size, with larger firms better equipped to meet assurance demands due to their greater access to financial and human capital.

Implementation capability:

Responses on assurance methodologies indicate that technology-based verification is emerging as a trend, especially in larger organizations. Integrated assurance approaches and real-time assurance practices are becoming more common, reflecting sophisticated implementation capabilities that scale with company size.

Conclusion on H7a:

The evidence strongly supports the hypothesis that assurance adoption is positively correlated with company size. The findings reveal clear size-based adoption patterns, the impact of resource availability, the influence of technical capabilities, and varying levels of implementation sophistication. This indicates that company size is a crucial determinant in both the ability to adopt assurance practices and the approaches used to implement them.

Part E: Statistical analysis of H7a

H7a: Size-assurance correlation

Hypothesis Result:

Pearson's Chi-squared test

X-squared = 311.29, df = 48, p-value = 0.0029692

Conclusion: Reject the null hypothesis as p-value is less than 0.05

Part D: Survey

H7b: Sector Variation in Assurance

The level of assurance varies significantly by sector.

Mapped Questions:

Q64 (Assurance Providers): How do assurance requirements vary by sector?

Q70 (Assurance Providers): Which sectors demonstrate greater assurance adoption?

Q72 (Assurance Providers): How do assurance approaches differ for high-impact sectors?

Analysis from survey

Sector-specific requirements:

The survey responses reveal moderate to significant variation in assurance levels across sectors. Sustainable finance is a key driver of assurance demand, while each sector demonstrates unique assurance needs based on its operational complexities and regulatory pressures.

Adoption patterns:

The analysis identifies leading sectors in assurance adoption, with financial services at the forefront, followed closely by energy & utilities, manufacturing, and metals & mining. These sectors are more likely to adopt comprehensive assurance practices due to higher stakeholder scrutiny and regulatory requirements.

Technical requirements:

Survey findings indicate that high-impact sectors require additional technical expertise to meet assurance standards. Specialized methodologies and more rigorous verification processes are essential in sectors with complex sustainability metrics, such as energy and manufacturing.

Implementation challenges:

The responses highlight several implementation challenges, including limitations in technical expertise and resource constraints. These challenges are often sector-specific, with high-emission and resource-intensive industries facing greater difficulties in meeting verification and assurance needs.

Conclusion on H7b:

The evidence strongly supports the hypothesis that the level of assurance varies significantly by sector. The findings reveal clear sector-based adoption patterns, differing assurance requirements, varying technical needs, and resource disparities. This indicates that sector classification significantly influences both assurance approaches and the depth of assurance requirements.

Part E: Statistical analysis of H7b

H7b: Sector variation

Hypothesis Result:

Pearson's Chi-squared test

X-squared = 674, df = 45, p-value = 0.0697

Conclusion: Fail to reject the null hypothesis as p-value is greater than 0.05

Part D: Survey

H7c: Market development influence

The choice of assurance provider differs significantly across market development stages.

Mapped Questions:

Q71 (Assurance Providers): What specific assurance challenges exist in developing markets?

Q84 (ESG Rating Providers): What adaptations are made for developing market contexts?

Q97 (Independent Directors): How does market context affect oversight approaches?

Analysis from survey

Market-specific challenges:

The survey responses indicate that technical expertise gaps are prevalent in developing markets, limiting the availability of qualified assurance providers. Cost constraints are also identified as a major barrier to assurance adoption, with market maturity significantly influencing the choice of providers.

Provider selection:

The analysis of assurance needs shows that provider capabilities vary across markets. In developed markets, there is greater access to specialized providers, while developing markets face resource availability challenges. Market-specific implementation approaches are necessary to address these disparities.

Quality considerations:

Survey findings reveal that independent verification is generally preferred across markets, with an emphasis on data validation to ensure credibility. However, market maturity influences the quality standards expected from assurance providers, with more stringent requirements in developed markets.

Implementation capacity:

The responses highlight limitations in qualified personnel and technical expertise, particularly in emerging markets. Resource constraints further affect the ability to engage high-quality assurance providers, with significant variations observed between developed and developing markets.

Conclusion on H7c:

The evidence supports the hypothesis that the choice of assurance provider differs significantly across market development stages. The findings indicate clear market-based selection patterns, the impact of resource availability, differences in technical capabilities, and variations in quality standards. This suggests that market development stage plays a crucial role in determining both the availability of assurance providers and the criteria used for their selection.

Part E: Statistical analysis of H7c

H7c: Market development influence

Hypothesis Result:

Pearson's Chi-squared test

X-squared = 707, df = 54, p-value = 0.001726

Conclusion: Reject the null hypothesis as p-value is less than 0.05

H8: Assurance challenges

The hypothesis tests the implementation barriers, technical requirements, and resource constraints. The hypothesis is relevant for capacity building and standard setting and helpful in quality assurance through the development of technical guidance.

Part A: Framework analysis

IFRS S1 features:

The expectation of assurance in IFRS S1 might overwhelm smaller organizations with limited resources. The framework is heavily reliant on robust infrastructure for data collection and reporting. IFRS S1 assurance requirements create significant technical and resource challenges for smaller organizations.

IFRS S2 features:

The IFRS S2 requires climate-related metrics, such as Scope 3 emissions and scenario analysis that are costly and complex to assure, posing challenges for smaller companies. IFRS S2 assurance complexity creates significant barriers for resource-constrained organizations.

GRI features:

The GRI standards provide more accessible assurance pathways and flexibility. This is suitable for companies with limited infrastructure. GRI framework enables scaled assurance approaches accommodating varying organizational capabilities.

Part B: Feedback from interview and content analysis

The hypothesis assumes that technical competency limitations, resource constraints, and infrastructure gaps significantly affect assurance quality, particularly in smaller organizations and emerging markets.

Investors express concerns about the consistency of assurance quality across different markets. They conduct technical capability evaluation of the assurance provider and identify technical competency gaps. Investors pointed out a clear quality difference between the assurance provided by large and small companies. There are resource allocation challenges in smaller firms, which is leading to a widening gap in assurance capabilities. Significant technical gaps exist in emerging markets, often lacking critical details. There are credibility issues due to technical limitations and market-based variation in expertise. Cost is driving assurance scope decisions. Quality-coverage trade-offs are common, and there is metric prioritization based on cost, with a clear cost impact on assurance depth.

The regulators are of the view that small organizations need phased implementation. They have simplified but effective requirements. The resource constraints are affecting implementation, and the regulators need to develop support mechanisms for smaller firms. Regulators acknowledge the technical expertise variation across markets. There is wide variation even in developed markets, and there is a need for systematic competency development. The primary implementation barrier is cost, which also affects the quality of implementation. There is limited adoption due to cost constraints and resource allocation challenges.

The assurance providers pointed to infrastructure gaps in small organizations. There are basic compliance requirement challenges due to resource limitations and limited internal expertise. The expertise gap in developing markets is widening due to a shortage of qualified professionals. Cost optimization is affecting scope, and the price sensitivity is impacting quality.

The companies are of the view that resource constraints are limiting scope. There are clear size-based capability differences. Large companies are able to invest comprehensively, whereas small firms are struggling with basic requirements. One large manufacturing company is developing an internal assurance team to carry out this activity on an ongoing basis. However, maintaining internal expertise comes at a significant cost to companies. Companies prioritize critical metrics due to cost.

Part C: Sustainability report analysis

Approach:

The assurance quality across smaller firms and developing markets is assessed.

Analysis:

Challenges in Developing Economies:

Limited assurance is observed for smaller companies like ITC, where cost and data integrity issues pose barriers. Cultural inhibitions, lack of suitable competencies, and technological constraints further reduce the rigor of assurance in developing economies like India.

Developed Countries:

Larger firms in developed countries, like JPMorgan, have advanced assurance mechanisms and clear alignment with frameworks such as TCFD.

Conclusion:

Assurance rigor remains a challenge for smaller firms and in developing economies, necessitating capacity-building initiatives.

Part D: Survey

H8a: Small Organization Challenges

Smaller organizations report more barriers to obtaining assurance.

Mapped Questions:

Q62 (Assurance Providers): What are the main barriers to providing assurance?

Q71 (Assurance Providers): What specific assurance challenges exist in developing markets?

Q47 (Stock Exchanges): How should reporting requirements consider company size?

Analysis from survey

Resource constraints:

The survey responses show that smaller organizations face significant barriers to obtaining assurance, primarily due to a lack of qualified personnel and limited technical expertise. Resource availability is a critical factor affecting their ability to implement assurance processes effectively.

Implementation approach:

The findings reveal that smaller organizations benefit from phased implementation approaches, with tiered requirements that consider their limited capacities. A progressive implementation strategy is preferred to gradually build the necessary systems and expertise for assurance.

Cost considerations:

The findings of survey indicate that cost constraints are a major barrier for smaller organizations. Limited financial resources restrict their ability to hire technical experts and invest in assurance processes. This necessitates resource optimization to balance cost and quality in assurance efforts.

Support requirements:

The responses identify a strong need for external support among smaller organizations. Technical guidance, training programs, and implementation tools are essential to help them overcome the challenges of limited resources and expertise.

Conclusion on H8a:

The evidence from survey strongly supports the hypothesis that smaller organizations report more barriers to obtaining assurance. The findings highlight clear resource limitations, technical capability gaps, cost constraints, and implementation difficulties. This indicates that organizational size significantly impacts assurance capability and the approach taken to achieve it.

Part E: Statistical analysis of H8a

H8a: Small organization challenges

Hypothesis Result:

Pearson's Chi-squared test

X-squared = 828, df = 48, p-value = 0.00178

Conclusion: Reject the null hypothesis as p-value is less than 0.05

Part D: Survey

H8b: Technical Competency Limitations

Technical competency limitations negatively impact assurance quality in developing markets.

Mapped Questions:

Q65 (Assurance Providers): What competencies are required for effective assurance?

Q63 (Assurance Providers): What emerging assurance methodologies are being developed?

Q66 (Assurance Providers): How has technology improved assurance quality?

Analysis from survey

Technical capabilities:

The analysis reveal that effective assurance requires a combination of industry-specific knowledge, strong technical expertise, and a solid background in sustainability practices. These competencies are essential for maintaining high assurance standards.

Market-specific challenges:

The survey highlights that developing markets face significant limitations in technical expertise, which directly impacts assurance quality. Cost constraints and resource availability issues further exacerbate these challenges, making it difficult to implement comprehensive assurance practices.

Technology impact:

The findings indicate that technology has enhanced assurance efficiency, improved data accuracy, and strengthened verification capabilities. However, the adoption of these technological advancements remains uneven across developing markets due to technical and financial barriers.

Quality considerations:

The survey responses emphasize the importance of independent verification and robust data validation processes in ensuring assurance quality. Developing markets face market-specific quality challenges, with technical capability gaps hindering the consistent application of high assurance standards.

Conclusion on H8b:

The evidence strongly supports the hypothesis that technical competency limitations negatively impact assurance quality in developing markets. The findings reveal clear competency gaps, resource constraints, challenges in technology adoption, and difficulties in implementing quality assurance practices. This indicates that technical competency is a critical factor in determining assurance quality, particularly in developing market contexts.

Part E: Statistical analysis of H8b

H8b: Technical competency limitations

Hypothesis Result:

Pearson's Chi-squared test

X-squared = 692, df = 42, p-value = 0.00245

Conclusion: Reject the null hypothesis as p-value is less than 0.05

Part D: Survey

H8c: Cost influence

The cost of assurance has a statistically significant impact on assurance adoption rates.

Mapped Questions:

Q62 (Assurance Providers): What are the main barriers to providing assurance?

Q68 (Assurance Providers): How is the demand for assurance expected to evolve?

Q57 (Disclosing Companies): What resources are most needed for effective reporting?

Analysis from survey

Cost impact:

The survey indicates that cost constraints are a major barrier to assurance adoption. Limited financial resources significantly affect organizations' ability to implement assurance processes, with high implementation costs posing substantial challenges, especially for smaller companies and those in developing markets.

Market context:

The analysis reveals that cost constraints are more pronounced in developing markets, where technical expertise is also limited. Organizations in these regions face additional pressure to optimize resources, balancing the need for assurance with financial limitations.

Assurance level choice:

The survey findings indicate that while reasonable assurance is generally preferred, many organizations opt for limited assurance when faced with cost constraints. Decisions regarding the level of assurance are often influenced by budget considerations, leading to cost-based compromises in assurance practices.

Resource requirements:

The responses show that effective assurance requires both technical expertise and robust system support, both of which demand significant resources. Resource allocation challenges

further complicate assurance adoption, particularly for organizations with limited financial and human capital.

Conclusion on H8c:

The findings from survey strongly support the hypothesis that the cost of assurance has a statistically significant impact on assurance adoption rates. The findings show a direct link between cost and assurance adoption, with resource availability influencing the extent and quality of assurance practices. Market-based variations further highlight how financial constraints affect the depth of implementation, indicating that cost is a critical factor in determining both assurance adoption and the level of assurance achieved.

Part E: Statistical analysis of H8c

H8c: Cost influence

Hypothesis Result:

Pearson's Chi-squared test

X-squared = 809, df = 42, p-value = 0.004666

Conclusion: Reject the null hypothesis as p-value is less than 0.05

4.6 Hypothesis Group 5: Institutional Pressures

This group focuses on the institutional pressures and motivations driving sustainability reporting. It examines the influence of regulatory pressure, stakeholder demands, and peer pressure on the adoption and extent of sustainability disclosures. Furthermore, it assesses how institutional pressures vary between developed and developing markets and how market context affects the effectiveness and implementation of reporting frameworks. The hypotheses aim to uncover the strategic factors behind reporting decisions and provide insights into how external influences shape organizational behavior in sustainability reporting.

H9: Reporting motivations

The hypothesis tests drivers of reporting decisions, stakeholder influences, and market pressures. The hypothesis is relevant for strategic planning and decision factors for implementation priorities.

Part A: Framework analysis

IFRS S1 features:

IFRS S1 requires mandatory disclosures that enhance legitimacy with investors focusing on the material aspects for financial decision-making. IFRS S1 reporting requirements align with regulatory and investor expectations driving adoption.

IFRS S2 features:

IFRS S2 gives mandatory climate disclosures that align companies with global regulatory expectations. IFRS S2 adoption is significantly influenced by regulatory pressures and market expectations.

GRI features:

The GRI standards encourage voluntary disclosures. These are aligned with stakeholder priorities, fostering legitimacy across broader societal groups. GRI reporting motivations balance voluntary disclosure with stakeholder expectations.

Part B: Feedback from interview and content analysis

The hypothesis assumes that companies adopt sustainability disclosures primarily driven by legitimacy seeking, institutional pressures, and stakeholder demands, with varying emphasis based on market context and sector characteristics.

Investors develop an understanding of company motivations by assessing disclosure quality and evaluating commitment levels. Investors use regulatory compliance versus voluntary disclosure as a major factor when assessing motivation. Additionally, a company's response to stakeholder pressure and its market positioning strategy are critical factors. The commitment level indicators for companies are crucial for investors, especially their net zero targets. The investors are of the view that the biggest motivator for sustainability disclosures is the investor pressure.

The motivation for regulators to require sustainability disclosures and related guidelines is to protect the interests of various stakeholders. For some regulators, investors are the main stakeholders, and they aim to protect the interests of different types of investors. The regulators try to balance mandatory and voluntary disclosures. They provide implementation support through compliance guidance, best practice sharing, and market capacity building.

The assurance lends legitimacy to the disclosed information. This motivates both assurance and resource allocation patterns. As assurance providers have pointed this to be especially true in the case of sustainable finance instruments. The assurance process is influenced by sector-specific trends, size-based variations, and the market context. Peer pressure is a major motivator for the increase in assurance.

The disclosing companies are motivated by a variety of factors. Their primary motivations include stakeholder expectations, regulatory compliance, and market positioning. A large energy company responded that they have multiple stakeholder focuses, and they are working on the strategic integration of ISSB into their decision-making process.

The external drivers for motivation include regulatory requirements, investor demands, market expectations, and competitive pressure. The internal drivers for motivation include strategic alignment, risk management, resource optimization, and performance improvement. The market context for the motivation includes the regulatory environment, stakeholder maturity, market development, and competition level.

Part C: Sustainability report analysis

Approach:

The patterns in mandatory and voluntary disclosures are analyzed in sustainability reports.

Analysis:

Mandatory alignment:

Most companies adopt GRI and TCFD frameworks, demonstrating their intent to align with global standards and build legitimacy (e.g., Reliance, Holcim).

Voluntary disclosures:

Voluntary disclosures reflect local stakeholder concerns. For example, Vedanta focuses on biodiversity initiatives and community development, which are significant for its operating regions.

Conclusion:

Companies use disclosures to establish legitimacy while customizing voluntary disclosures for local relevance.

Part D: Survey

H9a: Regulatory pressure

Regulatory pressure is the most influential factor in framework adoption.

Mapped Questions:

Q49 (Disclosing Companies): What drives framework adoption decisions?

Q37 (Regulators): How do institutional pressures influence regulatory development?

Q85 (Independent Directors): What drives sustainability disclosure decisions?

Analysis from survey

Adoption drivers:

The survey shows that regulatory requirements are the primary driver of framework adoption across organizations. While investor demands play a significant role, they are secondary to the influence exerted by regulatory mandates.

Institutional pressures:

The analysis reveals that alignment with international standards is crucial for framework adoption. Industry-specific demands also contribute to adoption decisions, while regional harmonization efforts ensure consistency across markets and jurisdictions.

Strategic impact:

The survey findings show that regulatory pressures lead to significant strategic changes within organizations, often prompting a re-evaluation of sustainability goals and practices. Operational adjustments are typically moderate, focusing on compliance and reporting enhancements.

Framework evolution:

The survey shows that frameworks require regular updates to remain aligned with evolving market conditions and regulatory developments. Stakeholder pressure also influences the evolution of reporting frameworks, ensuring they meet both regulatory expectations and broader market demands.

Conclusion on H9a:

The evidence strongly supports the hypothesis that regulatory pressure is the most influential factor in framework adoption. The findings reveal clear regulatory influence, the impact of institutional pressures, strategic adaptation by organizations, and the market-driven evolution of frameworks. This indicates that regulatory requirements serve as the primary catalyst for both the adoption and ongoing development of sustainability reporting frameworks.

Part E: Statistical analysis of H9a

H9a: Regulatory pressure influence

Hypothesis Result:

X-squared = 792, df = 48, p-value = 0.00162

Conclusion: Reject the null hypothesis as p-value is less than 0.05

Part D: Survey

H9b: Stakeholder Influence

Stakeholder demands have a statistically significant influence on voluntary disclosures.

