

Environmental sustainability initiatives and performance in multinational enterprises: A multi-case analysis of the South African mining Sector.

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## Abstract

This qualitative study investigated how multinational enterprises (MNEs) in South Africa's mining sector leverage internal and external mechanisms to translate environmental initiatives into improved environmental and organisational performance. The research was grounded in an interpretivist paradigm and employed a multi-case study design, drawing on six semi-structured interviews with senior managers and content analysis of five publicly available environmental reports. Key themes identified include green investment, innovation and digital technology, carbon capture and offset, waste elimination, and nature-based solutions, all of which are critical drivers of environmental performance. The triangulation of managerial insights and secondary data enhanced the validity of the findings, revealing nuanced strategies firms use to navigate regulatory pressures and stakeholder expectations. Ethical rigour was maintained through anonymisation and secure data handling, with purposive sampling ensuring rich contextual insights. This research contributes to understanding corporate sustainability practices in high-emission sectors within emerging economies and informs policy and managerial decisions aimed at fostering sustainable organisational growth.

## Key words

Regulatory pressure, shareholder expectations, environmental initiatives, sustainability

## Declaration

I declare that this research project is my own work. It is submitted in partial fulfilment of the requirements for the degree of the Master of Philosophy in International Business at the Gordon Institute of Business Science, University of Pretoria. It has not been submitted anywhere before for any degree or examination in any other university. I further declare that I have obtained the necessary authorisation and consent to carry out this research.

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**26 November 2025**

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## List of Acronyms and Abbreviations

AI: Artificial intelligence

CDP: Carbon Disclosure Project

DMPR: Department of Mineral and Petroleum Resources

ESG: Environmental, Social and Governance

GHG: Greenhouse Gas

GIS: Geographic Information System

GRI: Global Reporting Initiative

ICMM: International Council on Mining and Metals

ICP: Internal Carbon Pricing

IFRS: International Financial Reporting Standards

IoT: Internet of Things

JSE: Johannesburg Stock Exchange

NASA: National Aeronautics and Space Administration

Nbs: Nature-based solutions

NDC: Nationally Determined Contributions

PPP: Public Private Partnership

SASB: Sustainability Accounting Standard Board

UN GC: United Nations Global Compact

UN SGD: United Nations Sustainable Development Goals

UN: United Nations

VPSHR: Voluntary Principles on Security and Human Rights

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# 1. Chapter 1: Introduction

## 1.1 Business Relevance

Climate change adversely affects human health and well-being through multiple channels (World Health Organisation, 2023). Environmental degradation undermines critical prerequisites for human health, such as access to clean air, safe drinking water, adequate nutrition, and secure housing, thereby threatening overall well-being (World Health Organisation, 2023). The release of greenhouse gases principally originating from the extraction and consumption of fossil fuels plays a pivotal role in driving both climate change and the escalation of air pollution (World Health Organisation, 2023).

The climate change impact as outlined above by the World Health Organisation is as a result of human activities, and the South Africa's National Planning Commission highlighted this by stating that "we acknowledge that each and every one of us is intimately and inextricably of this earth with its beauty and life-giving sources; that our lives on earth are both enriched and complicated by what we have contributed to its condition" (The National Planning Commission, South Africa, n.d, pp.179).

The consequences of climate change, driven principally by human-induced global warming, are already manifesting and are irreversible for current generations (NASA, n.d). As greenhouse gases continue to be released into the atmosphere, these effects will intensify, driving further environmental, health, and social risks (United Nations, 2024). The magnitude and pace at which climate change unfold, as well as the risks associated with it, are determined by the urgency and effectiveness of mitigation and adaptation efforts (United Nations, 2024). Each subsequent increase in global temperature brings additional losses and damages, making immediate action essential to limit future harm (NASA, n.d).

Despite persistent geopolitical divides, there is a resolute international commitment to combating the climate crisis and sustaining the goals of the Paris Agreement, as articulated by United Nations Secretary-General António Guterres (United Nations, 2025). This commitment is evidenced by the actions of 125 countries representing over 78% of global greenhouse gas emissions, which have submitted or declared new Nationally Determined Contributions (NDCs). These countries are pursuing comprehensive, economy-wide climate targets that cover all sectors and greenhouse gases. Many have also announced ambitious new objectives for renewable energy expansion, improved energy efficiency, reductions in fossil fuel and methane emissions, and increased forest protection. Notably, there is a growing emphasis on integrating

climate adaptation and finance into NDCs, reinforcing the multifaceted nature of global climate governance (United Nations, 2025).

Tsang's (2023) analysis in the World Economic Forum report, contemporary business environments are undergoing transformative changes due to the intersecting pressures of climate change, digital innovation, and evolving social expectations regarding corporate roles and responsibilities. There is a growing acknowledgment amongst organisations of their broadened responsibilities to proactively advance the welfare of both local communities and society at large (Tsang, 2023).

To translate these growing commitments into effective action, businesses must cultivate innovative strategies that not only enhance operational performance but also embed sustainability at the core of their decision-making. Tsang (2023) underscores the necessity for firms to build and maintain trust within the communities in which they operate. This involves transparent engagement, responsible stewardship, and the proactive anticipation of challenges that arise in rapidly evolving, sustainability-focused marketplaces (Tsang, 2023). Organisations are called to foster resilience, harness opportunities for sustainable growth, and collaborate to address both acute climate risks and broader social imperatives

There is a notable shift among consumers toward prioritising sustainability, reflected in a growing tendency to select products that exhibit environmental stewardship across their entire supply chains (Tsang, 2023). Emerging empirical evidence underscores the intensifying preference for sustainability among consumers. Notably, Deloitte's research (Novak et al., 2022) found that 67% of respondents would accept a premium up to 41% for purchasing products bearing sustainability certifications, a disposition that is particularly marked amongst younger consumer cohorts. Supporting this, additional surveys confirm that Millennials and Generation Z are the leading groups driving increased demand and are often willing to pay a premium for sustainable goods (Deloitte, 2022).

Parallel to the consumer perspective, Deloitte (2022) found that employees globally are placing greater emphasis on their employers' environmental, social, and governance (ESG) practices. Nearly 40% of Generation Z and Millennial respondents indicated they had declined job opportunities or assignments misaligned with their ethical values, reflecting the rising importance of ESG alignment in talent strategies and retention.

Driven by evolving consumer demands, firms are increasingly integrating sustainability as a strategic catalyst for growth, fostering innovation, and fulfilling both stakeholder expectations and regulatory obligations. Organisations are incorporating forward-looking

business models, such as circular economy and nature-positive approaches, positioning themselves to capitalise on new opportunities while adhering to evolving market and stakeholder demands (Chow & Rotondo, 2025).