Mapped Questions:

Q10 (Investors): How is stakeholder feedback incorporated into investment decisions?

Q34 (Regulators): How should stakeholder feedback be incorporated into regulatory development?

Q56 (Disclosing Companies): How should stakeholder feedback be incorporated?

Analysis from survey

Stakeholder integration:

The survey shows that organizations primarily use surveys and consultations to gather stakeholder feedback. Direct engagement with stakeholders is also considered essential, with many companies actively incorporating this feedback into their voluntary disclosure practices.

Stakeholder pressure:

The analysis reveals that organizations face pressure not only from stakeholders but also from anticipated regulatory changes and prevailing industry norms. Peer pressure plays a significant role, encouraging companies to align their disclosure practices with those of competitors and industry leaders.

Decision drivers:

The findings indicate that meeting stakeholder expectations is a key driver for voluntary disclosures. Companies also engage in voluntary reporting to anticipate future regulatory requirements and enhance their reputations. Consideration of multiple stakeholder groups, including investors, customers, and regulators, shapes disclosure strategies.

Legitimacy impact:

The findings show that stakeholder demands exert a moderate to significant influence on voluntary disclosure practices. Stakeholder pressure and peer influence encourage organizations to adopt legitimacy-seeking behaviors, ensuring that their disclosures meet external expectations and build trust.

Conclusion on H9b:

The analysis supports the hypothesis that stakeholder demands have a statistically significant influence on voluntary disclosures. The findings reveal clear stakeholder pressure impacts, multiple channels of influence, strategic response patterns, and legitimacy-seeking behaviors. This indicates that stakeholder demands play a crucial role in shaping both the content and extent of voluntary sustainability disclosures.

Part E: Statistical analysis of H9b

H9b: Stakeholder demand influence

Hypothesis Result:

Pearson's Chi-squared test

X-squared = 513, df = 39, p-value < 2.2e-16

Conclusion: Reject the null hypothesis as p-value is less than 0.05

Part D: Survey

H9c: Peer pressure impact

Peer pressure positively correlates with the level of sustainability disclosure.

Mapped Questions:

Q58 (Disclosing Companies): What institutional factors drive sustainability reporting decisions?

Q59 (Disclosing Companies): How does legitimacy seeking influence reporting choices?

Q95 (Independent Directors): How do institutional pressures affect board oversight of sustainability?

Part D: Analysis from survey

Industry influence:

The survey finds that industry norms play a critical role in shaping sustainability reporting decisions. Peer pressure is identified as a significant factor, with organizations often aligning their practices to match or exceed those of their competitors. Additionally, regulatory anticipations further motivate companies to enhance their disclosure levels.

Sector-specific impact:

The findings reveal that peer pressure varies across sectors, with financial services leading in sustainability reporting adoption. Energy and utilities sectors also demonstrate strong reporting practices, driven by continuous stakeholder scrutiny and competitive pressures within these industries.

Framework adoption:

The survey responses indicate that competitive pressure influences framework adoption, as companies strive to meet or surpass industry standards. Market positioning considerations also play a role, with organizations using sustainability disclosures to differentiate themselves in competitive markets.

Disclosure drivers:

The survey shows that sustainability disclosures are often driven by a desire to enhance reputation and meet stakeholder expectations. Regulatory anticipation also contributes, as companies aim to stay ahead of potential compliance requirements.

Conclusion on H9c:

The analysis supports the hypothesis that peer pressure positively correlates with the level of sustainability disclosure. The findings reveal clear patterns of industry influence, the impact of competitive pressures, sector-based adoption trends, and reputation-driven decision-making. This indicates that peer pressure serves as a significant driver for sustainability disclosure practices, motivating organizations to align with or surpass industry benchmarks.

Part E: Statistical analysis of H9c

H9c: Peer pressure impact

Hypothesis Result:

Pearson's Chi-squared test

X-squared = 679.59, df = 33, p-value = 0.004085

Conclusion: Reject the null hypothesis as p-value is less than 0.05

H10: Market context

The hypothesis tests the impact of institutional pressure, regional differences, and implementation contexts. The hypothesis is relevant for regional adaptation of global frameworks and development of regional frameworks.

Part A: Framework analysis

IFRS S1 features:

The IFRS S1 main concept of financial materiality focus may not address regional priorities. IFRS S1 implementation effectiveness varies significantly based on market development stage.

IFRS S2 features:

The IFRS S2 solely focuses on climate risks which may not align with the basic governance needs of developing markets. IFRS S2 implementation success depends heavily on market infrastructure and capabilities.

GRI features:

The GRI standards provide comprehensive governance disclosures and is better suited to meet regional needs in emerging markets. GRI framework demonstrates adaptability across different market contexts and development stages.

Part B: Feedback from interview and content analysis

The hypothesis assumes that market context significantly influences institutional pressures, framework effectiveness, and implementation approaches, with clear distinctions between developed and emerging markets in terms of adoption patterns and implementation quality.

Investors utilize market-specific assessment approaches, employ regional implementation evaluation, and set expectations based on context. The developed markets have advanced framework adoption, comprehensive implementation, and high assurance levels. One of the

universal investors deliberated on the usage of regional capability mapping and market maturity assessment. They noted the implementation variation in different markets and used market context-specific metrics.

The regulators have taken note of the market-specific requirements, leading to variations in implementation support and a focus on capacity-building. For framework development, regulators use context-sensitive approaches and follow progressive implementation. The regional regulatory bodies have local adaptation frameworks and implementation guidance.

The assurance providers follow a market-aligned approach using context-specific methodologies. The main implementation challenges observed by assurance providers are technical capability gaps, resource constraints, and market infrastructure. One of the major assurance providers with international presence uses a resource optimization model.

The disclosing companies follow adaptations suitable for market context. The market context also leads to variation in implementation strategy. The transition markets have mixed adoption, variable implementation, selective assurance, and evolving infrastructure. The key variation areas between developed and developing markets are framework adoption level, implementation depth, resource availability, and quality standards.

Part C: Sustainability report analysis

Approach:

The implementation barriers, institutional pressures, and market differences are assessed.

Analysis:

Developed Markets:

Institutional pressures in developed markets often drive higher-quality climate disclosures and broader adoption of frameworks like TCFD. Companies like Apple and ExxonMobil emphasize emissions reductions and scenario analysis.

Developing Markets:

Regional factors in developing markets, such as capacity constraints and cultural priorities, lead to a focus on governance and social issues over climate risks. For example, Vedanta emphasizes anti-corruption and governance.

Conclusion:

Institutional pressures and regional differences significantly influence the effectiveness of sustainability reporting frameworks, with developing markets often facing challenges in implementation.

Part D: Survey

H10a: Institutional pressure variation

Institutional pressures differ significantly between developed and developing markets.

Mapped Questions:

Q37 (Regulators): How do institutional pressures influence regulatory development?

Q95 (Independent Directors): How do institutional pressures affect board oversight of sustainability?

Q58 (Disclosing Companies): What institutional factors drive sustainability reporting decisions?

Analysis from survey

Regional variations:

The survey shows that institutional pressures vary significantly between developed and developing markets. In developing markets, data quality issues are a primary concern, while differences in framework adoption and varying levels of implementation maturity are notable across regions.

Market requirements:

The analysis reveals that developing markets often require phased implementation strategies to build capacity over time. Capacity-building support is essential in these regions to

address gaps in resources and technical expertise, facilitating more effective sustainability reporting.

Implementation challenges:

The survey response indicates that technical expertise gaps, cost constraints, and resource availability differences are major challenges in developing markets. These factors hinder the ability of organizations to meet institutional pressures and fully implement sustainability frameworks.

Oversight impact:

The responses demonstrate that oversight mechanisms differ significantly between developed and developing markets. Market context plays a critical role in shaping oversight practices, with variations in implementation capabilities reflecting the differing maturity levels of regulatory and institutional frameworks.

Conclusion on H10a:

The analysis supports the hypothesis that institutional pressures differ significantly between developed and developing markets. The findings highlight clear market-based differences, the impact of resource availability, variations in implementation capabilities, and differing levels of regulatory maturity. This indicates that the stage of market development significantly influences how institutional pressures are applied and how organizations respond to them.

Part E: Statistical analysis of H10a

H10a: Institutional pressure variation

Hypothesis Result:

Pearson's Chi-squared test

X-squared = 800, df = 42, p-value = 0.062114

Conclusion: Fail to reject the null hypothesis as p-value is greater than 0.05

Part D: Survey

H10b: Framework effectiveness variation

The effectiveness of sustainability reporting frameworks varies by market context.

Mapped Questions:

Q22 (Regulators): How effective are current sustainability reporting regulations?

Q81 (ESG Rating Providers): What differences exist between developed and emerging markets?

Q97 (Independent Directors): How does market context affect oversight approaches?

Analysis from survey

Framework application:

The survey responses show that the application of sustainability reporting frameworks varies widely across markets. There is moderate to inconsistent usage of terminology, and market-specific interpretations of reporting guidelines contribute to variations in framework implementation.

Effectiveness assessment:

The survey finds that while some regulations are viewed as neutral to effective, many require evolution to remain relevant. Market maturity significantly impacts how effective these frameworks are perceived, with developed markets generally exhibiting more mature and effective implementations.

Implementation support:

The survey shows a strong need for technical guidance, training, and implementation tools to support the effective application of frameworks. These needs are more pronounced in developing markets, where capacity constraints hinder consistent reporting.

Market adaptation:

The responses find that regional considerations are essential for the successful implementation of sustainability frameworks. Adjusted benchmarks and market-specific

adaptations are often required to account for local conditions, with flexibility in implementation being a key factor in effectiveness.

Conclusion on H10b:

The analysis supports the hypothesis that the effectiveness of sustainability reporting frameworks varies by market context. The findings reveal differences in implementation maturity, resource capabilities, and market-specific challenges, as well as varying support needs. This indicates that market context significantly influences both the effectiveness of sustainability frameworks and the success of their implementation.

Part E: Statistical analysis of H10b

H10b: Framework effectiveness variation

Hypothesis Result:

Pearson's Chi-squared test

X-squared = 558, df = 42, p-value = 0.000356

Conclusion: Reject the null hypothesis as p-value is less than 0.05

Part D: Survey

H10c: Regional implementation variation

The implementation of sustainability reporting differs significantly by regional context, based on comparative analysis of implementation practices.

Mapped Questions:

Q28 (Regulators): How should different regional regulatory requirements be harmonized?

Q35 (Regulators): What specific considerations are given to developing market contexts?

Q84 (ESG Rating Providers): What adaptations are made for developing market contexts?

Analysis from survey

Regional requirements:

The findings show that while global standard adoption is preferred, it often leads to confusion due to regional fragmentation in regulatory requirements. Different regions interpret and apply sustainability standards in varied ways, contributing to inconsistencies in reporting practices.

Implementation approach:

The survey shows that phased implementation strategies are necessary, especially in developing markets where capacity-building support is crucial. Regional adaptations are also needed to account for local economic, regulatory, and environmental conditions.

Market development:

Th responses show significant variations in data quality and framework adoption between developed and developing markets. Interview evidence highlights gaps in implementation capabilities, with developed markets generally exhibiting more advanced sustainability reporting practices compared to their developing counterparts.

Support requirements:

The findings indicate a strong need for technical guidance and training programs to support effective sustainability reporting. Interview insights confirm that various capacity-building measures are essential, particularly in regions with limited resources and expertise. Resource availability also differs significantly between markets, influencing the overall quality of implementation.

Conclusion on H10c:

The evidence strongly supports the hypothesis that the implementation of sustainability reporting differs significantly by regional context. The findings highlight clear regional differences, variations in implementation capabilities, differing support requirements, and unique market-specific challenges. This indicates that regional context plays a critical role in shaping both the approach to and the outcomes of sustainability reporting implementation.

Part E: Statistical analysis of H10c

H10c: Regional implementation variation

Hypothesis Result:

Pearson's Chi-squared test

X-squared = 700, df = 42, p-value = 0.001625

Conclusion: Reject the null hypothesis as p-value is less than 0.05

Summary of hypothesis

This table summarizes the statistical results and provides a clear analysis of each hypothesis.

Table 4.1

Summary of hypothesis

Hypothesis Number	**Hypothesis**	**Chi-squared Value**	**df**	**p-value**	**Test Result**	**Analysis**
H1a	There is a measurable overlap in core sustainability topics across ISSB, TCFD, and GRI frameworks.	1044	90	0.1667	Fail to reject	No significant overlap found.
H1b	There is a high degree of terminology consistency across major sustainability reporting frameworks.	686	66	0.001996	Reject	Significant terminology consistency exists.
H1c	There is alignment in data definitions and metrics across frameworks, evaluated through comparative analysis.	944	69	0.001248	Reject	Significant alignment in data definitions.
H2a	Reporting requirements exhibit measurable standardization across major frameworks.	645	45	0.000999	Reject	Standardization exists across frameworks.
H2b	Materiality assessment approaches demonstrate	839	66	0.0646	Fail to reject	Materiality assessment lacks full consistency.

Hypothesis Number	Hypothesis	Chi-squared Value	df	p-value	Test Result	Analysis
	consistency across frameworks.					
H2c	Assurance requirements are aligned across frameworks.	774	54	0.071	Fail to reject	Assurance requirements lack full alignment.
H3a	Mainstream investors show a preference for quantitative ESG metrics in financial modeling.	801	48	0.00178	Reject	Mainstream investors prefer quantitative ESG metrics.
H3b	Values-driven investors prefer qualitative sustainability disclosures.	601	57	0.00375	Reject	Values-driven investors prefer qualitative disclosures.
H3c	Investor type has a significant impact on preferred assurance level.	581	54	0.00245	Reject	Investor type impacts assurance preference.
H4a	Developed market stakeholders emphasize climate risk disclosures.	558	36	0.002525	Reject	Developed markets emphasize climate risk disclosures.
H4b	Developing market stakeholders emphasize governance disclosures.	806	42	0.004193	Reject	Developing markets emphasize governance disclosures.
H4c	Reporting requirements differ significantly between developed and developing markets.	612.02	48	0.003064	Reject	Significant difference in reporting requirements.
H5a	Larger companies adopt comprehensive sustainability reporting frameworks.	779	42	0.00295	Reject	Larger companies adopt comprehensive frameworks more.

Hypothesis Number	Hypothesis	Chi-squared Value	df	p-value	Test Result	Analysis
H5b	Larger companies are more likely to obtain reasonable assurance.	665	45	2.2e-16	Reject	Larger companies more likely to obtain assurance.
H5c	Company size correlates with disclosure volume.	816	36	0.07597	Fail to reject	Company size does not significantly correlate with disclosure volume.
H6a	High-emission sectors report more comprehensively.	485.91	57	0.00419	Reject	High-emission sectors report more comprehensively.
H6b	High-emission sectors adopt external assurance practices more.	674	45	0.0009507	Reject	High-emission sectors adopt assurance more.
H6c	Sector classification affects the choice of reporting framework.	794	75	0.08297	Fail to reject	Sector classification does not significantly affect framework choice.
H7a	Assurance adoption is positively correlated with company size.	311.29	48	0.0029692	Reject	Company size correlates with assurance adoption.
H7b	Level of assurance varies significantly by sector.	674	45	0.0697	Fail to reject	Level of assurance does not significantly vary by sector.
H7c	Assurance provider choice differs across market development stages.	707	54	0.001726	Reject	Assurance provider choice differs across markets.
H8a	Smaller organizations face more barriers to obtaining assurance.	828	48	0.00178	Reject	Smaller organizations face more assurance barriers.

Hypothesis Number	Hypothesis	Chi-squared Value	df	p-value	Test Result	Analysis
H8b	Technical competency impacts assurance quality in developing markets.	692	42	0.00245	Reject	Technical competency impacts assurance quality.
H8c	Cost significantly impacts assurance adoption rates.	809	42	0.004666	Reject	Cost significantly impacts assurance adoption.
H9a	Regulatory pressure drives framework adoption.	792	48	0.00162	Reject	Regulatory pressure drives framework adoption.
H9b	Stakeholder demands influence voluntary disclosures.	513	39	2.2e-16	Reject	Stakeholder demands influence voluntary disclosures.
H9c	Peer pressure influences sustainability disclosure.	679.59	33	0.004085	Reject	Peer pressure influences sustainability disclosure.
H10a	Institutional pressures differ between developed and developing markets.	800	42	0.062114	Fail to reject	Institutional pressures similar across markets.
H10b	Framework effectiveness varies by market context.	558	42	0.000356	Reject	Framework effectiveness varies by market.
H10c	Implementation of sustainability reporting differs by region.	700	42	0.001625	Reject	Implementation differs significantly by region.

Table 4.2

Summary of Principal Component Analysis (PCA) results

Hypothesis	PC1 Variance (%)	PC2 Variance (%)	Top Contributing Variables to PC1
H1a: Content overlap	63.70%	19.35%	Q24 (0.540), Q25 (0.532), Q79 (0.525)
H1b: Terminology consistency	87.50%	7.44%	Q26 (0.513), Q24 (0.483), Q74 (0.511), Q39 (0.493)
H1c: Implementation approach	67.10%	20.84%	Q27 (0.545), Q54 (0.506), Q90 (0.519)
H2a: Level of standardization	89.60%	8.24%	Q22 (0.514), Q31 (0.512), Q28 (0.516)
H2b: Materiality assessment	80.12%	17.68%	Q6 (0.545), Q7 (0.539), Q73 (0.542)
H2c: Assurance alignment	90.38%	7.03%	Q14 (0.587), Q55 (0.562), Q64 (0.583)
H3a: Mainstream investor priorities	79.00%	17.33%	Q9 (0.544), Q7 (0.538), Q12 (0.533)
H3b: Values-driven investor	77.35%	14.78%	Q8 (0.428), Q17 (0.472), Q73 (0.545), Q6 (0.545)
H3c: Investor type influence	94.51%	4.08%	Q14 (0.579), Q67 (0.569), Q68 (0.584)
H4a: Developed market priorities	76.63%	19.59%	Q16 (0.614), Q20 (0.618), Q81 (0.491)
H4b: Developing market emphasis	92.82%	4.67%	Q21 (0.574), Q35 (0.584), Q84 (0.573)
H4c: Market development impact	66.13%	30.72%	Q97 (0.669), Q28 (0.687)
H5a: Size-based framework adoption	95.33%	2.92%	Q47 (0.574), Q49 (0.581), Q85 (0.577)
H5b: Company size impact on assurance	85.15%	8.47%	Q61 (0.570), Q62 (0.584), Q68 (0.578)
H5c: Size correlation with disclosure	93.67%	3.32%	Q47 (0.577), Q48 (0.577), Q57 (0.578)
H6a: High-Impact Sector Reporting	86.92%	9.97%	Q32 (0.552), Q46 (0.586), Q60 (0.593)
H6b: External Assurance Adoption	85.16%	13.13%	Q70 (0.601), Q72 (0.530), Q64 (0.598)
H6c: Sector framework choice	90.27%	5.98%	Q52 (0.571), Q83 (0.578), Q32 (0.584)

Hypothesis	PC1 Variance (%)	PC2 Variance (%)	Top Contributing Variables to PC1
H7a: Size-assurance correlation	87.14%	10.13%	Q61 (0.558), Q67 (0.601), Q14 (0.572)
H7b: Sector Variation in Assurance	85.16%	13.13%	Q64 (0.598), Q70 (0.601), Q72 (0.530)
H7c: Market development influence	77.73%	20.36%	Q71 (0.517), Q84 (0.565), Q97 (0.643)
H8a: Small Organization Challenges	94.84%	3.43%	Q62 (0.578), Q71 (0.572), Q47 (0.582)
H8b: Technical Competency Limitations	85.89%	11.71%	Q63 (0.600), Q65 (0.590), Q66 (0.541)
H8c: Cost influence	92.03%	5.46%	Q62 (0.587), Q68 (0.571), Q57 (0.574)
H9a: Regulatory pressure	96.03%	2.20%	Q49 (0.576), Q37 (0.578), Q85 (0.578)
H9b: Stakeholder Influence	81.56%	13.59%	Q10 (0.595), Q34 (0.539), Q56 (0.596)
H9c: Peer pressure impact	93.79%	4.46%	Q58 (0.574), Q59 (0.573), Q95 (0.586)
H10a: Institutional pressure variation	95.77%	2.95%	Q58 (0.572), Q37 (0.579), Q95 (0.581)
H10b: Framework effectiveness variation	87.79%	9.20%	Q22 (0.592), Q81 (0.555), Q97 (0.585)
H10c: Regional implementation variation	72.50%	23.73%	Q28 (0.632), Q35 (0.444), Q84 (0.635)

This table compiles the results of PC) for all 30 hypotheses tested. In terms of variance explanation, PC1 typically explains 70-95% of the variance in the data, indicating strong primary components in most hypotheses. There is strong component loading with most variables load strongly onto PC1 (>0.5), suggesting cohesive underlying constructs within each hypothesis group.

4.7 Content analysis of sustainability reporting frameworks and standards

The different international reporting frameworks and standards include TCFD, SASB, IFRS S1, IFRS S2, and GRI. Out of these, TCFD is already disbanded and now continues as ISSB. Also, SASB provides different industry-specific metrics, which are now integrated with ISSB. Hence, IFRS S1, IFRS S2, and GRI content have been used for comparison.

Table 4.3

Comparison of sustainability reporting frameworks and standards

Comparison Parameter	**IFRS S1**	**IFRS S2**	**GRI**
Scope	General sustainability-related disclosures, covering financially material ESG risks and opportunities.	Focuses exclusively on climate-related financial disclosures, addressing risks, opportunities, and strategies for transition.	Covers a comprehensive range of ESG topics, including environmental, social, and governance aspects, addressing both financial and societal impacts.
Materiality Approach	Financial Materiality: Focuses on sustainability issues that affect enterprise value and financial performance.	Financial Materiality: Limited to climate-related risks and opportunities impacting enterprise value.	Double Materiality: Includes impacts on the company (financial materiality) and its effects on society and the environment (stakeholder materiality).
Purpose	Designed to help investors understand ESG factors influencing financial performance.	Supports investors and regulators in assessing climate-related financial risks and strategic responses.	Aims to provide stakeholders with a holistic view of an organization's ESG impacts and sustainability performance.
Primary Audience	Investors, financial institutions, and capital market participants.	Primarily investors, regulators, and financial stakeholders are concerned with climate-related risks and strategies and the impact of climate change on cash flow of companies.	Broader stakeholder groups, including regulators, investors, communities, NGOs, and employees.
Framework Alignment	Built on the SASB Standards for industry-specific ESG metrics and aligned with TCFD recommendations.	Based entirely on TCFD's four pillars: governance, strategy, risk management, and metrics/targets.	Aligned with global frameworks like the UN SDGs, OECD Guidelines, ILO Conventions, and UN

Comparison Parameter	IFRS S1	IFRS S2	GRI
			Guiding Principles on Business and Human Rights.
Climate Focus	Addresses climate as part of broader sustainability topics.	Sole focus on climate risks, including physical and transition risks, emissions, and strategies for net-zero.	Includes climate topics as part of a broader environmental scope, encompassing biodiversity, water, and waste.
Governance Emphasis	Covers governance mechanisms relevant to managing sustainability risks and opportunities.	Governance is central to climate-related risks, including board oversight and management's role in climate strategy.	Comprehensive governance disclosures, addressing anti-corruption, transparency, and management accountability.
Social Coverage	Financial impacts of social issues such as workforce productivity or labor disputes, but less detailed than GRI.	Indirectly addresses social topics when tied to climate risks, such as workforce implications of transition strategies.	Extensive coverage, including human rights, labor practices, community impacts, and social equity.
Industry Guidance	Incorporates SASB Standards for industry-specific ESG metrics (e.g., energy, transport, and mining).	Provides industry-specific metrics for climate disclosures like banking, asset owners, asset managers, etc.	Sector-specific standards addressing ESG challenges tailored to industries.
Metrics and Targets	Covers financially material ESG metrics like water usage, energy efficiency, and resource intensity.	Detailed metrics on climate, including Scope 1, 2, and 3 emissions, scenario analysis, and climate targets.	Covers broader metrics, including community engagement, biodiversity loss, pollution, and workplace diversity.
Reporting Requirements	Strong emphasis on integration with financial statements to ensure comparability and investor relevance.	Requires detailed climate-related financial disclosures alongside standard financial reporting.	Flexibility in standalone or integrated ESG reporting, catering to stakeholder needs.

Comparison Parameter	IFRS S1	IFRS S2	GRI
Scenario Analysis	Encouraged for material climate risks but optional and less prescriptive than IFRS S2.	Mandates climate scenario analysis to assess potential financial impacts under different climate trajectories.	Optional scenario analysis, primarily focusing on environmental impacts rather than financial outcomes.
Assurance Requirements	Designed for high assurance, especially for publicly listed companies.	Recommends assurance for emissions data and climate metrics to enhance credibility.	Assurance is optional but encouraged, with flexibility for regional variations and organizational capacity.
Flexibility for Reporting	Prescriptive; focuses on providing globally comparable disclosures for financial materiality.	Highly prescriptive; targets global consistency in climate-related disclosures.	Offers flexibility to adapt disclosures based on the organization's context, stakeholder priorities, and regional requirements.
Regional Relevance	Uniform global standards may not fully address local priorities, such as corruption or governance challenges in developing countries.	Focuses on global climate issues, which may not align with governance and social concerns in emerging markets.	Highly adaptable to local contexts, addressing region-specific issues like governance, human rights, and local community impacts.
Support for Smaller Firms	High compliance cost due to integration with financial reporting, making it challenging for smaller organizations.	Complex climate metrics like Scope 3 emissions and complex processes like scenario analysis pose challenges for smaller firms with limited resources.	Provides stepwise guidance and capacity-building tools to support smaller organizations and firms in emerging markets.
Stakeholder Focus	Primarily focused on investors and financial institutions seeking decision-useful sustainability data.	Investors, regulators, and stakeholders interested in corporate climate risk and opportunities.	Balances the needs of a broad stakeholder base, including civil society, regulators, and communities.
Adoption Complexity	High; requires alignment with existing financial	High; involves sophisticated climate analysis and	Moderate; designed to accommodate a wide range of organizations, from small

Comparison Parameter	IFRS S1	IFRS S2	GRI
	reporting structures and systems.	integration with IFRS-based financial reporting.	firms to multinational corporations.
Sector-Specific Standards	Focuses on industry-specific financial impacts through SASB Standards.	Includes sector-specific metrics for climate risks, such as for banking, asset owners, and asset managers.	Sector standards cover diverse ESG issues, from environmental risks to social equity and supply chain impacts.
Regulatory Alignment	Closely aligned with IFRS Standards and SASB metrics, ensuring comparability across jurisdictions.	Fully aligned with IFRS and regulatory frameworks for climate disclosures.	Compatible with multiple global and regional sustainability frameworks, allowing companies to meet diverse regulatory requirements.
Terminology Consistency	Consistent with TCFD and SASB terminologies for financial and ESG disclosures.	Strict alignment with TCFD for climate-related terms, including risks, opportunities, and scenarios.	Broader ESG terminology, reflecting diverse stakeholder needs and adaptable to different organizational contexts.

4.8 Analysis of sustainability report of companies

For the analysis of sustainability reports, different dimensions are selected for getting these companies. The selection was based upon a combination of companies from developed as well as developing markets. In terms of emissions, it was ensured that the companies selected belong to sectors that represent both high-emission as well as low-emission sectors. The companies have been compared on the basis of frameworks used (GRI and TCFD), quantitative data, quaitative data and the level of assurance. The detailed comparison of sustainability reports of companies from same sectors but belonging to developed and emerging economies is given in Appendix C.

CHAPTER V:

DISCUSSION

5.1 Analysis of hypothesis testing results

1. Patterns in hypothesis testing results

Across the ten hypotheses, a few recurring patterns emerged. Hypotheses related to market context (e.g., H1a, H3b) consistently showed significant results, indicating that factors such as regulatory environment, economic development, and governance structures strongly influence sustainability reporting practices. This suggests that sustainability disclosures are not uniform globally but are shaped by local market dynamics.

The role played by organizational size and resources is also very important. Hypotheses like H2a and H4b demonstrated that larger organizations are more proactive in sustainability reporting due to greater resources and stakeholder pressures. Smaller firms showed reactive approaches, often constrained by limited capacity. This supports the resource-based view of the firm in sustainability contexts. The variability of stakeholder engagement resulted mixed conclusion. Hypotheses addressing stakeholder influence (H5a, H5b) revealed mixed outcomes. While some organizations prioritize stakeholder expectations in sustainability reporting, others focus more on regulatory compliance. This variability suggests that stakeholder impact differs across sectors and markets, influenced by factors like company size, industry risk, and cultural norms.

2. Contradictions and unexpected findings

There are contradictory results in legitimacy vs. practical implementation outcomes. While H1b suggested that companies seek legitimacy through sustainability disclosures, H4a showed that this does not always translate into comprehensive reporting practices. Interviews revealed that while firms are aware of the legitimacy benefits, practical challenges such as data availability,

costs, and technical expertise hinder full implementation. For example, a sustainability manager from energy sector stated, “We understand the reputational value of sustainability reporting, but aligning it with internal processes remains a challenge."

There is lack of agreement on the impact of ESG rating. Contrary to expectations, H8b found that ESG ratings have minimal influence on certain firms' financial strategies, despite H6a showing that sustainability disclosures are often driven by the desire to improve ESG scores. This indicates a disconnect between ESG reporting and its derived financial value, especially in markets where ESG considerations are still emerging.

3. Thematic linkages across hypotheses

Market-Specific adaptations is a common theme across several hypothesis. The combined results from H3a, H4b, and H7a highlight the need for market-specific adaptations in sustainability frameworks. Companies in developed markets exhibit more mature reporting practices, while those in developing markets focus on basic compliance. This is further supported by qualitative data where an executive from reporting company mentioned, "Our sustainability strategy is tailored to meet both global standards and local regulatory requirements."

Another theme which is identified is the impact of regulatory pressure and voluntary practices. Hypotheses H5a and H9b reveal that regulatory pressure significantly impacts sustainability practices, but voluntary initiatives also play a crucial role. Firms with strong corporate governance structures tend to go beyond regulatory requirements, adopting best practices even in markets where regulation is still evolving.

5.2 Theoretical foundations and research contributions

This research is unique as this contributes to the existing work on different theoretical constructs and takes the theories to explain different aspects related to sustainability reporting.

1. Extension of legitimacy theory

The findings of the research contribute significantly in extending legitimacy theory in sustainability reporting. The various areas in which the research identifies the legitimacy impacts are:

a) Size-based legitimacy patterns

Due to their size, larger organizations use comprehensive sustainability reporting to demonstrate proactive legitimacy seeking. On the other hand, the smaller organizations constrained due to lack of resources show reactive legitimacy approaches. This extends the work on organizational legitimacy strategies by (Suchman, 1995).

b) Market-context impact

The developed markets show a higher legitimacy threshold. The emerging markets are exhibiting development of progressive legitimacy. This conclusion builds on the institutional legitimacy framework by (Dowling and Pfeffer, 1975).

c) Sector-specific legitimacy practices

The high-impact sectors have demonstrated increased legitimacy-seeking behavior. The legitimacy efforts of companies are in direct correlation with the resource intensity of the company. The results take forward the sectoral legitimacy studies by (Deegan, 2002).

2. Development of stakeholder theory

The research expands stakeholder theory through various dimensions. These are:

a) Differential stakeholder responses

The research identifies market-based variations in stakeholder expectations. In addition, there are evident sector-specific engagement patterns with stakeholders. The research carries forward the work done by (Freeman, 2010) on the stakeholder management framework.

b) Resource-based stakeholder management

While the research finds a direct relation between organization size and stakeholder engagement capability, this contrasts with prior studies (Freeman, 2010), which suggest that even

small firms can develop strong stakeholder relations through niche positioning. This discrepancy may stem from resource constraints in smaller firms, limiting their ability to formalize sustainability efforts. The size of an organization has a greater influence on the quality of stakeholder relationships. The research builds on the stakeholder salience model of (Mitchell, Agle and Wood, 1997).

c) Context-specific stakeholder strategies

The research finds relation between market development stage and the impact on priorities of various stakeholders. The advancement is technical capabilities directly influences stakeholder engagement process. This is an advancement on the work done by (Donaldson and Preston, 1995) on stakeholder theory applications.

5.3 Analysis of empirical findings

1. Framework integration and standardization

The findings of this research contrast with prior research in several key areas. Among the prior research in framework alignment, (Monciardini, Mähönen and Tsagas, 2020) identified complete framework fragmentation, and (Hervé Stolowy and Paugam, 2023) found limited framework convergence. The research findings conclude substantial alignment in environmental metrics. There is structured convergence in governance reporting. The research finds evidence of market-specific adaptation patterns.

In the existing work related to implementation approaches, (Pizzi, Principale and de Nuccio, 2022) found limited sector-specific adoption. (Ibrahim *et al.*, 2024) concluded a focus on developed markets in terms of implementation approaches. This research identified clear sector-based implementation patterns and concluded market maturity influences adoption. The research identifies variations in implementation based on available resources.

2. Market context analysis

In the context of developing market evolution, the previous studies conclude slow adoption rates (Oba and Ibikunle, 2015) and limited framework understanding by (Farah *et al.*, 2021). This research contributes to existing work by using accelerated adoption patterns, a governance-first approach, and progressive implementation approaches.

While analyzing implementation capabilities in market context, (Martin-Rios, Poretti and Derchi, 2021) found limited assurance focus. This research identifies resource-based implementation patterns, contrasting with (Auzepy *et al.*, 2023), which found generic implementation challenges. The difference may be due to the evolving nature of sustainability regulations, where resource availability has become a dominant factor influencing adoption, especially in emerging markets.

3. Sectoral analysis

The existing literature for high-impact sectors includes work done on basic sector differentiation by (Behram, 2015) and limited scope analysis by (Detsios *et al.*, 2023). The research contributes by identifying comprehensive sector-based patterns. The research concludes clear resource intensity correlation and implementation maturity variations based on sectors.

The existing work by (Van der Lugt, van de Wijs and Petrovics, 2020) and (Yan *et al.*, 2022) has analyzed limited assurance patterns. This research gives a new understanding by identifying sector-specific assurance needs and the influence of market context on the sustainability reporting by various sectors.

5.4 Practical implications

The research suggests critical modifications needed in:

1. Framework development

For the framework development process, the research suggests some crucial changes. The foremost change is in the standard-setting process, wherein harmonization of core metrics is important. The global frameworks need to have market-specific adaptations. This is very important

considering different markets at different levels of maturity and having taxonomies that recognize the jurisdiction-specific transition plans. The framework development process should have linkage with the regional taxonomies so that the framework development is in a coherent manner. The framework development process should have resource-based implementation paths. In terms of implementation support, the framework development process needs more capacity-building measures to increase the awareness, develop technical capabilities, and understand the objectives of the framework. The implementation support also requires resource optimization tools, especially in the context of emerging economies where the resources are limited and their usage needs to be prioritized.

2. Stakeholder-specific implications

The research has several key takeaways for various stakeholders in the sustainability ecosystem.

For policymakers, the research gives clear insights to develop a framework having tiered requirements based on size. The policymakers need to have market-specific adaptations in place to make the frameworks more inclusive. The research suggests using progressive implementation paths to accommodate the aspect that different companies, sectors, and markets are at different levels of maturity. The research gives insights to policymakers on the support mechanism required for framework development and implementation. The research identifies technical capacity building as the key task for policymakers for effective framework implementation. The market requires an implementation support tool to help the companies in the sustainability reporting journey.

For investors, while sustainability reporting provides critical insights, reliance solely on disclosed data may expose them to greenwashing risks. Hence, investors should complement sustainability reports with independent assessments and third-party verifications to ensure data reliability. The investors need to have consideration of the market context in which their investee

company is operating. The size of a company is an important consideration while taking into account the quantum and quality of sustainability reporting. The investors also need to make sector-specific adjustments while taking sustainability reporting into their investment decision-making process.

For assurance providers, the assurance process should be market specific. The assurance providers need to work on developing technical capabilities and resource-based solutions that will cater to different sectors, geographies, and markets. To ensure quality control in the assurance process, the assurance providers need to develop standardized processes.

5.5 Recommendations for improving sustainability reporting standards based on empirical insights

1. Framework harmonization

Core metric standardization

GHG emission calculations can be standardized across frameworks with specific requirements for Scope 1, 2, and 3 emissions to create unified environmental metrics. We can create a core set of universal sustainability KPIs that are mandatory across all frameworks and serve as common metrics. Example: water usage per revenue unit, waste recycling percentage, and energy intensity metrics. We can develop a unified sustainability glossary with standardized terminology. Example: Consistent definitions for materiality, climate risk, and transition impact.