The Minerals Council South Africa has affirmed its commitment to a just energy transition that is both people-centred and pragmatic, specifically tailored to the nation's unique developmental, economic, and energy security imperatives. This approach aligns with the priorities and objectives outlined in South Africa's latest Nationally Determined Contribution Report to the United Nations Framework Convention on Climate Change (UNFCCC), emphasising the need for a transition strategy that harmonises global climate goals with local socioeconomic realities (Minerals Council South Africa, 2025).

### 1.2 Theoretical relevance

The pursuit of sustainable development faces formidable obstacles including pervasive poverty, widening inequality, persistent hunger, armed conflict, the accelerating impacts of climate change, deforestation, and recurring pandemics, all of which collectively constrain progress (Scherer & Voegtlin, 2020). Amongst these, climate change stands out as a critical contemporary challenge that has garnered increasing global attention. Zaheer (2025) stated that the success of multinational enterprise (MNE) sustainability initiatives depends on the interplay of both extrinsic (stakeholder pressures from investors, consumers, activists; regulatory requirements; access to green financing and incentives) and intrinsic motivations (alignment with firm strategy, pursuit of competitive advantage, and the imperative for organisations to sustain public acceptance and validation of their actions within society and employees). Whilst MNEs possess the resources, technology, and international reach to significantly advance climate action, their engagement in sustainability efforts is fundamentally driven by strategic self-interest, legitimacy concerns, stakeholder pressures, and regulatory frameworks rather than pure altruism (Zaheer, 2025).

This focus has propelled green transformation and sustainability to the forefront of corporate agendas, with environmental performance emerging as a pivotal determinant of firm value in the eyes of investors (Lee & Raschke, 2023). Specifically, multinational enterprises (MNEs) have played significant roles not only as contributors to climate change but also as key actors capable of addressing these challenges through their vast operational, governance, and resource capacities (Allen et al., 2025).

With investors placing greater emphasis on environmental performance, there is intensified scrutiny on how firms respond to pressing societal issues, including the imperative shift towards renewable energy sources (Malen, 2022). This transition

demands that firms adopt fundamental changes in their operational processes and integrate sustainability principles proactively within their strategic frameworks (Alt et al., 2024; Budhwar et al., 2025). Multinational enterprises, leveraging their extensive internal markets and capabilities in governance, financing, and technology, are uniquely positioned to develop and implement effective solutions for environmental challenges (Allen et al., 2025).

Government regulation acts as a critical driver for this transformation. As regulatory bodies enforce policies aimed at reducing greenhouse gas emissions, firms experience external pressures compelling them to realign business strategies toward sustainability objectives (Aragon-Correa et al., 2020; Li et al., 2022). However, responding effectively requires navigating both government pressures and multifaceted stakeholder expectations, including demands from investors, consumers, and broader society (Allen et al., 2025; Bhatia & Kumar, 2022). This necessitates deploying environmental initiatives to embed sustainability in organisational practices. Environmental initiatives require functioning internal mechanisms, encompass governance structures such as ownership models and board oversight, which align managerial behaviour with shareholder and societal interests to support sustainable development (Alizadeh et al., 2022; García-Meca & Martínez-Ferrero, 2020; Sewald & Walsh, 1990). García-Meca and Martínez-Ferrero (2020) emphasise that strong internal corporate governance remains a central pillar reinforcing an organisation's commitment to sustainability.

Conversely, external mechanisms involve environmental pressures from regulatory frameworks, competitive market dynamics, and societal demands that compel organisations to respond, particularly when internal governance falls short (García-Meca & Martínez-Ferrero, 2020). These dual layers of control create a comprehensive environment encouraging firms to adopt sustainability-oriented practices and policies.

In practice, addressing environmental challenges requires organisations to implement concrete environmental initiatives aimed at generating positive ecological outcomes or mitigating negative environmental impacts associated with their goods and services (Griffin & Prakash, 2014). Notably, integrating environmental considerations into human resource practices, encompassing sustainable recruitment, selection, training, and employee development has been shown to be an effective strategy for advancing organisational environmental performance (de la Rosa-Navarro et al., 2024; Emelifeonwu et al., 2024). Such initiatives develop employee awareness, skills, and commitment toward sustainability, thereby contributing substantively to organisational environmental goals.

In summary, confronting urgent sustainability challenges demands that multinational enterprises integrate robust internal governance mechanisms and external stakeholder pressures into strategic decision-making processes. This integration, coupled with targeted environmental initiatives can significantly improve firms' environmental performance and align corporate actions with global sustainability imperatives, whilst improving organisational performance.

### 1.3 Research Questions

The formulation of the research question in this study was informed by Asiaei et al. (2023), whose work investigated the influence of ambidextrous green innovation and green intellectual capital on organisational environmental performance. Building upon their recommended direction for future research, specifically the investigation of internal and external mechanisms and initiatives to enhance environmental and organisational performance, this exploratory study sought to address this gap. Accordingly, this research investigated how various mechanisms and initiatives implemented by organisations contribute to improvements in both environmental and organisational performance.

In response to the recommendations by Asiaei et al. (2023) the following research questions are set out:

**Main Research Question:** How do internal and external mechanisms translate environmental initiatives into environmental performance for organisational (firm) performance? (Asiaei et al., 2023)

**Sub-questions 1:** What are the external and internal mechanisms that are used for environmental initiatives? (Asiaei et al., 2023; De Funes et al., 2024)

**Sub-questions 2:** How do environmental initiatives improve environmental performance? (Asiaei et al., 2023; De Funes et al., 2024)

**Sub-questions 3:** How does environmental performance improve organisational performance? (Asiaei et al., 2023)

### 1.4 Research Aims

This research was designed to investigate the pathways through which organisations leverage both internal governance mechanisms and external stakeholder engagements to translate environmental initiatives into tangible improvements in environmental and organisational performance. Utilising a qualitative case study methodology, the inquiry facilitated detailed exploration of managerial perspectives by engaging with key participants from selected organisations. Through these interactions, the study provided

an in-depth understanding of organisational responses to environmental sustainability challenges, specifically focusing on the implementation and integration of environmental initiatives within operational and strategic domains.

The analysis centered on the approaches and procedures employed by organisations to embed environmental considerations into their core business strategies and functions, assessing the extent to which these efforts yield measurable advances in sustainability outcomes and overall firm performance. The qualitative design was instrumental in eliciting rich, context-specific insights into the dynamic interplay between environmental initiatives, environmental performance, and competitive outcomes, directly informed by the experiences and decisions of those responsible for implementation.

In light of escalating global environmental pressures and the heightened urgency of climate change mitigation, the study's outcomes offer substantial relevance. By shedding light on the mechanisms through which sustainability is operationalised, the research provides both scholarly contributions to the corporate sustainability discourse and actionable guidance for practitioners seeking to enhance ecological and competitive performance in an increasingly sustainability-oriented market environment.

### 1.5 Research Contribution

The study's aim was an understanding of internal and external mechanisms/initiatives that MNEs leverage to achieve better environmental outcomes and organisational performance in emerging markets. The study aimed to fill theoretical gaps by uncovering how organisational deploy environmental initiatives for MNE sustainability in South Africa, an emerging market, with a particular focus on the mining sector.

Previous work often treated environmental and organisational performance separately, however this study directly theorises and empirically tests how effective environmental initiatives contribute both to environmental metrics (e.g. waste reduction, improved resource use) and to organisational outcomes (e.g. cost savings, competitiveness, innovation, financial results) in emerging markets, helping establish MNE's long-term value creation and sustainability (Bouguerra et al., 2025; Bu et al., 2025).

By focusing on MNEs in South Africa, emerging market, with focus on the mining sector, the study addresses the contextual influences (such as regulatory pressures, and stakeholder expectations) that shape the design and impact of sustainability initiatives. The contextual influences are often underexplored in mainstream literature that overrepresents developed economies (Lee et al., 2025).

This research sought to deepen the understanding of microfoundations, such as individual creativity and work/stakeholder arrangements, that support agility and responsiveness in implementing sustainability strategies, showing how these factors underpin organisational success and adaptability (Lee et al., 2025).

It aimed to highlight how MNE-driven environmental initiatives within their global value chains enable capability building, knowledge transfer, and sustainability spillovers to suppliers and partners, thereby influencing the broader ecosystem and the environmental performance of local firms in emerging markets (Lee et al., 2025).

The study's outcomes have direct relevance for policymakers (by illustrating how regulations and incentives affect MNEs' strategic responses) and managers (by identifying best practices and success factors for sustainability in resource-constrained, high-growth environments). Managers of MNEs operating within South Africa, stand to benefit substantially from the business and practical implications highlighted by this study.

Several themes emerged from the study that collectively have potential to add and/or enrich the existing body of knowledge. Within each of these overarching themes, additional subthemes were identified, some of which offers specific avenues for potential theoretical refinement. These potential refinements contribute to a more nuanced understanding of the studied phenomenon and advance conceptual clarity within the relevant academic discourse:

- **Habitat Creation and Management Practices**, for MNE that operates in the environment where there is wildlife, stringent wildlife management policies are required to be embedded within their strategies and operational context.
- **Cultural and Ecological Heritage Protection Policies**, environmental initiatives
- **Demand-Side Load Shifting Programs**, as result of unreliable Eskom power supplies (load shedding issues), present unique challenges for mining companies to adapt and lead initiatives that address power challenges, in turn leading to environmental performance.

## 1.6 Scope of Study

### *Theoretical framing and literature context*

This study was anchored in the intersecting frameworks of institutional theory and stakeholder theory, specifically examining how regulatory pressures and multi-stakeholder collaboration shape the environmental strategies of multinational enterprises (MNEs). Regulatory pressure, as conceptualised within institutional theory, positions

regulatory institutions as critical actors in compelling organisational compliance and driving environmental improvements (Jun et al., 2017). In parallel, stakeholder theory foregrounds the influence of diverse internal and external stakeholders, such as investors, communities, and advocacy groups, on organisational decision-making and sustainable practice adoption (De Colle et al., 2010). By synthesising insights from both theoretical perspectives, the present research advances an integrated understanding of how MNEs engage with institutional and stakeholder networks to respond to environmental challenges and propel sustainability initiatives across their global value chains.

### *Empirical context and physical scope*

Empirically, this study focused on MNEs listed on the Johannesburg Stock Exchange (JSE) and operating in South Africa's mining and automotive sectors. Inclusion on the JSE requires that publicly traded companies adhere to stringent sustainability disclosure practices, ensuring the regular reporting of environmental efforts and outcomes. The mining and automotive sectors, selected due to their pivotal roles within the South African economy and their status as predominant CO<sub>2</sub> emitters, provide a critical context for investigating corporate environmental performance and regulatory compliance. Indeed, these sectors constitute the principal sources of carbon emissions nationwide, intensifying scrutiny from regulators and stakeholders alike (Rafindadi & Usman, 2019). By analysing environmental strategies and reporting within these sectors, the study elucidates sector-specific responses to regulatory and stakeholder pressures in a high-emissions context, generating insights that may have broader implications for sustainable enterprise management in emerging economies.

### *1.7 Overview of the Research Report*

The rest of this report is structured as follows:

**Chapter 2** provides a comprehensive review of relevant literature that establishes the theoretical and conceptual foundation of the study.

**Chapter 3** articulates the research questions that emerge from the synthesis of existing scholarship.

**Chapter 4** outlines the research design and methodological approach employed to address these questions.

**Chapter 5** presents the empirical findings derived from the data analysis process.

**Chapter 6** offers a critical discussion of the results in relation to the extant literature and theoretical perspectives.

Finally, **Chapter 7** concludes the study by summarising key findings, highlighting theoretical and practical contributions, proposing recommendations for management and stakeholders, and presenting the final version of the conceptual framework.

The forthcoming **Chapter 2** presents a comprehensive review of the relevant literature that underpins the theoretical and conceptual foundation of this study.

## 2. Chapter 2: Literature Review

### 2.1 Introduction

For the literature review, an extensive search was conducted across a range of management journals including those focused on research, strategy, international business, and the broader management domain with particular emphasis on highly ranked journals in top management scholarship. This approach was adopted in recognition of the fact that significant and innovative scholarship on these topics is frequently published in outlets beyond the boundaries of general management journals, thereby ensuring comprehensive coverage of the relevant academic discourse.

The primary objective of this research was to investigate the processes through which firms initiate environmental initiatives that lead to improvements in both environmental and organisational performance, as suggested by Asiaei et al. (2023). Notably, this study is amongst the first to empirically capture the roles of stakeholder pressure, regulatory evolution, and organisational resource utilisation as antecedents to environmental initiatives, particularly within the context of South African mining firms, which are recognised as major contributors to pollution (Rafindadi & Usman, 2019).

Addressing the research gap identified by Asiaei et al. (2023), this study examined whether the implementation of internal and external resources serves as a mechanism/initiative for improving environmental and organisational performance. By integrating stakeholder theory, institutional theory, and the resource-based view, the investigation offers new theoretical perspectives on the determinants of sustainability practice adoption within the South African mining sector.

The literature review is structured to systematically examine the relevant constructs and sub-constructs underpinning the relationships among stakeholder influence, regulatory context, resource allocation, environmental initiatives, and organisational outcomes, thereby advancing a nuanced understanding of sustainability-oriented performance in high-impact industries.