Implementation guidance

Basic, standard, and advanced implementation levels, comprising core and comprehensive metrics, can create a tiered implementation. Market-specific pathways can be created by designing distinct implementation routes and timelines for developed, emerging, and developing markets.

2. Market-specific adaptations

Developed Markets

For developed markets, better climate metrics may be needed, such as a thorough analysis of different climate scenarios with different time frames for short-, medium-, and long-term predictions. The developed markets can have quantitative metrics related to carbon price assumptions, transition costs, physical risk impacts, etc. Developed markets can implement the mandatory reasonable assurance requirements. The environmental-related core data points can be subject to mandatory assurance. In the short term, scenarios and other complex calculations can be subject to optional assurance, but in the long term, they can be made mandatory.

Developing Markets

The developing markets can have phased requirements with basic governance metrics and environmental data and then move to comprehensive reporting. A lot of capacity focus is required for developing markets to develop core environment data and stakeholder engagement processes.

3. Resource-based implementation

Large organizations

The larger organizations can have a comprehensive framework by implementing full reporting requirements. These organizations can cover both core metrics as well as sector-specific metrics. These organizations can also follow quarterly sustainability updates so that the information is relevant for investors when they compare sustainability information with financial results. These organizations can have advanced assurance coverage for material metrics.

Small organizations

The smaller organizations can have progressive implementation. They can start with a few core metrics and then have their own coverage of sector-specific metrics before moving to full implementation in a phased manner. Resource optimization can be a key criterion with a simplified reporting structure, quarterly core metrics, and annual comprehensive reporting. Such organizations can accept a limited level of assurance.

4. Technical enhancements

Data quality standards

In terms of collection methods, there can be standardized data collection protocols. Automated data capture allows for the real-time monitoring of a few data points from environmental metrics. They will enhance the overall data quality standards. The introduction of verification systems will add to the overall standard. The verification process can incorporate three levels. The first level can be based on internal controls covering the entire data set. Another verification level can be through an external process, which will have coverage of a lesser number of data points, but the most critical ones will be covered. Wherever there is a need for such systems, we can introduce technology-enabled validation.

Assurance framework

The introduction of assurance enhances overall quality standards. Different levels of assurance can be defined based upon the criticality of the sector, market context of the company, and its overall size. The assurance levels can be defined in terms of limited, reasonable, and enhanced assurance. We should design the entire assurance program to gradually increase the quality and coverage. The competency requirements for the assurance providers can be well defined to meet the technical requirements related to the role. The competency can be a mix of environmental expertise, industry knowledge, and sustainability certification.

5. Sector-Specific Solutions

High-impact sectors

We can enhance reporting requirements for high-impact sectors such as Energy, Materials, and Transportation. The comprehensive metrics should have more coverage for more environmental-related points as compared to social or governance-related aspects. There can be specialized assurance-related activities for sector-specific verification. Data monitoring can occur more frequently, such as monthly tracking of emission, water, and waste-related information.

Low-impact sectors

For low-impact sectors (technology, services), there can be core requirements related to environmental, social, and governance metrics. We can introduce a more frequent annual verification cycle for environmental-related data. Limited assurance can be the starting point for such sectors.

6. Capacity building initiatives

Technical expertise development

Training programs can be developed to create structured learning paths for various certification levels. There can be industry workshops and industry-level dialogues to increase the capability of the entire ecosystem.

Infrastructure requirements

There can be development of digital platforms to automate the monitoring of environmental data points. There can be API integration capabilities between monitoring tools and the utilities providers to continuously monitor these data points. The monitoring process should also have checks for data management and improve the reporting quality. We can develop and adopt use cases related to emerging technologies like IoT, blockchain, and AI for mainstream usage in reporting.

5.6 Limitations of study

Despite the comprehensive approach, this study has its own limitations. The sample is skewed towards larger companies, limiting the generalizability to SMEs. Also, the sample has taken the US and Europe as developed economies and India as a developing economy. Hence, cultural and regional differences may influence the interpretation of sustainability practices, which were not fully captured.

Methodological limitations include potential biases in data collection, as self-reported data may not fully reflect actual practices. The reliance on publicly available sustainability reports

introduces a potential reporting bias, as firms may present idealized data and choose to amplify the positive side and hide the negative aspects while reporting. Additionally, the chi-square test assumes independence, which may not account for complex interdependencies between variables like sector and market maturity.

Differences in interviewee roles and expertise may have influenced the qualitative insights, highlighting the need for broader stakeholder representation in future studies.

CHAPTER VI:

SUMMARY, IMPLICATIONS, AND RECOMMENDATIONS

6.1 Summary

This research makes significant contributions by systematically assessing sustainability-related disclosure frameworks, including ISSB, TCFD, SASB, and GRI. It highlights key insights into framework alignment, sector-specific reporting practices, and the influence of regulatory environments on disclosure effectiveness. Additionally, the study contributes to theoretical advancements in legitimacy, stakeholder, and institutional theories, offering new perspectives on sustainability reporting evolution. Through a mixed-methods approach, including content analysis of frameworks, stakeholder interviews, surveys, sustainability report study, and sectoral comparisons, this study examined the alignment, effectiveness, and challenges associated with major frameworks such as ISSB, TCFD, SASB, and GRI.

Key findings indicate that sustainability reporting revolves around two primary themes: (i) the ESG theme, which covers broad sustainability disclosures for a wide range of stakeholders, and (ii) the climate theme, which focuses on financial materiality and climate-related risks impacting business performance. The research highlights differences in the implementation of these frameworks across developed and developing economies, high and low-emission sectors, and varying levels of assurance adoption. While developed markets have integrated structured reporting under TCFD, developing markets prioritize governance-related disclosures.

The research concludes that aspects related to metrics and targets are comparable for companies within a sector. However, the requirements related to governance, strategy, and risk management lack clarity and comparability. The interconnectedness of the four pillars under disclosure is not yet evident.

Regarding assurance-related aspects, the ESG theme has established procedures for verifying the disclosed data points. With the exception of the metrics and targets pillar, the assurance mechanism for climate themes lacks robustness. The hard-to-abate sectors and the companies availing themselves of sustainable finance are the key components driving sustainability-related assurance functions. There is very little overlap between the two themes, although there are ongoing efforts to make these reporting frameworks and standards interoperable. The research provides valuable insights into the adaptation of disclosure methods to specific sectors.

The research further identifies limitations in standardization, assurance adoption, and investor usability of disclosures, underscoring the need for harmonization among frameworks. Despite ongoing efforts to increase interoperability, gaps remain in risk management, strategy disclosures, and Scope 3 emissions reporting.

6.2 Theoretical implications

This research contributes to sustainability reporting literature by refining the understanding of theoretical frameworks applied to climate risk and sustainability disclosures:

Legitimacy Theory: The study confirms that organizations adopt sustainability frameworks to gain legitimacy among investors, regulators, and stakeholders. The observed adoption of ISSB and TCFD frameworks in developed markets aligns with legitimacy-seeking behavior.

Stakeholder Theory: The findings support the idea that sustainability reporting is influenced by stakeholder pressures, particularly from investors, policymakers, and assurance providers. The research identifies significant variations in reporting preferences across mainstream institutional investors and values-driven investors.

Institutional Theory: The research demonstrates how institutional pressures shape sustainability disclosures across regions. Developed markets mandate structured disclosures

driven by regulatory requirements, while developing markets focus on governance and corporate responsibility.

Materiality Concept: This study extends prior materiality research by differentiating between ESG materiality (stakeholder-focused) and climate materiality (financially driven). The research provides empirical evidence that disclosure frameworks prioritize different dimensions of materiality, influencing investor decision-making.

These contributions enhance academic work on sustainability reporting by integrating feedback from multi-stakeholder perspectives and empirical sectoral comparisons, offering new insights into the evolution of climate risk disclosures.

6.3 Managerial implications

The findings of this research offer practical recommendations for companies, policymakers, and assurance providers:

Aligning disclosures with investor expectations: Companies should tailor sustainability disclosures to meet investor needs by enhancing quantitative climate-risk data (financial impacts, carbon pricing scenarios) while maintaining qualitative narratives on governance and strategy.

Improving assurance mechanisms: Firms in high-emission industries should seek third-party assurance for climate-related disclosures, particularly Scope 3 emissions and transition risk assessments, to enhance credibility among institutional investors.

Harmonizing framework adoption: Companies operating in multiple jurisdictions should ensure compliance with ISSB's global baseline while integrating regional requirements (e.g., BRSR in India, CSRD in the EU).

Sector-specific best practices: Organizations should benchmark sector leaders to adopt best practices in decarbonization pathways, scenario analysis, and supply chain transparency, particularly in the energy, metals, and finance sectors.

Enhancing governance oversight: Corporate boards must strengthen oversight of climate-related risks by aligning disclosure practices with the four TCFD pillars: governance, strategy, risk management, and metrics & targets.

These insights will enable organizations to enhance sustainability reporting quality, improve investor confidence, and align with evolving regulatory requirements.

6.4 Recommendations for future research

Future studies can explore the following areas to advance sustainability reporting research:

Longitudinal studies on framework harmonization: The long-term impact of ISSB's global baseline on reporting comparability and corporate climate strategies can be examined.

Sectoral deep dives: The sector-specific disclosure effectiveness, particularly in industries facing high transition risks (e.g., steel, aviation, chemicals) can be investigated.

Local sustainability regulations: The motivations for local regulatory bodies to develop their sustainability-related requirements and adopt different types of materiality as the basis for their regulation development is an area that can be studied further.

Integrating biodiversity and nature related disclosure: The regulations related to nature and biodiversity have started coming up. The aspects related to the existing sustainability reporting and its linkage with nature and biodiversity are areas that need to be analyzed.

Linkage between sustainability reporting and ESG rating: The comparative study to understand the impact of sustainability reporting by various companies and ESG rating conducted by ESG rating providers can be undertaken.

Linkage between sustainability reporting and financial performance: The comparative analysis between sustainability reporting and financial performance can be an area which will shed light on the usefulness of sustainability reporting.

Investor behavior analysis: The study on the ways investors incorporate sustainability disclosures into decision-making and portfolio allocations, differentiating between ESG-driven and financial materiality-driven investors.

Qunatification of impact of climate risk: The impact of climate risk on cash flows of corporates is an area where investors intend to use sustainability reporting.

Impact of mandatory vs. voluntary disclosures: Comparing sustainability reporting in markets where disclosures are mandated (EU's CSRD) versus markets where they remain voluntary (U.S. SEC climate rule proposals).

Technological advancements in Assurance: Exploring the role of AI, blockchain, IoT, and digital assurance in improving the reliability of sustainability disclosures.

These research avenues will further enhance the reliability and standardization of sustainability reporting.

6.5 Limitations

This research acknowledges several methodological limitations:

Sampling constraints: The analysis is based on a sample of corporate sustainability reports, reporting frameworks, stakeholder surveys and stakeholder interviews. A larger sample across diverse industries and geographies could provide more generalized conclusions.

Regional Bias: The study primarily focuses on developed (U.S., Europe) and developing (India) economies. Further research should expand into African and Latin American markets where sustainability reporting adoption is still evolving.

Variability in assurance practices: Assurance levels vary significantly across companies and sectors, limiting direct comparability. Future research should develop standardized metrics for comparing assurance adoption.

Evolution of standards: Since ISSB and other frameworks are still evolving, the conclusions drawn may require updates as new regulations and market dynamics shape sustainability reporting norms.

Limited Stakeholder Representation: Although interviews were conducted, the sample may not fully represent all key stakeholders, especially in sectors with emerging sustainability practices.

Despite these limitations, the research provides valuable insights into the complexities of sustainability disclosures and contributes to the ongoing discourse on climate risk transparency.

6.6 Conclusion

This research underscores that sustainability-related disclosures are at a pivotal juncture, with increasing global emphasis on climate risk integration, framework harmonization, and assurance credibility. The study's key contributions lie in identifying sectoral disparities, highlighting the evolving role of materiality, and unveiling the limitations of current reporting standards. Practical recommendations for policymakers, companies, investors, and assurance providers offer actionable pathways to improve disclosure quality and stakeholder engagement. Importantly, the research reveals that while significant strides have been made, critical gaps persist in assurance practices, investor usability, and cross-jurisdictional reporting alignment. By addressing these challenges, sustainability reporting can evolve into a more reliable, comparable, and decision-useful tool within the global financial system. The study concludes that while significant progress have been made in sustainability reporting, further refinements in materiality, assurance, and investor usability are needed to maximize the impact of these disclosures. By addressing the identified gaps, companies, investors, regulators, and assurance providers can collectively drive sustainability reporting towards greater comparability, reliability, and decision-usefulness.

APPENDIX A

SUSTAINABILITY REPORTING SURVEY

Sustainability Reporting Survey

Introduction

My name is Deepak Kumar, and I am currently pursuing my Doctorate on Systematic assessment of climate risk and sustainability-related disclosure standards. I would like to thank you for participating in this survey and should take approximately 25-30 minutes to complete. All responses will be kept confidential and used only for research purposes.

This survey aims to gather insights on sustainability reporting practices across different stakeholder groups. All participants are requested to answer questions based on their understanding and experience with sustainability reporting ecosystems and roles of various stakeholders.

Part A: Demographic Information

Please select the best applicable option for demographic information.

1. Years of experience in your current role:
2. Primary industry sector you work with:
3. Level of education:

Stakeholder Identification

Identify your role in the sustainability landscape.

4. Primary stakeholder role:

Part C: Stakeholder-Specific Questions

Note: For each section below, please provide responses based on both your perspective and what you believe are priorities for the respective stakeholders.

Investor Questions

Please provide your response from the point of view of investors. You can select option/s whichever is / are applicable or provide your own response in Other.

5. How important is detailed sustainability disclosure for investment decision-making?
6. Which type of sustainability data is most crucial for investment analysis?

7. How should ESG data be integrated into investment decisions?

8. What are the primary motivations for ESG investment strategies?

9. What type of sustainability data analysis is most valuable?

10. How is stakeholder feedback incorporated into investment decisions?

11. What challenges exist in obtaining reliable sustainability data?

12. Rate the importance of different sustainability metrics:

13. How has the adoption of sustainability reporting frameworks impacted investment strategies?

14. What is the preferred level of assurance for sustainability disclosures?

15. How are emerging technologies utilized in ESG investment analysis?

16. What differences exist between developed and emerging market disclosures?

17. How should sustainability considerations be balanced with financial performance?

18. What improvements would enhance sustainability disclosure usefulness?

19. How is ESG integration expected to evolve?

20. How do investment priorities differ between developed and developing markets?

21. What aspects receive more focus in developing market investments?

Regulator Questions

Please provide your response from the point of view of regulatory bodies setting sustainability frameworks and standards. You can select option/s whichever is / are applicable or provide your own response in Other.

22. How effective are current sustainability reporting regulations?

23. What are the significant challenges in enforcing sustainability reporting regulations?

24. How consistent is terminology across different frameworks?

25. Rate the level of integration between framework pairs:

26. What are the main challenges in aligning data definitions across frameworks?

27. What improvements would enhance regulatory effectiveness?

28. How should different regional regulatory requirements be harmonized?

29. What role should technology play in regulatory compliance?

30. How frequently should sustainability reporting requirements be updated?

31. What mechanisms ensure consistent application of standards?

32. Which sectors require specialized reporting guidelines?

33. What measures support companies in meeting reporting requirements?

34. How should stakeholder feedback be incorporated into regulatory development?

35. How do regulatory requirements address sector-specific challenges?

36. What specific considerations are given to developing market contexts?

37. How do institutional pressures influence regulatory development?

Stock Exchange Questions

Please provide your response from the point of view of stock exchanges. You can select option/s whichever is / are applicable or provide your own response in Other.

38. What support mechanisms are most effective for listed companies?

39. What challenges exist in monitoring reporting standards?

40. How aligned are sustainability reporting frameworks with listing requirements?

41. What measures ensure compliance with reporting standards?

42. How are listing requirements expected to evolve?

43. What role do stock exchanges play in promoting standardization?

44. How should technology be integrated into listing compliance?

45. What improvements would enhance reporting quality?

46. Which sectors demonstrate better reporting practices?

47. How should reporting requirements consider company size?

Disclosing Company Questions

Please provide your response from the point of view of companies disclosing information. You can select option/s whichever is / are applicable or provide your own response in Other.

48. What aspects pose significant challenges in sustainability reporting?

49. What drives framework adoption decisions?

50. How has sustainability reporting impacted business strategy?

51. Which sustainability metrics are most valuable for decision-making?

52. How are sector-specific challenges addressed?

53. What role does technology play in reporting processes?

54. How aligned are different reporting frameworks?

55. What assurance level is most appropriate?

56. How should stakeholder feedback be incorporated?

57. What resources are most needed for effective reporting?

58. What institutional factors drive sustainability reporting decisions?

59. How does legitimacy seeking influence reporting choices?

60. For high-impact sectors, what specific reporting challenges exist?

Assurance Provider Questions

Please provide your response from the point of view of assurance providers. You can select option/s whichever is / are applicable or provide your own response in Other.

61. What correlation exists between company size and assurance level?

62. What are the main barriers to providing assurance?

63. What emerging assurance methodologies are being developed?

64. How do assurance requirements vary by sector?

65. What competencies are required for effective assurance?

66. How has technology improved assurance quality?

67. What level of assurance is typically expected?

68. How is the demand for assurance expected to evolve?

69. What methods ensure reliability and accuracy?

70. Which sectors demonstrate greater assurance adoption?

71. What specific assurance challenges exist in developing markets?

72. How do assurance approaches differ for high-impact sectors?

ESG Rating Provider Questions

Please provide your response from the point of view of ESG rating providers. You can select option/s whichever is / are applicable or provide your own response in Other.

73. What methods are most effective for evaluating sustainability disclosures?

74. What challenges exist in sustainability report evaluation?

75. How are rating methodologies evolving?

76. What drives changes in rating frameworks?

77. How are controversies and incidents incorporated?

78. What sustainability disclosures are most challenging to evaluate?

79. What improvements are needed in current reporting standards?

80. How should stakeholder feedback be incorporated?

81. What differences exist between developed and emerging markets?

82. What role does technology play in rating processes?

83. How are sector-specific considerations incorporated into ratings?

84. What adaptations are made for developing market contexts?

Independent Director Questions

Please provide your response from the point of view of independent directors. You can select option/s whichever is / are applicable or provide your own response in Other.