Figure 1: The structure of the literature review

Main Research Question	Sub-question 1	Sub-question 2	Sub-question 3
Main Research How do internal and external mechanisms translate initiatives into environmental performance for organisational (firm) performance? (Asiaei et al., 2023)	What are the external and internal mechanisms that are used for environmental initiatives? (Asiaei et al., 2023; De Funes et al., 2024)	How do environmental initiatives improve environmental performance? (Asiaei et al., 2023; De Funes et al., 2024)	How does environmental performance improve organisational performance? (Asiaei et al., 2023)
<b>Key Constructs</b> <ul style="list-style-type: none"> <li>Environmental initiatives</li> <li>Environmental performance</li> <li>Organisational performance</li> </ul>	<b>2.2 Stakeholder Expectations &amp; Regulatory pressure</b> <ul style="list-style-type: none"> <li>2.2.1 Stakeholder expectations</li> <li>2.2.2 Regulatory pressure</li> </ul>	<b>2.3 Environmental initiatives</b> <ul style="list-style-type: none"> <li>2.3.1 Green supply chain and operations</li> <li>2.3.2 Innovation and digital resources</li> <li>2.3.3 Peer collaboration and stakeholder green value co-creation</li> <li>2.3.4 Firm common ownership</li> </ul>	<b>2.4 Environmental performance</b> <ul style="list-style-type: none"> <li>2.4.1 Internal Carbon Pricing</li> <li>2.4.2 Carbon Emission Control</li> <li>2.4.3 Climate Regulation Certification</li> <li>2.4.4 Greenwashing (risk mitigation)</li> <li>2.4.5 Waste management</li> </ul>
		<b>2.5 Organisational performance</b> <ul style="list-style-type: none"> <li>2.5.1 Access to credit/funding</li> <li>2.5.2 Access to market/export incentives</li> <li>2.5.3 Reduced costs/increased value</li> </ul>	<b>2.6 Literature review Conclusion</b>
			<b>2.7 Conceptual framework</b>

Source: Author's own

## 2.2 Stakeholder expectations and regulatory pressures

### 2.2.1 Stakeholder expectations

Multinational enterprises (MNEs) face continually evolving stakeholder expectations concerning environmental sustainability, shaped by global regulation, consumer activism, and internal governance standards (Malen, 2022). The literature demonstrates that stakeholders, including investors, governments, NGOs, communities, and employees, actively shape MNE environmental strategies through both direct pressure and engagement across local and global markets (Alamos-Concha et al., 2024; Aragon-Correa et al., 2020; Zaheer, 2025).

Recent research in multinational enterprise (MNE) stakeholder studies has begun to address the outcomes for various stakeholder groups, while also exploring the inclusiveness and spread (diffusion) of multi-stakeholder initiatives across different countries and contexts (Albino-Pimentel et al., 2024). The studies primarily emphasised effects for the MNE itself or its direct stakeholders and there is limited research addressing outcomes with explicit societal relevance that arise from the interactions between MNEs and civil society, meaning, very few analysis explored broader impacts beyond the enterprise or stakeholder group, such as public good or societal shifts resulting from MNE–civil society collaborations (Albino-Pimentel et al., 2024).

In having strategic goals of meeting the requirements of the stakeholders, multinationals leverage entrepreneurial orientation (EO) and adapt to contingencies, both internal and

external, to shape their organizing decisions and successfully pursue environmental sustainability (Bouguerra et al., 2024). EO, characterised by innovativeness, risk-taking, and proactiveness, encourages MNEs to pioneer sustainable solutions, engage stakeholders, and respond dynamically to complex environmental challenges (Bouguerra et al., 2024). Multinational enterprises with widely distributed products and services are required to address the distinct expectations of strategic partners, specialised suppliers, and diverse customer groups operating within intricate organisational frameworks. These transnational structures are variously conceptualised in the literature as global commodity chains, global value chains, global production networks, or global factories (Ambos et al., 2021; Asmussen et al., 2023; Kano et al., 2020). Research indicates that there are no unique or one size fit all stakeholder expectations, and to effectively address both the scale and heterogeneity of stakeholder groups involved, it may be necessary to adopt a hybrid orchestration approach, blending different management modes to coordinate and align diverse interests simultaneously (Blazevic et al., 2021).

Stakeholder pressure manifest itself through several forms, such as regulatory directives, market expectations, media scrutiny, consumer demands for green products and activist lobbying (Aragon-Correa et al., 2020; Liao & Zhang, 2023). Government and non-profit organisations are pivotal in promoting sustainable governance (Aragon-Correa et al., 2020), while external stakeholders' active engagement is considered essential for advancing organisational learning and innovation in sustainability practices. Government for instance expect multinationals to drive greenhouse gas emissions (Aragon-Correa et al., 2020). Studies show both internal (e.g., parent company, employees) and external (e.g., governments, NGOs, media) stakeholders directly impact subsidiaries' adoption of environmentally responsible management (ERM) practices (Aureli et al., 2020; Cardoni et al., 2020; Journeault et al., 2021).

Investors and institutional asset owners increasingly expect MNEs to align with international frameworks and provide robust, transparent disclosures about climate action, governance, and net zero transition plans (Aguilera et al., 2023; Velte, 2023; Zaheer, 2025). Failure to meet these expectations can incur transition, physical, and legal risks, alongside reputational harm (Aguilera et al., 2023). Proactive engagement especially with external stakeholders is linked with positive outcomes such as higher legitimacy, improved corporate reputation, and better alignment with regulatory trends (Casprini et al., 2020). Literature reviews and empirical studies consistently show stakeholder satisfaction, transparency, and collaborative initiatives are critical to

achieving enduring environmental and ESG performance (Donaghey & Reinecke, 2021; Garcia-Torres et al., 2024).

Customers and local communities exert pressure through green purchasing behaviours (Zaheer, 2025) and activism, prompting firms to legitimise their operations and address environmental externalities (Beck et al., 2020). Media and community groups often play a role in catalysing corporate responses to environmental risks and sustainability controversies (Beck et al., 2020). Collaborative stakeholder engagement through dialogue, co-creation of solutions, and adherence to recognised frameworks is repeatedly highlighted as best practice in contemporary literature (Donaghey & Reinecke, 2021; Garcia-Torres et al., 2024).

The literature emphasises that stakeholder expectations and their influence vary significantly across markets, reflecting differences in income levels, policy environments, and consumer behaviour. Managing sustainability across diverse and dispersed organisational structures significantly increases complexity for multinational enterprises, necessitating adaptive, context-specific management approaches and flexible strategies for engaging stakeholders. This underscores the relevance of examining the South African context to understand how multinational firms operating within this market navigate the dual objectives of improving environmental performance and achieving organisational success while simultaneously fulfilling varied stakeholder expectations.

### 2.2.2 Regulatory pressures

Environmental sustainability regulatory pressure refers to the formal and informal mechanisms compelling organisations, to adopt responsible and innovative practices for the protection of the environment (Hawkins et al., 2021; Liao & Zhang, 2023). Regulatory pressure derives primarily from government agencies through laws, standards, incentives, and compliance requirements, but is also exerted by stakeholders such as local communities, activist groups, and market actors, who influence corporate behaviour and legitimisation (Liao & Zhang, 2023).

Formal regulations include command-and-control regulations setting explicit standards (emissions caps, resource use limits), market-based mechanisms (carbon taxes, cap-and-trade), and mandatory reporting requirements (Liao & Zhang, 2023). Studies show well-designed governmental regulations consistently stimulate green innovation by making sustainability investments and technological upgrades a necessity rather than a choice, which both mitigates environmental damage and offers potential economic benefits (Liao & Zhang, 2023).