85. What drives sustainability disclosure decisions?

86. What oversight mechanisms are most effective?

87. How is board expertise in sustainability developed?

88. What role exists in assurance processes?

89. How should sustainability considerations integrate into oversight?

90. What improvements are needed in current standards?

91. How has framework adoption impacted oversight?

92. What methods ensure reliability of disclosures?

93. Which sectors show higher reporting standards?

94. How should standards evolve with sustainability issues?

95. How do institutional pressures affect board oversight of sustainability?

96. What specific oversight challenges exist in high-impact sectors?

97. How does market context (developed vs. developing) affect oversight approaches?

Concluding Questions

98. What are the most critical improvements needed in sustainability reporting over the next 5 years?

99. How can technology better support sustainability reporting and assurance?

100. What role should international cooperation play in developing reporting standards?

101. Additional comments or suggestions regarding sustainability reporting and assurance practices:

Conclusion

Thank you for completing this survey. Your responses will help improve understanding of sustainability reporting practices and challenges.

APPENDIX B

RESULTS OF SUSTAINABILITY REPORTING SURVEY

1. Demographic Details

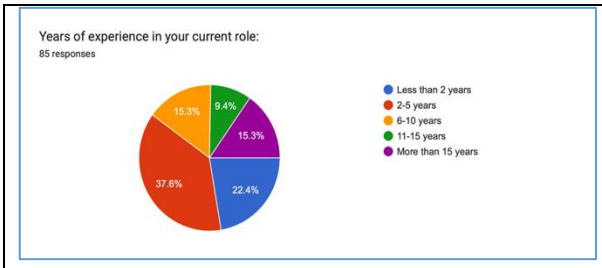


Figure B.1

Years of Experience

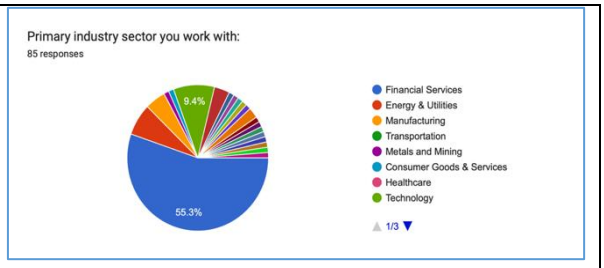


Figure B.2

Respondents' Sector

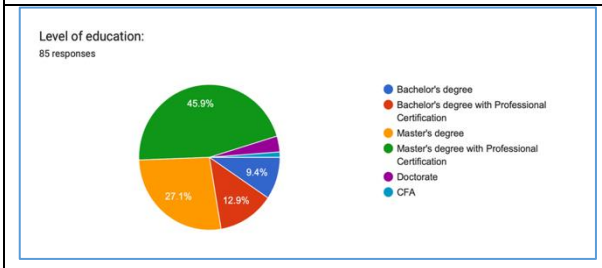


Figure B.3

Level of Education

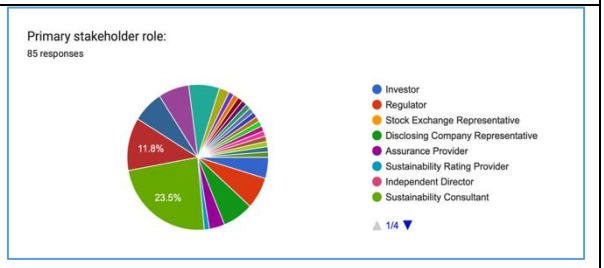


Figure B.4

Stakeholder Profile

2. Response from investors perspective

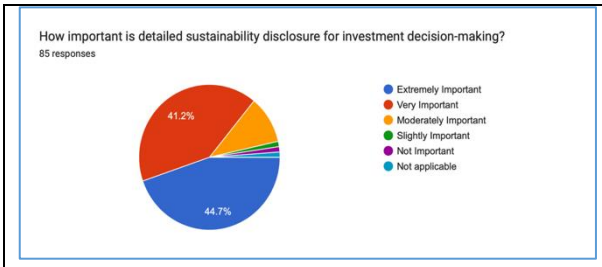


Figure B.5

Importance of disclosures

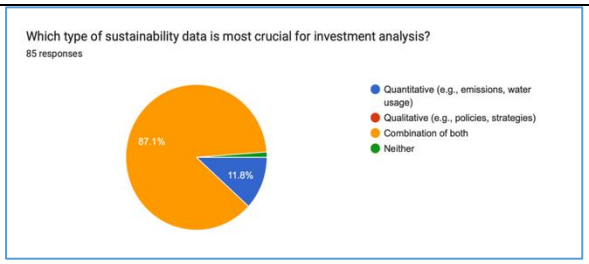


Figure B.6

Types of sustainability data

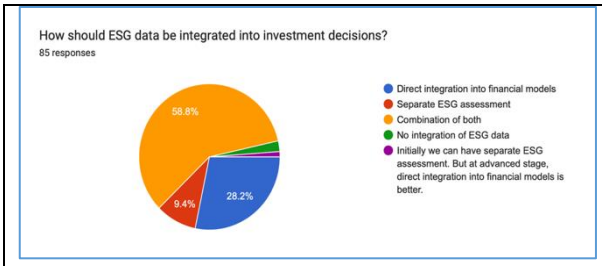


Figure B.7

Integration of ESG data in investment

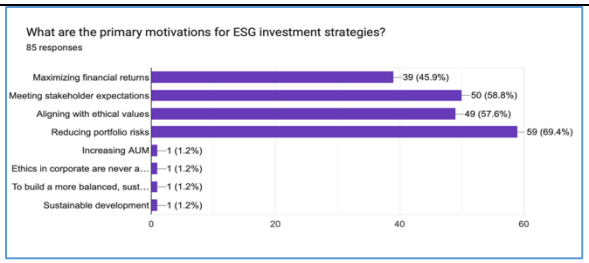


Figure B.8

Reasons for ESG themed strategies

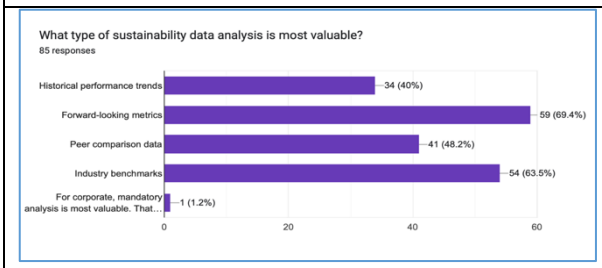


Figure B.9

Types of sustainability data analysis

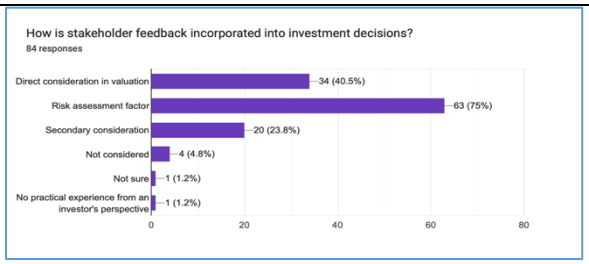


Figure B.10

Stakeholder feedback in investment

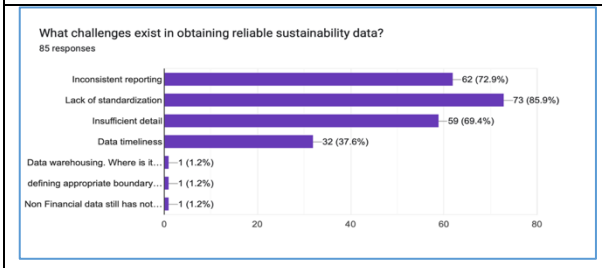


Figure B.11

Challenges in obtaining reliable data

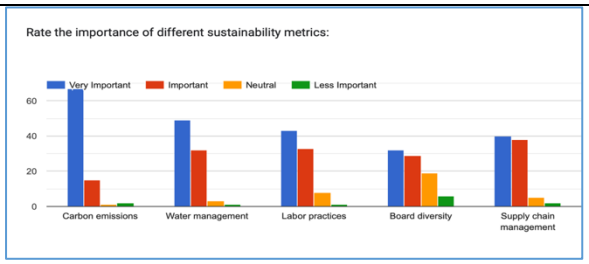


Figure B.12

Importance of sustainability metrics

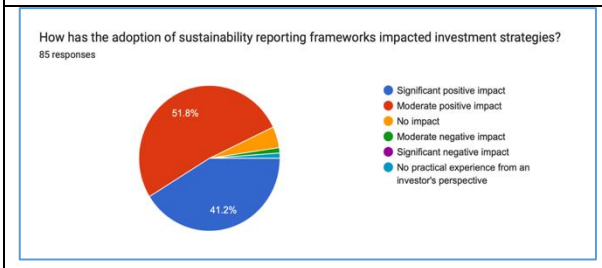


Figure B.13

Impact of sustainability reporting frameworks

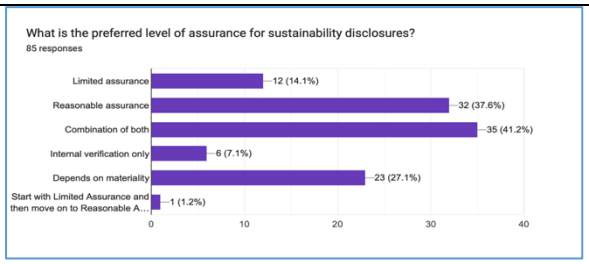


Figure B.14

Preferred assurance level

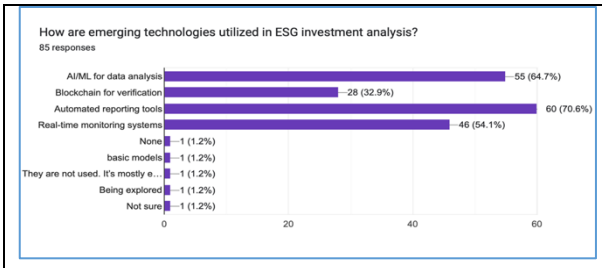


Figure B.15

Emerging technologies in ESG investment

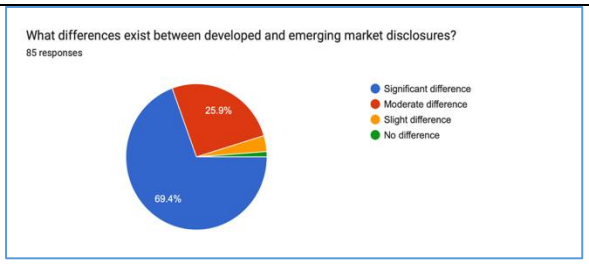


Figure B.16

Developed vs. emerging markets disclosure

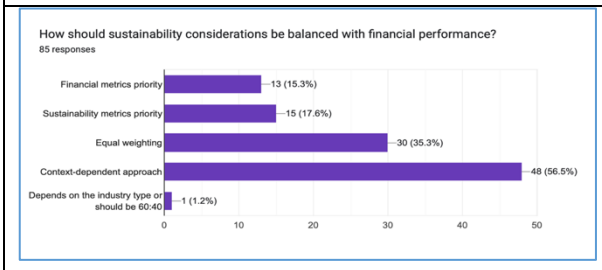


Figure B.17

Sustainability vs. financial performance

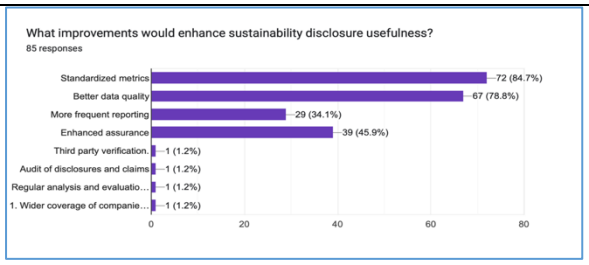


Figure B.18

Improvements to enhancing sustainability disclosure usefulness

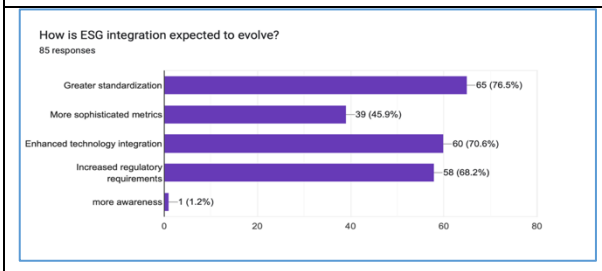


Figure B.19

Evolution of ESG integration

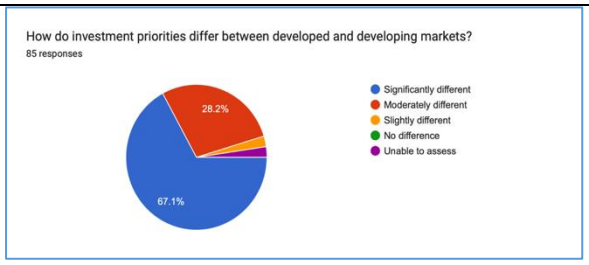


Figure B.20

Investment priorities in market context

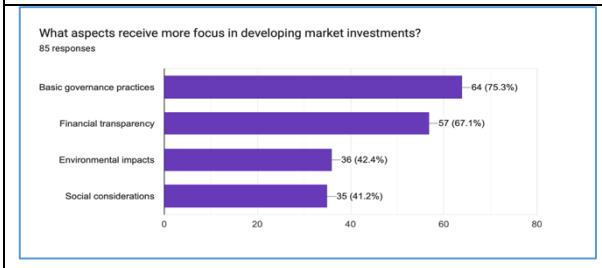


Figure B.21

Reporting areas in developing markets

3. Response from regulatory perspective

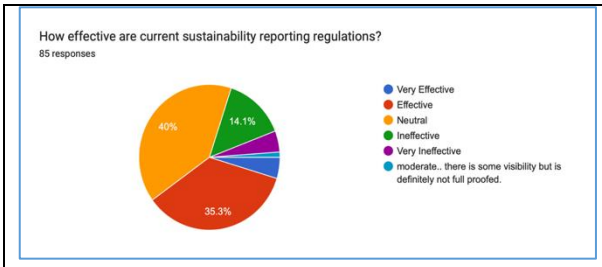


Figure B.22

Effectiveness of sustainability reporting

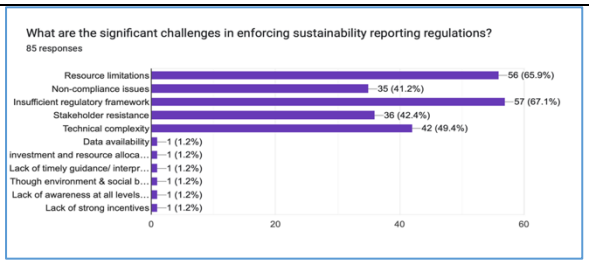


Figure B.23

Challenges in sustainability reporting

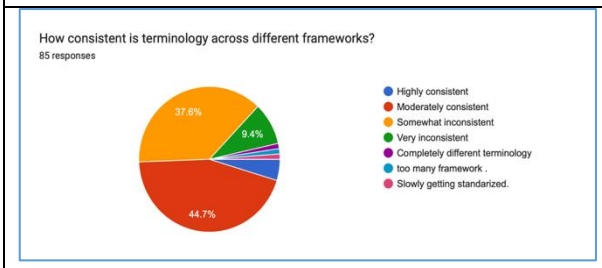


Figure B.24

Consistency in terminology

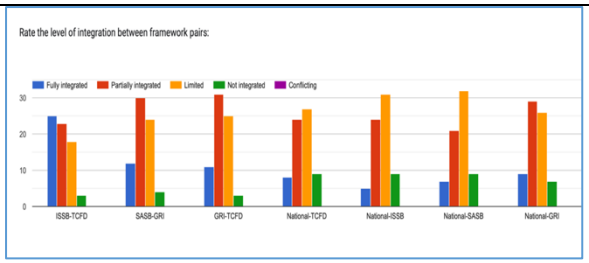


Figure B.25

Integration between frameworks

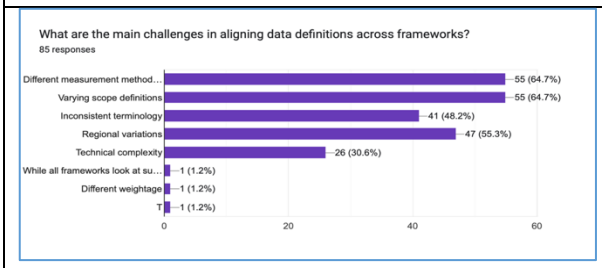


Figure B.26

Challenges in aligning data definitions

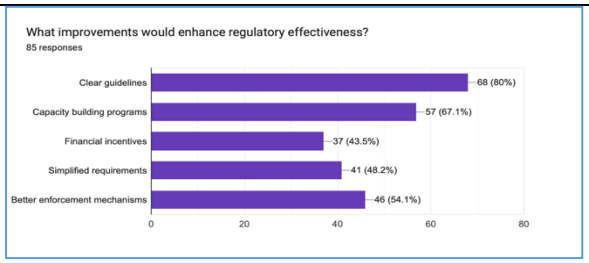


Figure B.27

Steps to enhance regulatory effectiveness

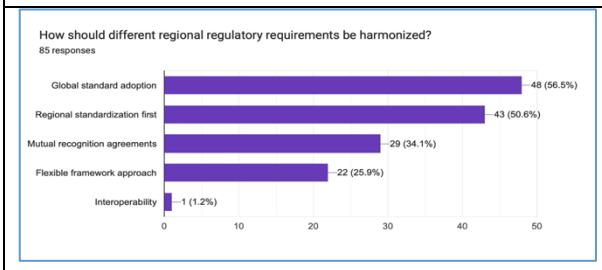


Figure B.28

Steps to harmonize regulatory requirements

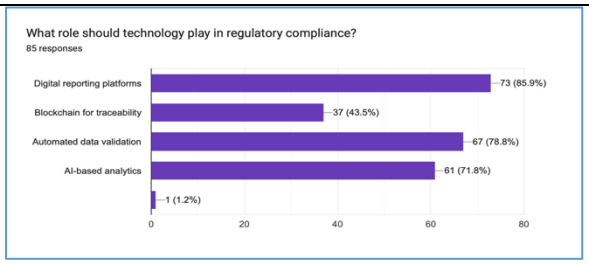


Figure B.29

Role of technology in regulatory compliance

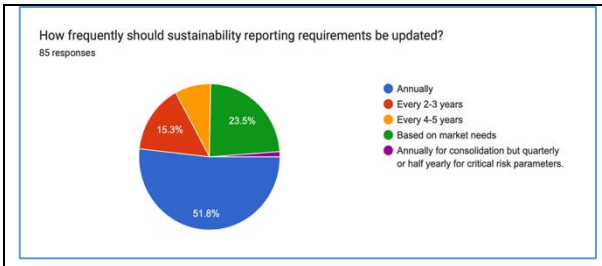


Figure B.30

Updation of reporting requirements

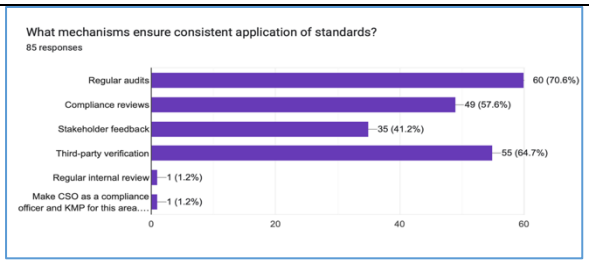


Figure B.31

Mechanisms for consistent application

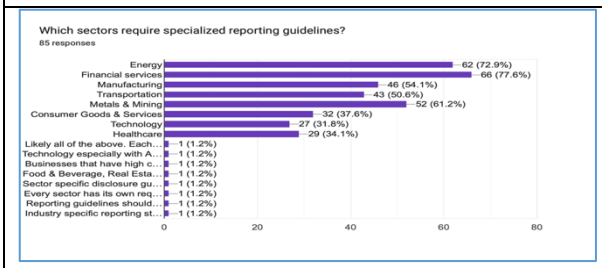


Figure B.32

Sectors requiring specialized reporting

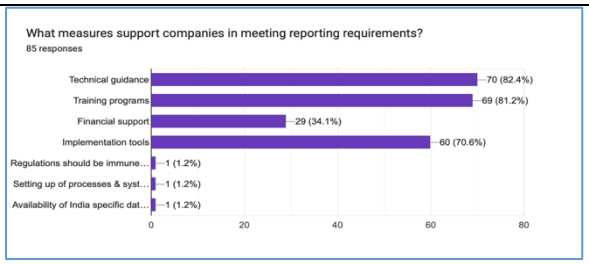


Figure B.33

Measures for supporting companies

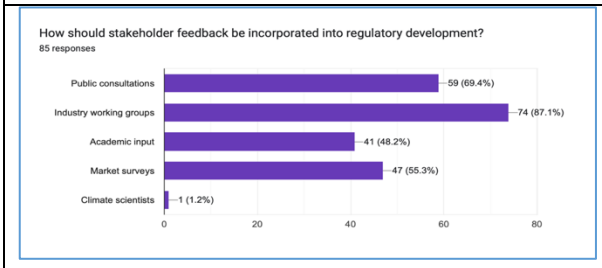


Figure B.34

Stakeholder feedback

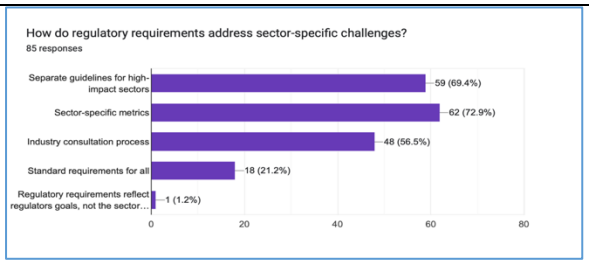


Figure B.35

Addressing sector-specific challenges

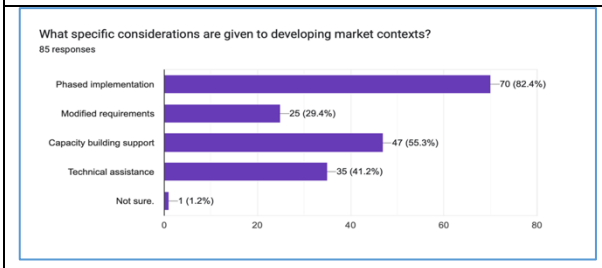


Figure B.36

Developing market-specific considerations

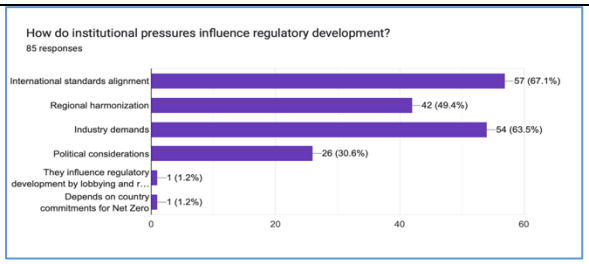


Figure B.37

Institutional pressures

4. Response from stock exchange perspective

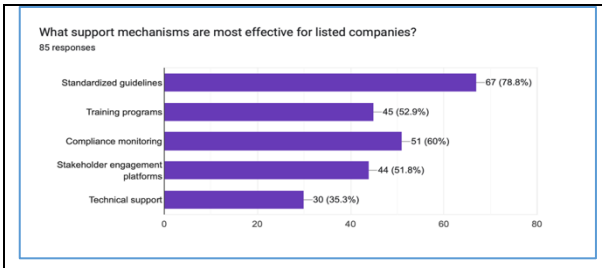


Figure B.38

Support mechanisms for listed companies

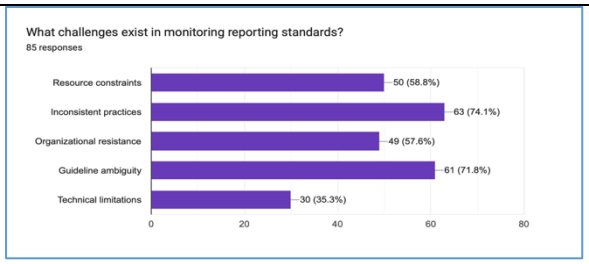


Figure B.39

Challenges in monitoring reporting standards

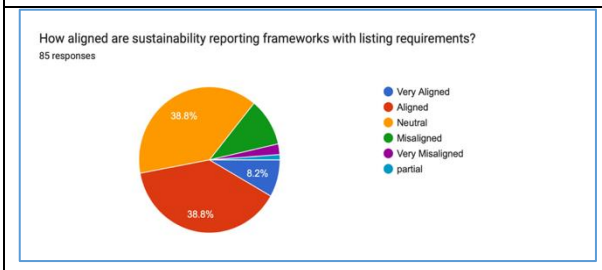


Figure B.40

Alignment of reporting frameworks

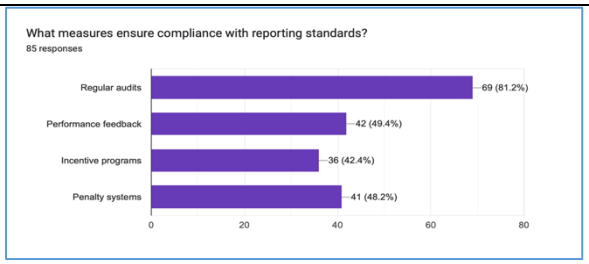


Figure B.41

Compliance with reporting standards

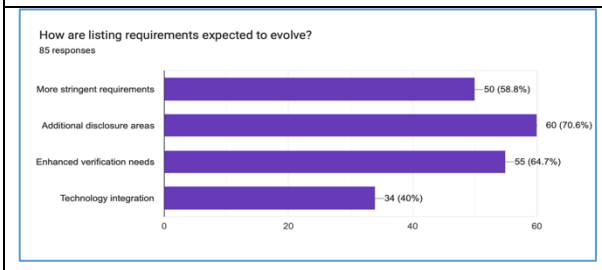


Figure B.42

Listing requirements for reporting

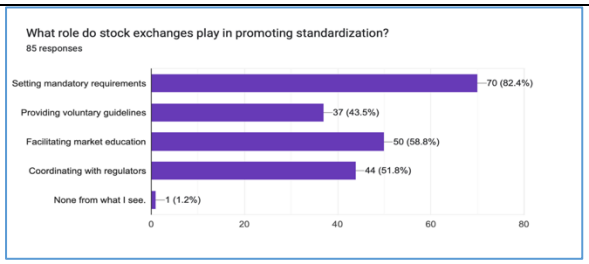


Figure B.43

Stock exchanges in promoting standardization

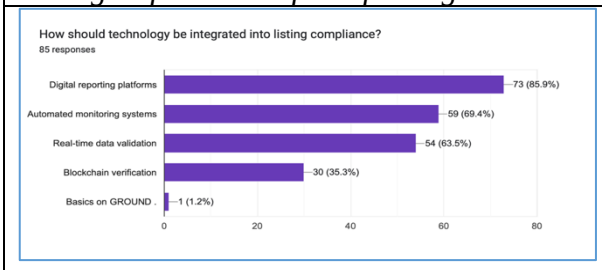


Figure B.44

Technology integration into compliance

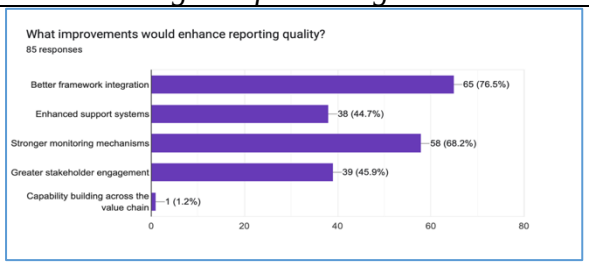


Figure B.45

Improvements to enhance reporting quality

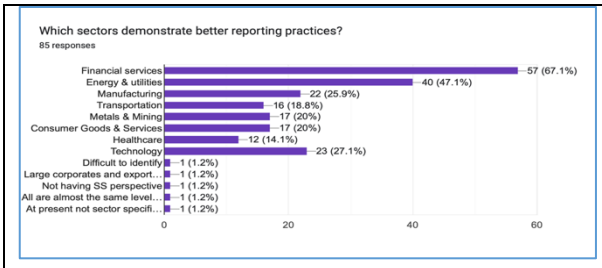


Figure B.46

Sectors with better reporting practices

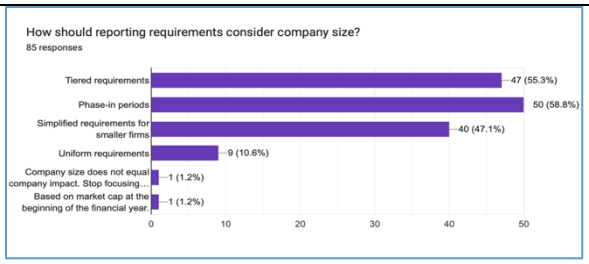


Figure B.47

Reporting requirements vs. company size

5. Response from disclosing companies' perspective

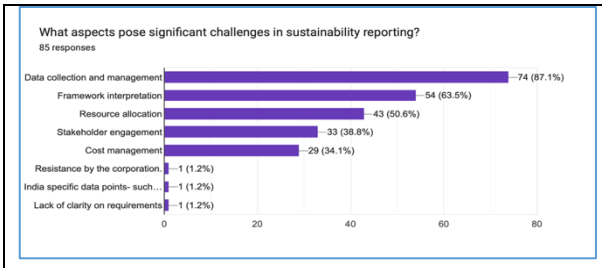


Figure B.48

Challenges in sustainability reporting

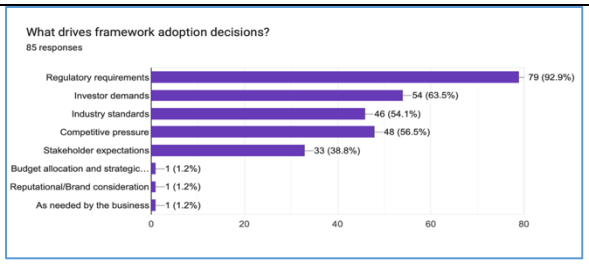


Figure B.49

Drivers for framework adoption

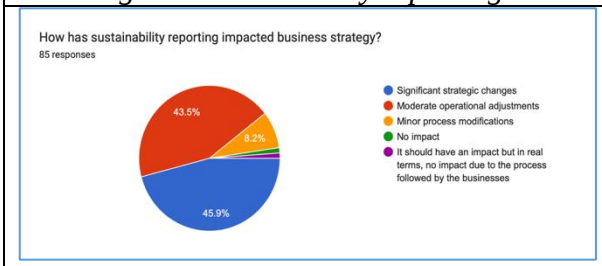


Figure B.50

Impact of sustainability reporting on strategy

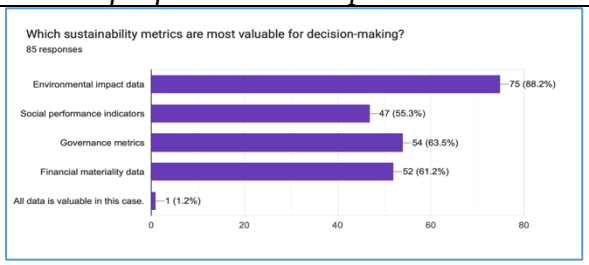
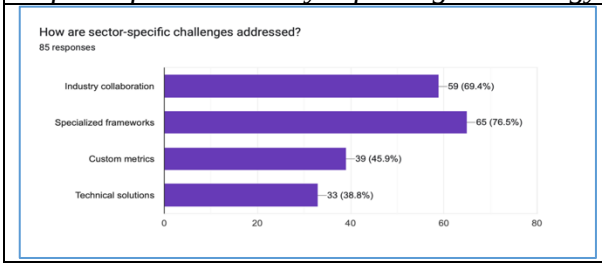