Informal regulations include communities, consumers, and local organisations drive informal regulatory pressure through social expectations, reputation management, and activism (Liao & Zhang, 2023). Firms facing strong stakeholder scrutiny are more likely to expand voluntary adoption of environment-related practices, especially when seeking legitimacy or entering new international markets (Seroka-Stolka, 2023).

For multinational enterprises (MNEs), regulatory pressure on environmental sustainability is complex, arising from varied national, regional, and global frameworks, as well as differing stakeholder expectations across markets (Zaheer, 2025). MNEs navigate not only compliance with home-country and host-country regulations, but also international standards and voluntary initiatives, which collectively drive environmental innovation, reporting, and green strategy adoption (Aguilera et al., 2023).

Multinational enterprises (MNEs) that have high global connectedness, achieved through international diversification, can leverage broader resources that support their pursuit of environmental innovation (Aguilera et al., 2023). This international scope provides access to a wider pool of knowledge, capabilities, and partnerships, allowing MNEs to drive environmental innovation with comparatively lower levels of risk than those firms operating purely within domestic markets. Regulatory pressure serves as both a constraint (increasing costs, raising required standards) and a motivator (stimulating investment in cleaner production, circular economy models, and cross-market learning). Importantly, whilst regulatory pressure may be a motivator, overly stringent or unbalanced regulation may drive firms to relocate to jurisdictions with laxer standards, creating potential “pollution havens” (Deng et al., 2023). The study by Adarkwah et al. (2022) elucidate the complex interplay between investment/foreign direct investment (FDI) flows and environmental policy changes, as well as firm-level disinvestment decisions prompted by legislative shifts.

### **2.3 Environmental initiatives**

Multinational enterprises (MNEs) operate in environments characterised by multiple, diverse sources of pressure that shape their environmental initiatives (Zaheer, 2025). Stakeholder pressure, including demands from investors, customers, employees, NGOs, and communities, compels MNEs to adopt sustainability strategies not only to ensure operational legitimacy but also to safeguard reputation and meet market expectations (Liao & Zhang, 2023). Regulatory pressure, meanwhile, obliges MNEs to comply with home- and host-country environmental laws, standards, and reporting mandates, often pushing them to innovate, improve transparency, and integrate green technologies into global operations (Zaheer, 2025). Extant empirical research indicates that both

stakeholder and regulatory pressures play a pivotal role in motivating multinational enterprises to adopt environmental management practices, pursue green innovation, and engage in sustainability reporting (Aguilera et al., 2023; Seroka-Stolka, 2023; Zaheer, 2025). These pressures act both independently and in tandem, with stakeholder expectations sometimes surpassing legal requirements, prompting MNEs to go beyond compliance and embed proactive environmental initiatives across their diverse international value chains (Aguilera et al., 2023). The below are the environmental initiatives that MNEs deploy to improve environmental and organisational performance.

### 2.3.1 Green supply chain and operations

Global supply chains are critically important for multinational corporations because these firms are increasingly expected to propagate sustainable business practices throughout their entire international networks (Beugelsdijk et al., 2024; Zaheer, 2025). The green supply chain and operations highlight the multinational's shift from traditional supply chain management toward environmentally sustainable practices encompassing sourcing, production, and distribution (Beugelsdijk et al., 2024). Green supply chain management entails the incorporation of ecological principles into each phase of the supply chain, responding to regulatory, stakeholder, and market-driven imperatives to promote environmental sustainability across business operations (Beugelsdijk et al., 2024).

Core components of green supply chain management encompass environmentally responsible procurement, eco-conscious design, sustainable manufacturing processes, and green logistics. Asiaei et al. (2022) demonstrated that green intellectual capital enhances environmental performance exclusively through the mediating effect of ambidextrous green innovation, which encompasses both exploitative innovations, focused on refining and leveraging existing knowledge, and exploratory innovation, centered on developing novel knowledge and products. This finding indicates that the organisational deployment of green knowledge assets and capabilities yields tangible environmental benefits only when these resources are mobilised within a dual innovation strategy that balances incremental improvements with pioneering advancements. Companies implementing these practices frequently collaborate with suppliers and partners to minimise environmental impacts, while simultaneously pursuing operational efficiencies and enhancing their competitive positioning (Kumar et al., 2022; Makismov et al., 2022).

Evidence from empirical studies demonstrates that GSCM adoption enhances not only environmental performance (e.g., reducing emissions, waste, and resource usage) but

also competitive positioning (Alvarez-Gonzalez et al., 2023; Hagendorff et al., 2025). Proactive firms view green supply chain initiatives as a strategic lever for innovation, brand reputation, and compliance with regulatory and stakeholder demands (Alvi et al., 2022). Li and Ramanathan (2020) outlined that organisation's environmental initiatives focused on environmental investments, generally improve environmental performance, especially when investments are directed at pollution prevention rather prevention control. Almandoz et al. (2021) outlined that green investing, positively influences corporate environmental performance, primarily through normative, cultural, and indirect mechanisms rather than direct governance. Almandoz et al. (2021) further noted that green investing impact to environmental performance was stronger in countries with robust shareholder protection and weaker in countries with stringent state environmental policies, highlighting the importance of institutional logics and their compatibility. Despite proven benefits, challenges such as increased short-term costs, complex managerial and logistical challenges, and the need for ongoing performance metrics are documented, with successful implementation depending on collaboration, robust monitoring, and organisation-wide commitment to sustainability (George & Schillebeeckx, 2022; Oetzel & Oh, 2022; Zaheer, 2025).

Overall, literature confirms that the growth and performance of green supply chains are optimised by fostering collaboration, aligning incentives, measuring outcomes, and continuously innovating across the supply network, reinforcing the critical role of sustainability in modern supply chain and operations management.

### 2.3.2 Innovation and digital resources

Innovation and digital resources have become foundational to modern environmental initiatives and the advancement of sustainable corporate strategies, especially for achieving Sustainable Development Goals (George & Schillebeeckx, 2022; Guandalini, 2022). Technological innovation including green production techniques, advanced monitoring, and eco-design directly drives emission reduction, energy efficiency, and the broad adoption of low-carbon processes (Makismov et al., 2022; Zaheer, 2025). The role of institutional frameworks is pivotal in this context, as they generate R&D incentives, provide policy support and subsidies, and establish regulatory mechanisms that reinforce the development and deployment of sustainable technologies (De Funes et al., 2024).

Digitalisation, as highlighted by George and Schillebeeckx (2022), and Ren and Zuo (2025), fundamentally reshapes resource management and operational structures, making digital services more accessible through technologies like cloud computing. Digital technologies such as blockchain, IoT, and AI further enhance energy sector

efficiency, streamline resource allocation, and enable integration of renewable energy into major grids (Ren & Zuo, 2025). These advancements also play a crucial role in scaling sustainability across multinational supply chains by supporting standard diffusion and progress monitoring. Both custom and off-the-shelf digital solutions, as evidenced by Kocoglu and Mithani (2025), have proven effective in achieving environmental objectives from a resource-based management perspective.

Nevertheless, the literature acknowledges risks associated with technological complexity. Research by Nygaard and Silkoset (2022) indicates that intricate supply chains and sophisticated production technologies can increase information asymmetry, limiting consumer ability to verify green claims. Relatedly, Chen et al. (2025) found that corporate digitalisation may amplify greenwashing by enabling impression management, information manipulation, and operational opacity. However, contrary evidence from Johan et al. (2024) drawing on affordance theory, demonstrates that well-applied financial technology can mitigate greenwashing through enhanced transparency, managerial efficiency, and greener innovation.

In conclusion, technology and digitalisation offer both significant pathways for progress, facilitating eco-efficiency, regulatory compliance, and organisational resilience, and present new risks, including the potential misuse of innovation for greenwashing. The direction of impact depends greatly on the specific applications, institutional settings, and the degree of transparency and accountability governing technological adoption.

### 2.3.3 Peer collaboration and stakeholder green value co-creation

Research conducted by Annan et al. (2025) on small manufacturing firms in Ghana demonstrates that green value co-creation, characterised by collaborative engagement between firms, customers, and suppliers in the joint development and implementation of environmentally sustainable initiatives, acts as a crucial moderating factor in the relationship between green process innovation and firms' financial performance. Specifically, the benefits of green process innovation on financial outcomes are maximised when firms cultivate intensive green value co-creation but exercise restraint with overt customer-driven green strategies (Annan et al., 2025). This suggests that resource orchestration actively coordinating and leveraging both internal and external capabilities, enables the organisation to optimise the financial returns from green innovation investments (Annan et al., 2025). Corroborating these findings, Cabigiosu et al. (2025) demonstrate that collaborative mechanisms and customer engagement strategies substantially enhance innovation performance. However, their study cautions that excessive customer involvement can diminish innovation gains, indicating a

threshold beyond which value co-creation becomes inefficient (Cabigiosu et al., 2025). Similarly, Lei et al. (2025) showed that, in multinational enterprises (MNEs), the parent company's superior innovation performance positively filters down to subsidiaries via nurturing mechanisms and motivational support, driving overall organisational innovation outcomes and improve environmental performance.

These studies underscore that green innovation and value co-creation when precisely orchestrated and contextually moderated yield significant financial and innovation benefits for firms. The implications are clear: balancing internal and external stakeholder collaboration is essential for maximising the impact of green process innovation, and spillover effects within MNEs can catalyse broader performance improvements.

#### 2.3.4 Firm common ownership

Institutional common ownership describes scenarios in which institutional investors hold significant and influential equity stakes in multiple firms, including those in direct competition within the same industry (Healy & Mintz, 2021). These common owners, functioning as principals, actively engage with firm managers (agents) to improve corporate practices related to customer outcomes, scrutinise cost and revenue strategies, and diagnose performance shortfalls relative to industrial peers (Edmans et al., 2019). Owing to their broad investments, institutional common owners gain access to industry-specific knowledge by frequently interacting with managerial teams across their portfolios, thereby equipping them to provide comparative insights and strategic guidance that surpass what single-firm investors can offer (Park et al., 2019).

Research on the environmental dimension of institutional ownership yields nuanced findings. Aguilera et al. (2023) report that, although foreign institutional owners can positively impact investee firms' environmental performance, the magnitude of their influence is not uniformly significant. In contrast, Velte (2022) found that long-term, sustainability-oriented, and foreign institutional investors are typically associated with enhancements in firms' environmental, social, and governance (ESG) performance as well as corporate social responsibility (CSR) outcomes. Significantly, Velte (2022) identified that institutional investors with a long-term orientation enhance the positive association between sustainability-focused strategies and financial performance, acting as a moderating mechanism that strengthens the alignment between firms' environmental objectives and economic outcomes.

Further, Focke et al. (2022) document that companies with high levels of sustainable institutional investor ownership are more likely to respond to the Carbon Disclosure

Project, demonstrating increased carbon risk awareness and a greater willingness to disclose climate-related metrics.

Overall, literature suggests that institutional common ownership can be conducive to environmental sustainability. By internalising negative externalities and encouraging voluntary emission reductions and abatement investments across their portfolios, large shareholders drive firms' efforts to address environmental concerns, promote green innovations, and reduce systematic risk, particularly when these investors take a long-term, stewardship-oriented approach (Focke et al., 2022; Healy & Mintz, 2021; Velte, 2022).

## **2.4 Corporate Environmental Performance**

### **2.4.1 Internal carbon pricing**

Internal carbon pricing (ICP) has become an essential initiative for advancing corporate environmental performance, particularly within multinational enterprises (MNEs) (Wang et al., 2022). ICP is typically implemented in three main forms: an internal carbon fee, in which a company levies a specific charge on each ton of greenhouse gas (GHG) emitted; a shadow price, which serves as an estimated cost for carbon in strategic decision-making and investment planning for low-carbon projects; and an implicit price, which reflects the cost incurred to reduce GHG emissions via targeted sustainability efforts (Wang et al., 2022).

Empirical findings indicate that organisations exhibiting higher levels of emissions and facing increased exposure to climate-related risks demonstrate a pronounced propensity to implement internal carbon pricing (ICP) practices as part of their climate mitigation efforts (Ben-Amar et al., 2022). For these organisations, ICP not only encourages the alignment of investments and operations with net zero objectives but also serves as a response to stakeholder and regulatory expectations. This dual-purpose approach results in measurable improvements in environmental performance and confers tangible competitive advantages, such as enhanced access to export markets due to lower emission profiles (Wang et al., 2022).

Recent regulatory developments particularly in regions such as Western Europe have further accelerated ICP adoption within MNEs (Nippa et al., 2021). Studies show that MNEs disseminate successful carbon management practices and firm-specific climate advantages throughout their global subsidiaries, amplifying the impact of host-country environmental regulation (Nippa et al., 2021).

Collectively, the literature demonstrates that embedding internal carbon pricing (ICP) within firms' financial and operational decision-making processes plays a dual role: it advances organisational environmental sustainability goals while simultaneously promoting long-term competitiveness and corporate resilience (Ben-Amar et al., 2022; Nippa et al., 2021; Wang et al., 2022).

#### 2.4.2 Carbon Emissions Control

Pressure from stakeholders, encompassing both customer demands (as outlined in stakeholder theory) and regulatory mandates (as seen in institutional theory), serves as a significant catalyst for the adoption of resource-based environmental initiatives within organizations (Haddoud et al., 2023). Such initiatives, including comprehensive environmental planning and energy management, foster quantifiable improvements in carbon emission control and pollution reduction, which in turn drive enhanced environmental performance (Haddoud et al., 2023). Empirical evidence from Turkish firms demonstrates that heightened environmental compliance not only improves sustainability outcomes but also leads to increased export incentives by aligning with international standards (Haddoud et al., 2023).