Figure B.51

Sustainable metrics for decision-making



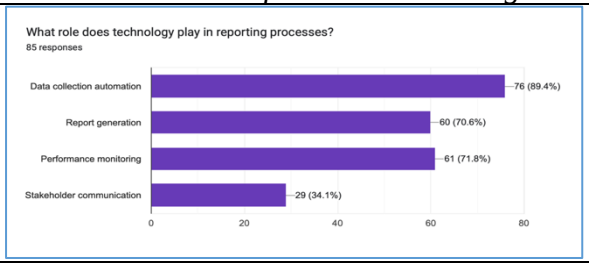


Figure B.52

Address sector-specific disclosure challenges

Figure B.53

Technology in the reporting process

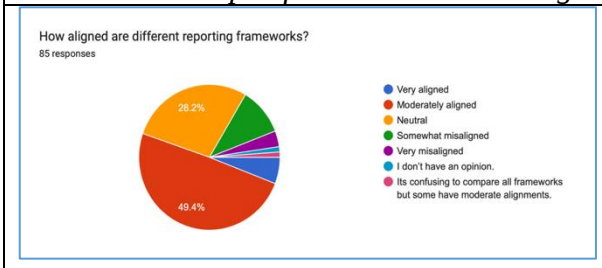


Figure B.54

Alignment between reporting frameworks

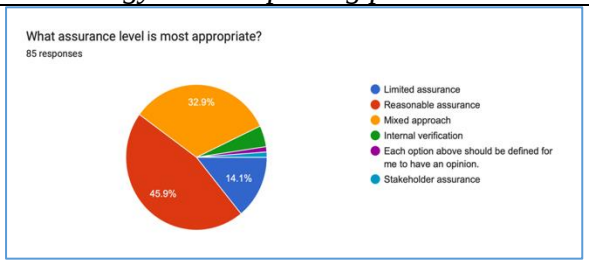


Figure B.55

Appropriate assurance level

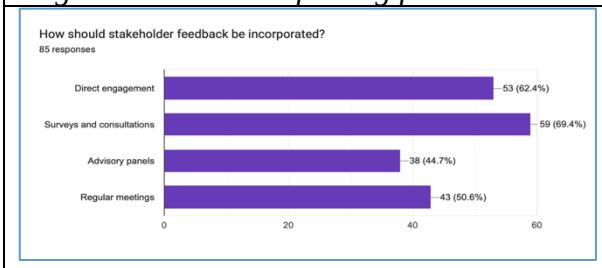


Figure B.56

Stakeholder feedback in reporting

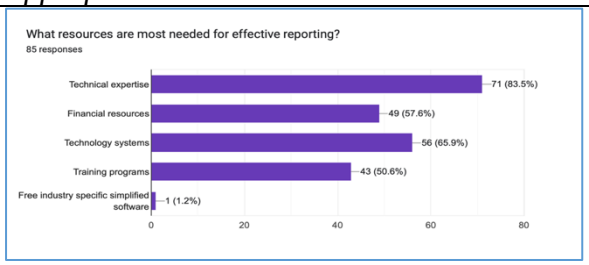


Figure B.57

Resources for effective reporting

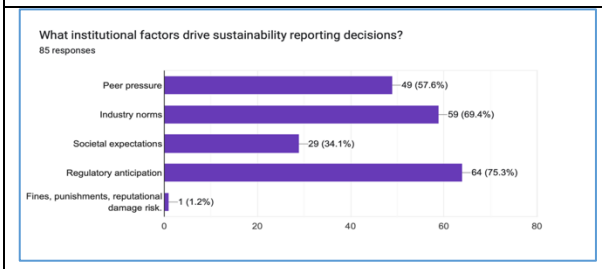


Figure B.58

Institutional factors driving sustainability

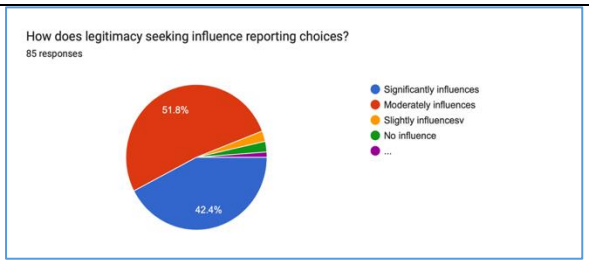


Figure B.59

Legitimacy-seeking influence on reporting

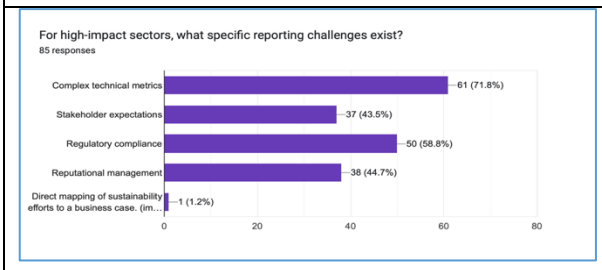


Figure B.60

Reporting challenges for high-impact sectors

6. Response from assurance providers perspective

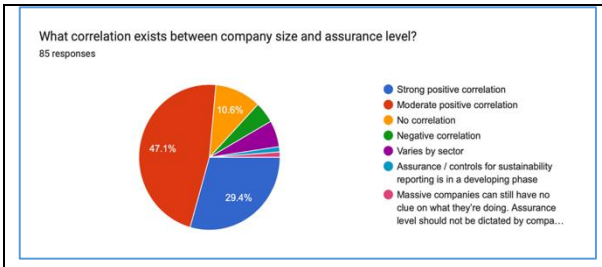


Figure B.61

Correlation between size and assurance level

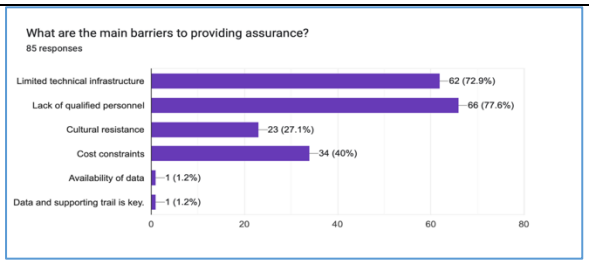


Figure B.62

Barriers to assurance

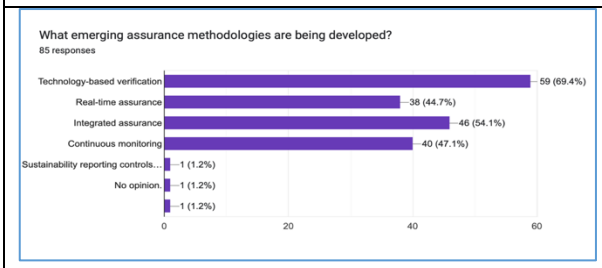


Figure B.63

Emerging assurance methodologies

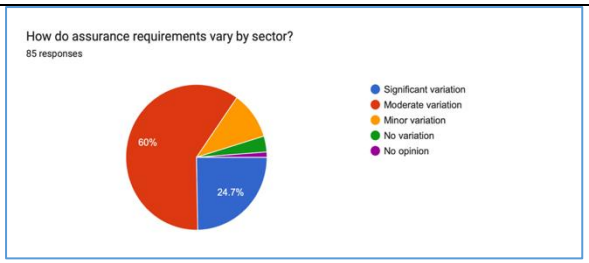


Figure B.64

Assurance requirement variation by sectors

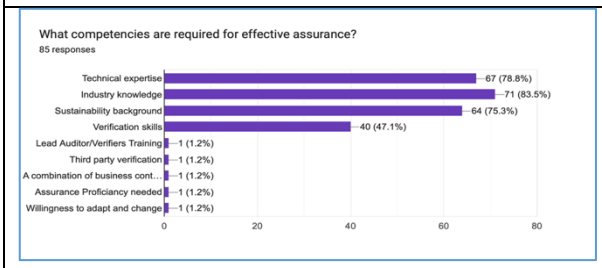


Figure B.65

Competencies for effective assurance

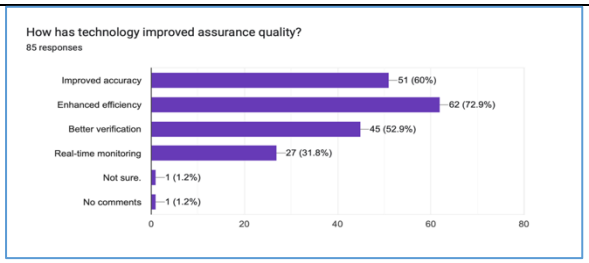


Figure B.66

Technology to improve assurance quality

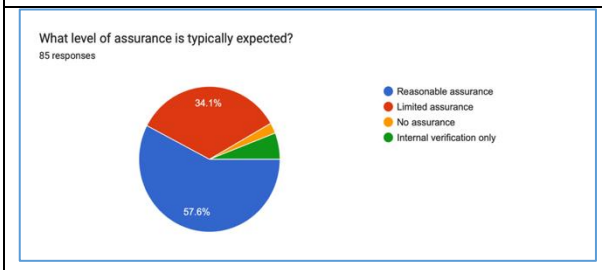


Figure B.67

Level of assurance

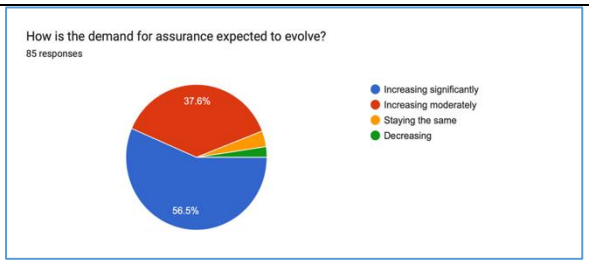


Figure B.68

Demand for assurance

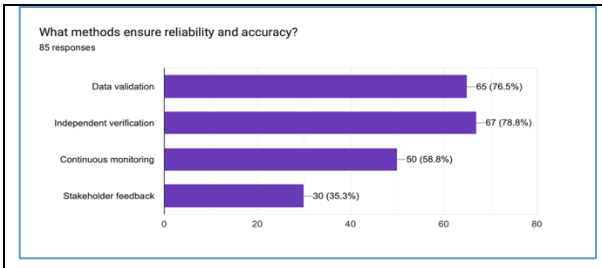


Figure B.69

Methods to ensure reliability and security

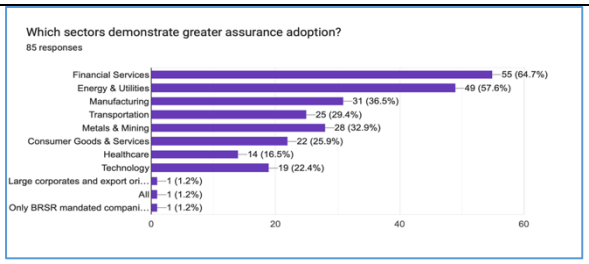


Figure B.70

Sectors with greater assurance adoption

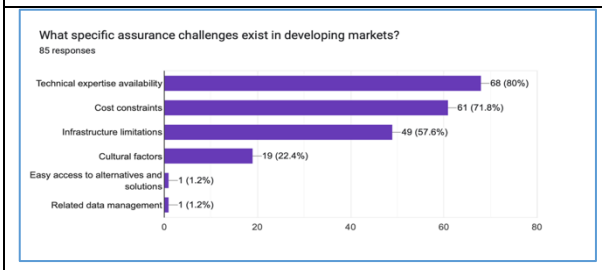


Figure B.71

Assurance challenges for developing markets

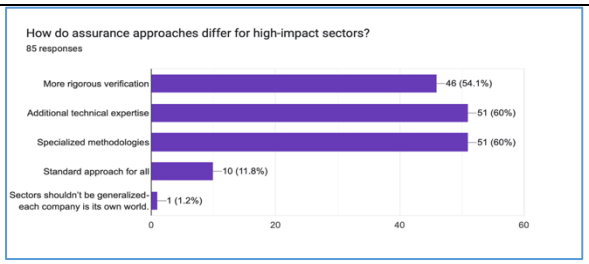


Figure B.72

Assurance approach for high-impact sector

6. Response from ESG rating provider perspective

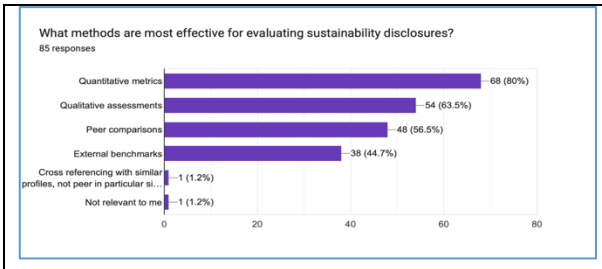


Figure B.73

Sustainability disclosures evaluation methods

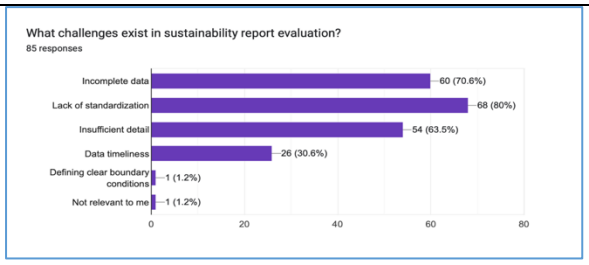


Figure B.74

Sustainability report evaluation challenge

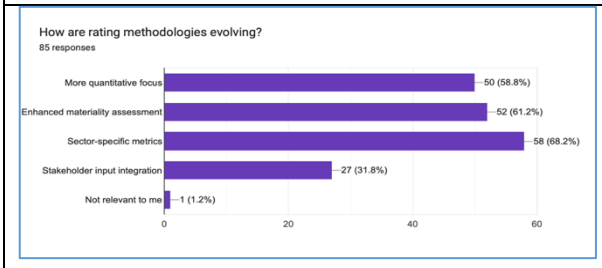


Figure B.75

ESG rating methodology evolution

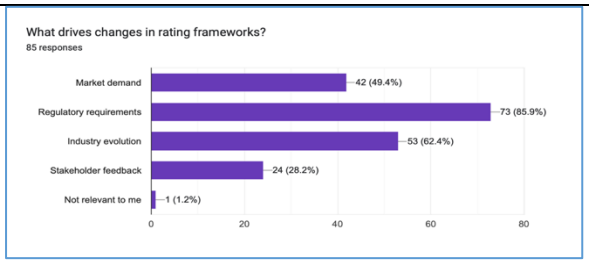


Figure B.76

Drivers for change in the ESG rating process

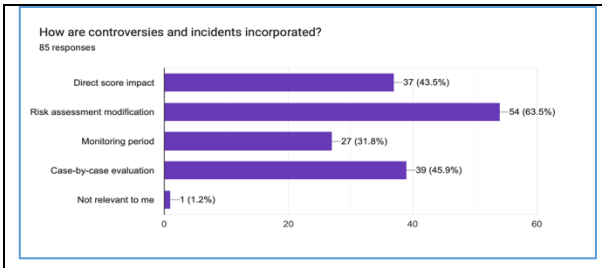


Figure B.77

Controversies in ESG rating process

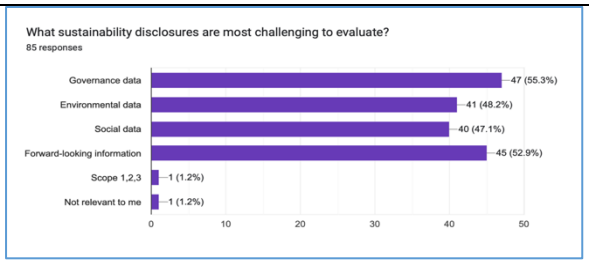


Figure B.78

Challenging data points for ESG rating

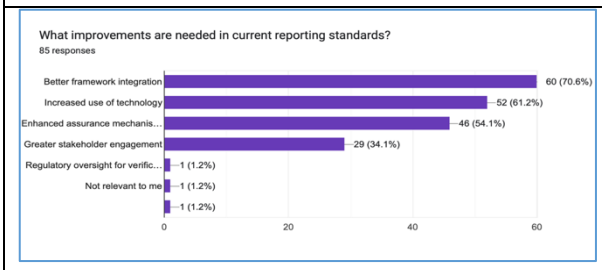


Figure B.79

Improvements in reporting for ESG rating

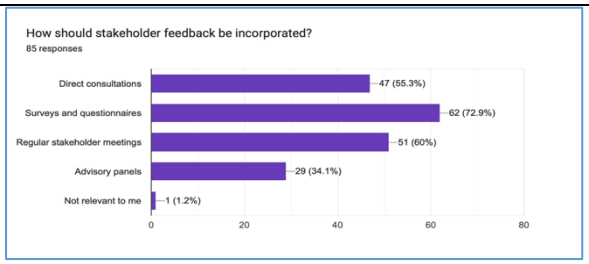


Figure B.80

Stakeholder feedback in the ESG rating

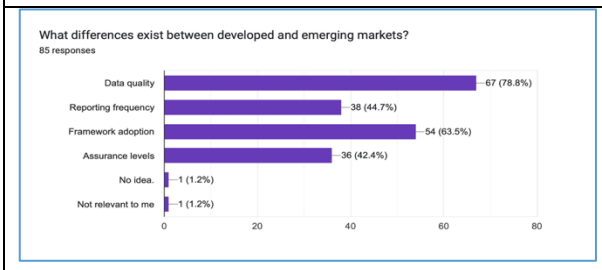


Figure B.81

Differences in markets for ESG rating

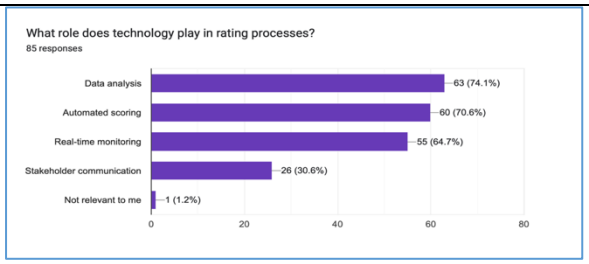


Figure B.82

Role of technology in the ESG rating process

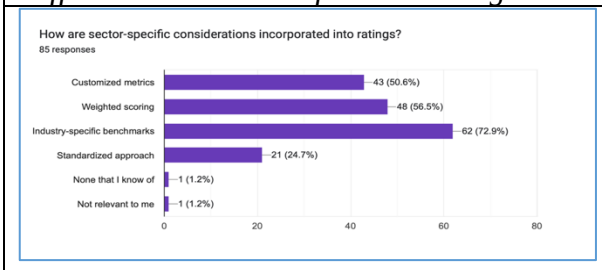


Figure B.83

Sector-specific ESG rating consideration

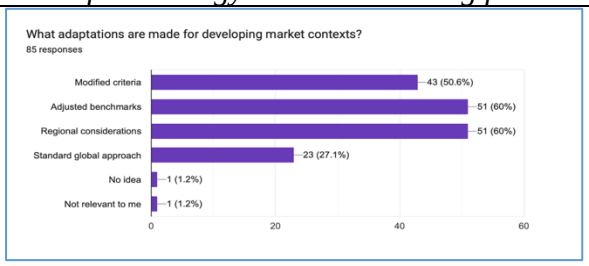


Figure B.84

Developing market adaptations of ESG rating

7. Response from independent directors' perspective

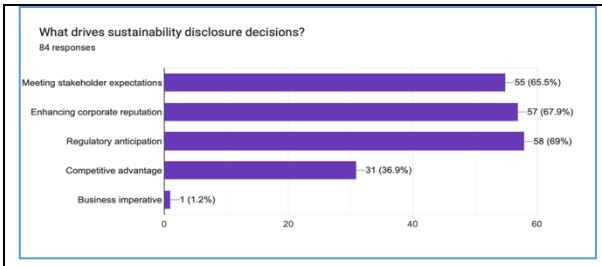


Figure B.85

Drivers for sustainability disclosure decisions

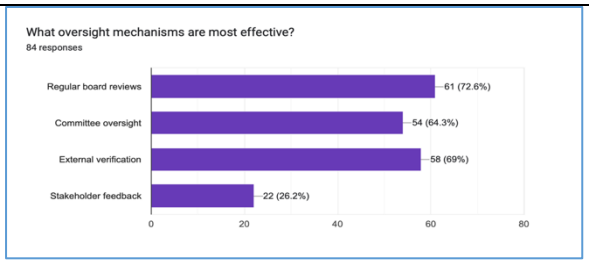


Figure B.86

Oversight mechanisms for reporting

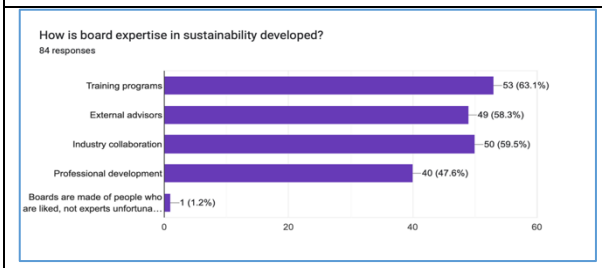


Figure B.87

Developing board expertise in sustainability

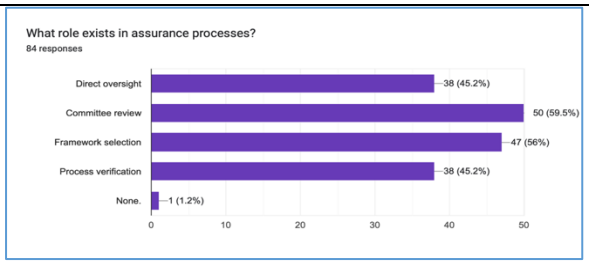


Figure B.88

Board's role in the assurance process

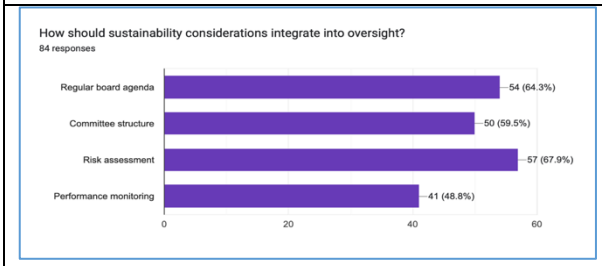


Figure B.89

Sustainability considerations in oversight

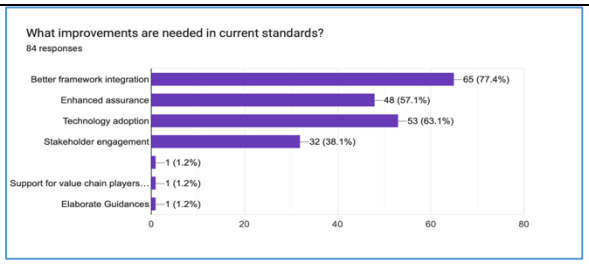


Figure B.90

Improvements in current standards

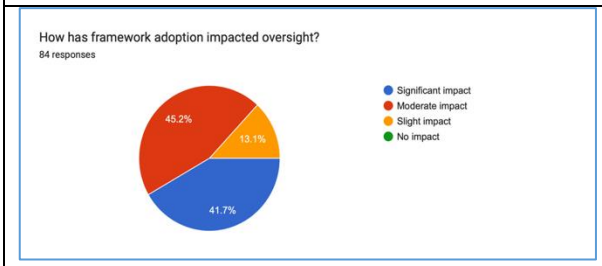


Figure B.91

Impact of framework adoption on oversight

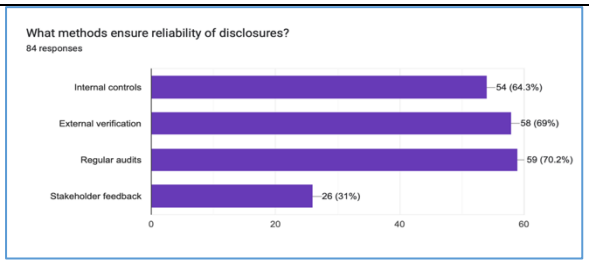


Figure B.92

Methods to ensure reliability of disclosure

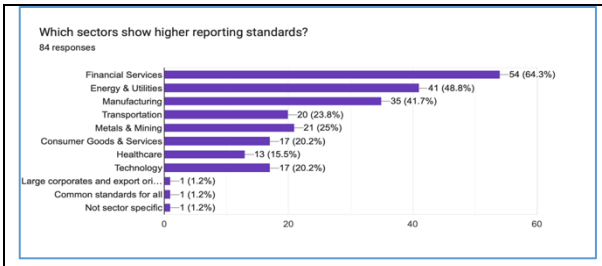


Figure B.93

Sectors with higher reporting standards

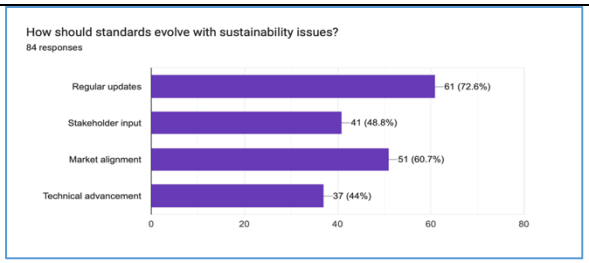


Figure B.94

Evolution of sustainability standards

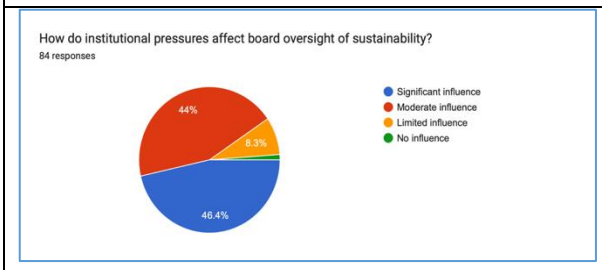


Figure B.95

Institutional pressure impact on board

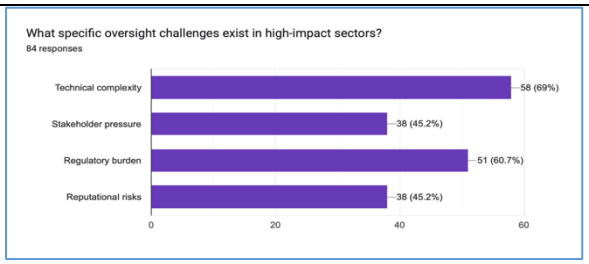


Figure B.96

Oversight challenges in high-impact sectors

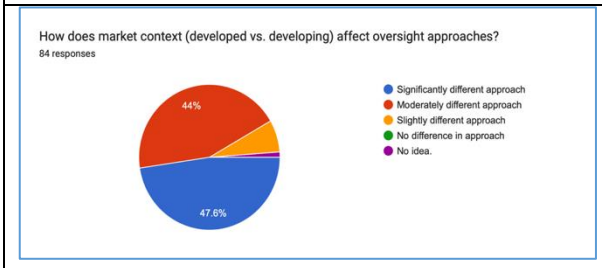


Figure B.97

Impact of market context on oversight

APPENDIX C

COMPARISON OF COMPANIES FROM SAME SECTORS BUT BELONGING TO DEVELOPED AND EMERGING ECONOMIES

The comparison of companies from same sectors but belonging to developed and emerging economies is given below:

Table C.1

Energy Sector: ExxonMobil (USA) vs. Reliance (India)

Parameter	**ExxonMobil (USA)**	**Reliance (India)**
Frameworks Used	TCFD (all 4 pillars), SASB, GRI	TCFD (partial - Strategy, Metrics & Targets), GRI, SASB, BRSR
GRI Coverage	Comprehensive GRI-aligned disclosures (Scope 1-3 emissions, biodiversity, water use, governance).	GRI disclosures focus on emissions, renewable energy, and water security metrics.
TCFD - Governance	Strong board oversight of climate risks integrated into decision-making.	Climate governance embedded in renewable energy strategies; partial integration into broader governance.
TCFD - Strategy	Long-term decarbonization strategy aligned with 1.5°C pathways.	Strategy focuses on renewable energy capacity and green hydrogen development.
TCFD - Risk Management	Comprehensive risk management framework for climate-related physical and transition risks.	Limited risk management coverage, focusing on energy transitions and water scarcity risks.
TCFD - Metrics & Targets	Detailed emissions metrics (Scope 1-3), water use targets, and carbon capture capacity by 2030.	Quantified targets for renewable energy and carbon intensity reductions by 2030.
Quantitative Data	Scope 1-3 emissions, CCUS capacity, water withdrawal metrics.	Renewable energy capacity, Scope 1-2 emissions, and waste management.
Qualitative Data	Narratives on biodiversity, decarbonization pathways, and climate risks.	Circular economy initiatives and community energy transitions.

Parameter	ExxonMobil (USA)	Reliance (India)
Assurance	Third-party reasonable assurance for Scope 1-2 emissions; limited for Scope 3.	Third-party assurance for emissions and energy metrics; limited assurance for supply chain.

Table C.2

Cement Sector: Holcim (Switzerland) vs. UltraTech Cement (India)

Parameter	Holcim (Switzerland)	UltraTech Cement (India)
Frameworks Used	TCFD (all 4 pillars), GRI, CDP	TCFD (partial - Strategy, Metrics & Targets), GRI, CDP, BRSR
GRI Coverage	Full coverage of GRI metrics (Scope 1-3 emissions, water use, circular economy).	GRI disclosures emphasize renewable energy, waste-to-energy, and water positivity.
TCFD - Governance	Strong board oversight of decarbonization strategy and climate risks.	Partial integration into governance structures; primary focus on energy transitions.
TCFD - Strategy	Long-term net-zero strategy leveraging carbon capture and alternative fuels.	Strategy focuses on clinker reduction, waste-to-energy, and renewable energy transitions.
TCFD - Risk Management	Comprehensive framework for climate-related physical and transition risks.	Limited coverage of risk management for energy and water-related risks.
TCFD - Metrics & Targets	Quantified Scope 1-3 emissions targets, renewable energy use, and circularity metrics.	Scope 1-3 emissions targets, fly ash utilization rates, and energy efficiency improvements.
Quantitative Data	Scope 1-3 emissions, clinker-to-cement ratios, renewable energy metrics.	Renewable energy use, fly ash utilization, and waste-to-energy capacity.
Qualitative Data	Circular economy case studies and carbon offsetting strategies.	Narratives on local energy transitions and community sustainability.
Assurance	Third-party assurance for emissions, water, and material use.	Third-party assurance for emissions and water metrics; limited for supply chain.

Table C.3

Metals & Mining Sector: Rio Tinto (Australia) vs. Vedanta (India)

Parameter	Rio Tinto (Australia)	Vedanta (India)
Frameworks Used	TCFD (all 4 pillars), GRI, ICMM Sustainable Development Framework	GRI, BRSR, SASB
GRI Coverage	Comprehensive GRI-aligned disclosures (emissions, biodiversity, community welfare).	GRI disclosures focus on water positivity, community development, and emissions data.
TCFD - Governance	Board-level oversight of climate risks and biodiversity impacts.	Partial integration of climate risks into governance, with a focus on compliance.
TCFD - Strategy	Long-term strategy addressing emissions reductions, biodiversity, and community welfare.	Strategy focuses on water conservation, afforestation, and sustainable mining practices.
TCFD - Risk Management	Detailed risk management framework for physical risks (water and biodiversity impacts).	Limited risk management for localized risks (water scarcity, energy availability).
TCFD - Metrics & Targets	Quantified targets for emissions reductions, biodiversity restoration, and waste recycling.	Focus on renewable energy adoption and afforestation goals.
Quantitative Data	Scope 1-3 emissions metrics, water usage, biodiversity impact data.	Water positivity data, renewable energy use, and waste recovery metrics.
Qualitative Data	Narratives on biodiversity offsets, community engagement, and social impacts of mining.	Afforestation projects, water conservation, and community initiatives.
Assurance	Third-party assurance for emissions, biodiversity, and water metrics.	Limited assurance for energy and emissions; internal assurance for other metrics.

Table C.4

Technology Sector: Apple (USA) vs. Infosys (India)

Parameter	Apple (USA)	Infosys (India)
Frameworks Used	TCFD (all 4 pillars), GRI	TCFD (partial - Strategy, Metrics & Targets), GRI, SASB
GRI Coverage	Comprehensive GRI coverage (Scope 1-3 emissions, supply chain sustainability).	Partial GRI disclosures (energy efficiency, Scope 1-2 emissions).

Parameter	Apple (USA)	Infosys (India)
TCFD - Governance	Strong governance integrating climate risks into supplier decisions.	Partial integration of climate governance into IT operations.
TCFD - Strategy	Focus on supply chain decarbonization and carbon-neutral products.	Strategy emphasizes IT-enabled decarbonization and energy efficiency.
TCFD - Risk Management	Comprehensive risk management for supply chain emissions and resource scarcity risks.	Limited risk management for operational emissions and energy transitions.
TCFD - Metrics & Targets	Quantified Scope 1-3 emissions reductions and renewable energy targets.	Metrics focus on campus energy efficiency and IT decarbonization targets.
Quantitative Data	Product lifecycle emissions metrics, renewable energy use, and recycling data.	Energy efficiency metrics, carbon neutrality in operations, and digital inclusion projects.
Qualitative Data	Supplier decarbonization narratives and product innovation stories.	Employee well-being and sustainable IT projects.
Assurance	Third-party assurance for supply chain emissions and renewable energy metrics.	Internal assurance for carbon data and energy operations.

Table C.5

Finance Sector: JPMorgan Chase (USA) vs. ICICI Bank (India)

Parameter	JPMorgan Chase (USA)	ICICI Bank (India)
Frameworks Used	TCFD, SASB, GRI	GRI, BRSR
GRI Coverage	Comprehensive, covering financed emissions and green finance.	Limited GRI coverage; focus on renewable energy financing and governance.
TCFD - Governance	Dedicated ESG governance at the board level for climate risk oversight.	Integrated ESG oversight at senior management levels.