In research by Boateng et al. (2024) the study highlighted that positive environmental performance, underpinned by information transparency and internally motivated sustainability practices, significantly enhances organisational access to credit. Strengthened internal motivation for eco-friendly initiatives translates to accelerated growth, validating the financial and strategic benefits of proactive sustainability management (Boateng et al., 2024).

#### 2.4.3 Climate regulation certification

Compliance with regulatory and environmental requirements further enables firms to address multifaceted stakeholder expectations, including those of civil society and a growing base of environmentally conscious customers who demand operationalisation of sustainability principles (Nyberg & Wright, 2022), as well as reputational imperatives for subsidiaries of multinational parent companies (Jiang et al., 2020). It is therefore important for MNEs to manage environmental pressures, and avoid incurring non-compliance costs, with firm responses to the risks influenced by the marginal abatement cost relative to prevailing emissions market prices (Nippa et al., 2021).

Dang et al. (2025) found that climate regulations imposed on firms are shown to negatively affect their access to credit, with particularly pronounced implications for long-term financing. The heightened compliance demands tied to climate policies increase operational costs and expose firms to greater perceived financial risk, especially among

carbon-intensive and publicly listed entities (Dang et al., 2025). This risk perception prompts banks and other financial institutions to adopt more stringent lending standards, raising collateral requirements, tightening credit eligibility, and increasing interest rates, which further restricts firms' ability to secure funding for strategic, long-term investments (Dang et al., 2025).

The lack of adequate long-term financing, in turn, constrains firms' ability to invest in energy efficiency improvements and sustainability initiatives, escalating operating leverage and ultimately reducing firm value. These findings mirror those of Boateng et al. (2024) who confirmed that undertaking robust environmental initiatives not only enhances environmental performance but also improves organisational access to credit by mitigating informational and environmental risks.

Whilst effective climate regulation is vital for broad sustainability goals, its design and implementation must account for the credit needs of firms. Supporting innovation, transparency, and sectoral resilience is essential for both facilitating compliance and safeguarding firms' ability to generate environmental and financial value in a climate-constrained global economy.

#### 2.4.4 Greenwashing (risk mitigation)

Greenwashing encompasses deliberately misleading communications that inflate perceptions of a company's environmental responsibility among stakeholders (Balluchi et al., 2020). Such practices can significantly distort stakeholder trust, damage corporate credibility, and intensify negative reactions during environmental scandals, particularly when gaps between public claims and actual conduct are exposed (Balluchi et al., 2020). Empirical studies by Cui et al. (2024) reveal that multinational corporations' environmental score ratings frequently serve as managerial tools to obscure inadequate carbon reduction efforts, manifesting a "talk more, act less" pattern indicative of greenwashing. Empirical research indicates that domestic cultural characteristics including individualism, masculinity, and uncertainty avoidance serve as moderating factors that negatively influence the alignment between firms' environmental claims and their substantive sustainability actions (Cui et al., 2024). After the Paris Agreement, greenwashing became more prevalent in societies characterised by greater power distance, with the treaty failing to curb these deceptive practices (Cui et al., 2024).

Research by Chen et al. (2025) further demonstrates that digitalisation heightens greenwashing risks, enabling impression management and information manipulation that complicate stakeholder evaluation of actual environmental performance. By contrast, Johan et al. (2024), using affordance theory, find that digital solutions, particularly

financial technology, can counteract greenwashing by boosting transparency, managerial efficiencies, and green innovation.

Collectively, these studies underscore that greenwashing not only undermines genuine environmental progress through deceptive symbolic actions, but also reflects deeper vulnerabilities within corporate governance, digital strategy, and national cultural dynamics.

#### 2.4.5 Waste Elimination

Multinational enterprises (MNEs), due to their scale, global influence, and visibility, are poised as the first entities to move beyond the foundational targets of carbon neutrality and zero waste towards genuine ecosystem value creation (George & Schillebeeckx, 2022). Addressing the interlinked challenges of rapid economic decarbonisation, the marine plastic waste crisis, and biodiversity decline now increasingly coincides with tackling poverty and enhancing public health (George & Schillebeeckx, 2022). While legacy sustainability and ESG frameworks have been grounded in process efficiency, lean operations, and waste minimisation, these cost-leadership approaches are proving inadequate for meaningful firm-level differentiation and transformative environmental stewardship (George & Schillebeeckx, 2022).

As global market and regulatory contexts shift, stakeholder activism and demands for integrated governance are challenging firms to coordinate environmental and health strategies beyond the narrow confines of operational efficiency. The traditional sustainability paradigm centered around minimising negative externalities like waste, pollution, and social injustice remains vital but insufficient as a foundation for superior value creation and long-term appropriation (George & Schillebeeckx, 2022).

Against this backdrop, the role of green training is gaining prominence as a catalyst for reimagining waste management practices within MNEs (Xie & Zhu, 2020). Green training fundamentally aims to increase employees' environmental commitment by enhancing their motivation and engagement with green concepts, leading directly to reductions in hazardous waste processes and resource overconsumption (Xie & Zhu, 2020). Such training and development initiatives are deliberately structured to heighten employee awareness of environmental issues and promote sustainable practices, such as recycling and proactive waste management, thereby contributing to measurable improvements in environmental performance (Alvarez-Gonzalez et al., 2023).

### 2.5 Organisational Performance

Studies suggest that leveraged improved environmental sustainability performance can endow firms with a sustainable competitive advantage (Shui et al., 2025), underpin long-

term organisational survival (Budhwar et al., 2022), inform more effective corporate strategies (Farag et al., 2025), and facilitate success in mergers and acquisitions (Hussain & Kumar, 2025).

#### 2.5.1 Access to credit/funding

Recent empirical research underscores the critical nexus between environmental performance and organisational access to credit, revealing a complex interplay between proactive sustainability practices, financial disclosures, and the impact of external regulatory pressures. Boateng et al. (2024) demonstrate that firms exhibiting strong environmental performance anchored in information transparency and a robust internal sustainability culture enjoy enhanced credit accessibility. This positive relationship is attributed to the reduction of informational asymmetries and environmental risks, which, in turn, strengthens firm credibility in the eyes of financial institutions. The internal motivation to pursue eco-friendly initiatives thus yields not only ecological benefits but also facilitates organisational growth, highlighting the financial and strategic merits of a proactive sustainability orientation (Boateng et al., 2024).

In contrast, Dang et al. (2025) provide evidence that the imposition of external climate regulations can generate adverse consequences for credit access, particularly concerning the availability of long-term financing. Increased compliance obligations inflate operating costs and raise the perceived financial risk among lenders, especially for carbon-intensive and publicly listed enterprises (Dang et al., 2025). As a result, financial institutions respond with heightened lending standards, raising collateral requirements, tightening eligibility thresholds, and elevating interest rates, thereby constraining firms' ability to secure the patient capital necessary for substantive energy efficiency and sustainability investments. These restrictions on long-term financing ultimately limit a firm's capacity to pursue value-enhancing environmental projects, elevate operational leverage, and diminish overall firm value (Dang et al., 2025).