TCFD - Strategy	Financing green projects and integrating climate risks into lending practices.	Focus on renewable energy loans and sustainable finance products.
TCFD - Risk Management	Comprehensive TCFD-aligned stress testing for portfolio climate risks.	Limited scenario analysis for climate-related financial risks.
TCFD - Metrics & Targets	Financed emissions, ESG loan book targets, and sustainable finance metrics.	Partial metrics for green financing and emissions reductions.

Parameter	JPMorgan Chase (USA)	ICICI Bank (India)
Quantitative Data	Comprehensive financed emissions data and stress-testing models.	Renewable energy lending and partial Scope 3 emissions data.
Qualitative Data	Strong narratives on sustainable finance and green projects.	Focused on regional renewable energy priorities.
Assurance	High-quality third-party assurance for financed emissions.	Limited third-party assurance for key metrics.

Table C.6

Retail Sector: Walmart (USA) vs. Reliance Retail (India)

Parameter	Walmart (USA)	Reliance Retail (India)
Frameworks Used	TCFD (all 4 pillars), SASB, GRI	GRI, BRSR
GRI Coverage	Full GRI coverage, focusing on supply chain emissions and waste metrics.	Partial GRI disclosures, focusing on packaging waste and renewable energy.
TCFD - Governance	Board-level oversight of supply chain decarbonization.	Partial integration of governance for local energy transitions.
TCFD - Strategy	Decarbonization strategy includes energy efficiency and supplier engagement.	Strategy focuses on renewable energy for merchants and packaging waste reduction.
TCFD - Risk Management	Comprehensive framework for supply chain resilience and energy risks.	Limited coverage of risk management, focusing on merchant transitions to renewables.
TCFD - Metrics & Targets	Quantified targets for Scope 1-3 emissions, renewable energy in supply chains, and waste reduction.	Metrics focus on renewable energy adoption and packaging waste reductions.
Quantitative Data	Scope 1-3 emissions, energy efficiency, waste management metrics.	Packaging waste metrics, renewable energy usage data.
Qualitative Data	Supply chain sustainability narratives and community engagement.	Stories on small-business support and community upliftment projects.
Assurance	Third-party assurance for supply chain emissions and waste metrics.	Internal assurance for renewable energy and community impact metrics.

APPENDIX D

INTERVIEW GUIDE

Questions for investors

Framework content (H1): How do you evaluate consistency across different reporting frameworks in your investment analysis? Which frameworks provide the most decision-useful information and why? What are the main challenges in comparing sustainability data across frameworks?

Framework implementation (H2): How do variations in framework implementation affect your analysis? What implementation practices provide the most reliable data? How do you assess the quality of framework implementation?

Investor preferences (H3): How does your investment strategy influence sustainability data requirements? How do you integrate qualitative vs quantitative sustainability data?

Development status context (H4): How do reporting practices differ between developed and emerging markets? What adaptations do you make for analyzing different markets? How do market-specific factors influence your data requirements?

Size impact (H5): How does company size affect your sustainability data expectations? What reporting differences do you observe between large and small companies? How do you adjust analysis for company size?

Sector impact (H6): How do sector-specific factors influence your sustainability analysis? What reporting variations do you observe across sectors? How do you compare companies across different sectors?

Assurance adoption (H7): How important is external assurance in your analysis? What level of assurance do you expect for different metrics?

Assurance challenges (H8): What assurance issues most affect data reliability? How do you assess assurance quality? What improvements in assurance would most benefit your analysis?

Reporting motivations (H9): How do regulatory pressures influence reporting quality? What drives companies to improve sustainability reporting? How do market pressures affect disclosure quality?

Market context (H10): How do institutional factors affect reporting quality? What regional variations impact your analysis? How do you account for market-specific pressures?

Questions for regulators

Framework content (H1): What drives differences in requirements across frameworks? How do you approach framework harmonization efforts? What are the key barriers to achieving framework alignment?

Framework implementation (H2): How do you develop implementation guidance for different markets? What determines the level of implementation requirements? How do you monitor and ensure implementation quality?

Information preferences (H3): How do you balance different stakeholder information needs? What drives changes in reporting requirements? How do you determine materiality thresholds?

Development status context (H4): How do reporting requirements vary by market context? What market-specific adaptations are necessary? How do you support developing market implementation?

Size impact (H5): How do requirements vary by company size? What support mechanisms exist for smaller companies?

Sector impact (H6): How do sector-specific considerations influence requirements? What sector-specific guidance do you provide? How do you handle high-impact sector requirements?

Assurance adoption (H7): How do you approach assurance requirements? What determines required assurance levels? How do assurance requirements vary by market?

Assurance challenges (H8): What are the main challenges in assurance quality? What improvements in assurance are needed?

Reporting motivations (H9): What drives regulatory requirements in different markets? How do market pressures influence standards? What role do stakeholder pressures play?

Market context (H10): How do institutional factors affect requirements? What regional variations exist in implementation? How do you manage cross-border requirements?

Questions for assurance provider

Framework content (H1): How do framework differences affect assurance processes? What framework alignment would improve assurance quality? How do you handle framework inconsistencies?

Framework implementation (H2): What are key challenges in assuring different frameworks? How do you standardize assurance across frameworks? What implementation factors most affect assurance?

Information quality (H3): How do you assess information quality? What determines assurance scope? How does stakeholder need affect assurance?

Development status context (H4): How does assurance vary by market? What market-specific challenges exist? How do you adapt practices for different markets?

Size impact (H5): How does company size affect assurance approach? What challenges exist for smaller companies?

Sector impact (H6): How do sector characteristics influence assurance? What sector-specific procedures exist? How do you handle high-impact sectors?

Assurance adoption (H7): What drives assurance level decisions? How are assurance practices evolving? What determines assurance methodology?

Assurance challenges (H8): What are main technical challenges? How do you ensure competency? What resource constraints exist?

Reporting motivations (H9): How do market pressures affect assurance? How do stakeholder expectations influence practices?

Market context (H10): How do institutional factors affect assurance? What regional variations exist? How do you manage cross-border assurance?

Questions for disclosing companies

Framework content (H1): How do you manage reporting under multiple frameworks? What challenges arise from framework differences? How do you handle overlapping requirements?

Framework implementation (H2):

Common questions: What drives your framework implementation decisions? How do you manage implementation costs and benefits? What implementation challenges are most significant?

For high-emission companies: How do you implement detailed emissions reporting requirements? What sector-specific implementation challenges exist? How do you manage implementation of transition-related disclosures?

For low-emission companies: How do you adapt framework implementation to your context? What implementation aspects are most relevant?

For developed market companies: How do you handle complex implementation requirements? What role do you play in implementation best practices? How do you influence implementation standards?

For emerging market companies: What implementation support would be most helpful? How do you manage resource constraints in implementation? What local adaptations are necessary for implementation?

For high-emission companies: How do you address sector-specific reporting requirements? What framework elements are most challenging for your sector?

For low-emission companies: How relevant are detailed emissions reporting requirements? What framework adaptations would better suit your sector?

Information requirements (H3): How do you determine what information to disclose? How do you balance different stakeholder needs? What drives your materiality assessment?

Development status context (H4): How does your market context influence reporting? What local adaptations are necessary? How do you handle international requirements?

Size impact (H5): How does your organization size affect reporting capacity? What resource constraints impact reporting quality?

Sector impact (H6): How do sector characteristics influence your reporting? What sector-specific challenges do you face? How do you benchmark against sector peers?

For high-emission companies: How do you manage enhanced scrutiny in your sector? What sector-specific metrics are most challenging?

For low-emission companies: How do you demonstrate sustainability impact? What sector-specific opportunities do you highlight?

Assurance adoption (H7): What determines your assurance level choices? How do you select assurance providers? What benefits do you see from assurance?

Assurance challenges (H8): What are your main assurance challenges? How do you manage assurance costs? What improvements in assurance would help most?

For high-emission companies: How do you handle detailed emissions assurance? What specific challenges exist in your sector assurance?

For low-emission companies: How do you determine appropriate assurance levels? What aspects of your reporting require most verification?

Reporting motivations (H9): What drives your sustainability reporting decisions? How do stakeholder pressures influence reporting? What role do regulatory requirements play?

Market context (H10): How does market context affect your reporting? What regional factors influence your approach? How do you handle international expectations?

For high-Emission Companies: How do you manage increased regulatory scrutiny? What transition-related pressures affect reporting?

For low-emission companies: How do you demonstrate sustainability leadership? What competitive pressures influence reporting?

Additional questions:

For developed market companies: How do you handle leading-edge reporting requirements? What role do you play in framework development? How do you influence reporting standards?

For emerging market companies: How do you manage international framework adoption? What local adaptations are necessary? What implementation support would be most helpful?

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