#### 2.5.2 Access to market/ export incentives

Empirical analysis confirm that firms characterised by elevated emissions profiles and heightened vulnerability to climate-related risks exhibit an increased likelihood of adopting internal carbon pricing mechanisms as part of their climate management strategies (Ben-Amar et al., 2022). This internal carbon pricing mechanism incentivises alignment of corporate investments and operational activities with net zero objectives while responding to escalating stakeholder and regulatory expectations (Ben-Amar et al., 2022). Such proactive environmental management translates into improved firm competitiveness, including enhanced access to export markets, as lower emission

profiles increasingly serve as non-tariff barriers and market entry requirements (Wang et al., 2022).

Stakeholder pressure, particularly from environmentally conscious customers, and regulatory mandates exert significant influence on organisational adoption of resource-based environmental initiatives such as environmental planning and energy management (Haddoud et al., 2023). Empirical studies among Turkish firms exemplify these trends, demonstrating that heightened environmental compliance not only advances sustainability performance but also facilitates export incentives by conforming to rigorous international environmental standards and expectations (Haddoud et al., 2023).

### 2.5.3 Reduced costs/ increased value

Firms face substantial costs and risks associated with the management of toxic novel entities, encompassing monitoring, control, and compliance expenditures alongside legal and reputational hazards arising from toxic releases (Hagendorff et al., 2025). These economic burdens create strong incentives for organisations, particularly multinational enterprises (MNEs), to invest in reducing harmful chemical emissions. Such investments serve not only to mitigate direct risks to employees and local communities but also to avoid costly litigation and sanctions. Consequently, a growing demand for green skills within MNEs is evident, especially aimed at minimising the use and release of chemicals recognised as detrimental to human health (Hagendorff et al., 2025).

At the same time, digitisation emerges as a pivotal enabler in reducing these costs and accelerating sustainability transitions (George & Schillebeeckx, 2022). Innovations such as cloud computing have lowered the barriers to digital infrastructure, thereby democratising access and reducing monitoring costs for diverse environmental data. Real-time emission detection via remote sensing and Internet of Things (IoT) devices, alongside distributed ledger technologies, facilitate precise and transparent tracking across global cold chains and supply networks (George & Schillebeeckx, 2022). These digital advances decrease coordination costs and enable MNEs to organise more complex and specialised global value chains, elevating the strategic importance of collective action across ecosystem boundaries as a new competitive advantage (George & Schillebeeckx, 2022).

The implementation of both internal and external green supply chain management (GSCM) practices, such as sustainable procurement, collaborative initiatives with customers and suppliers, and eco-centered product design, has been shown to reduce inventory levels and resource consumption, enhance asset recovery, control costs, and

strengthen corporate reputation (Alvarez-Gonzalez et al., 2023). Yet, failure to engage with sustainability challenges in global supply chains presents severe risks, ranging from reputational damage, consumer boycotts, and legal sanctions to disruptions in raw material availability, cost escalations, profit erosion, and diminished investor confidence (Beugelsdijk et al., 2024).

Implementing such green practices is inherently complex, involving substantial upfront costs and continuous organizational learning to achieve breakthroughs in sustainable manufacturing operations (Xie & Zhu, 2020). Whilst traditional sustainability efforts and ESG initiatives have largely targeted process efficiencies and waste minimisation, these cost leadership strategies fall short in delivering meaningful differentiation or competitive advantage in evolving market contexts (George & Schillebeeckx, 2022).

## **2.6 Literature review conclusion**

The literature reviewed in this chapter underscores the complexity and dynamism of environmental sustainability practices among multinational enterprises (MNEs), particularly within the mining sector in South Africa. In summary, the reviewed literature demonstrates that environmental sustainability initiatives in multinational enterprises (MNEs) are shaped by the confluence of stakeholder pressures, regulatory frameworks, and the strategic orchestration of organisational resources (Asiaei et al., 2023; Rafindadi & Usman, 2019). Empirical investigations consistently show that stakeholder engagement, encompassing investors, governments, NGOs, communities, and employees, actively drives the formulation and implementation of environmental strategies (Alamos-Concha et al., 2024; Aragon-Correa et al., 2020; Zaheer, 2025). Meanwhile, regulatory developments and market expectations prompt firms to adopt environmental management practices that go beyond compliance, fostering innovation and transparency (Aguilera et al., 2023; Velte, 2023; Seroka-Stolka, 2023). Theoretical frameworks including stakeholder theory, institutional theory, and the resource-based view converge to illuminate how internal and external pressures catalyse the adoption of environmental initiatives that ultimately influence organisational performance.

Research highlights the criticality of green supply chain management and resource-based environmental approaches, with technological and digital innovations underpinning advancements in eco-efficiency, reporting, and emissions control (Beugelsdijk et al., 2024; Makismov et al., 2022; George & Schillebeeckx, 2022; Ren & Zuo, 2025). However, these innovations also introduce governance challenges, such as greenwashing and information asymmetry, necessitating robust stakeholder collaboration and credible frameworks to ensure substantive progress (Balluchi et al.,

2020; Chen et al., 2025; Cui et al., 2024; Johan et al., 2024). Complementary mechanisms such as peer collaboration, institutional ownership, and internal carbon pricing further reinforce the efficacy of sustainability practices and create financial and competitive advantages for firms (Focke et al., 2022; Velte, 2022; Wang et al., 2022; Ben-Amar et al., 2022). Notably, effective stakeholder engagement and collaborative mechanisms are regularly highlighted as pivotal for both legitimacy and improved environmental outcomes, while context sensitivity is required to navigate the heterogeneity of expectations across diverse markets.

Despite notable advances, several gaps persist. Moreover, research reveals a nuanced interplay between environmental performance and access to credit and market opportunities, emphasising that robust sustainability practices can confer competitive and financial advantages, whereas poorly designed regulatory regimes may inadvertently constrain long-term financing for strategic sustainability investments. Much of the extant research privileges firm-level outcomes, leaving broader societal impacts and the effectiveness of multi-stakeholder collaborations relatively underexplored (Albino-Pimentel et al., 2024; Bouguerra et al., 2024). Furthermore, the dual potential of digitalisation as a force for transparency and for greenwashing calls for further empirical scrutiny and governance innovation (Nygaard & Silkoset, 2022; Chen et al., 2025). This highlights the need for research to bridge these gaps and develop adaptive strategies for MNEs to navigate heterogeneous stakeholder expectations and rapidly evolving regulatory landscapes, especially in contexts such as South Africa's mining sector (Asmussen et al., 2023; Kano et al., 2020; Blazevic et al., 2021).

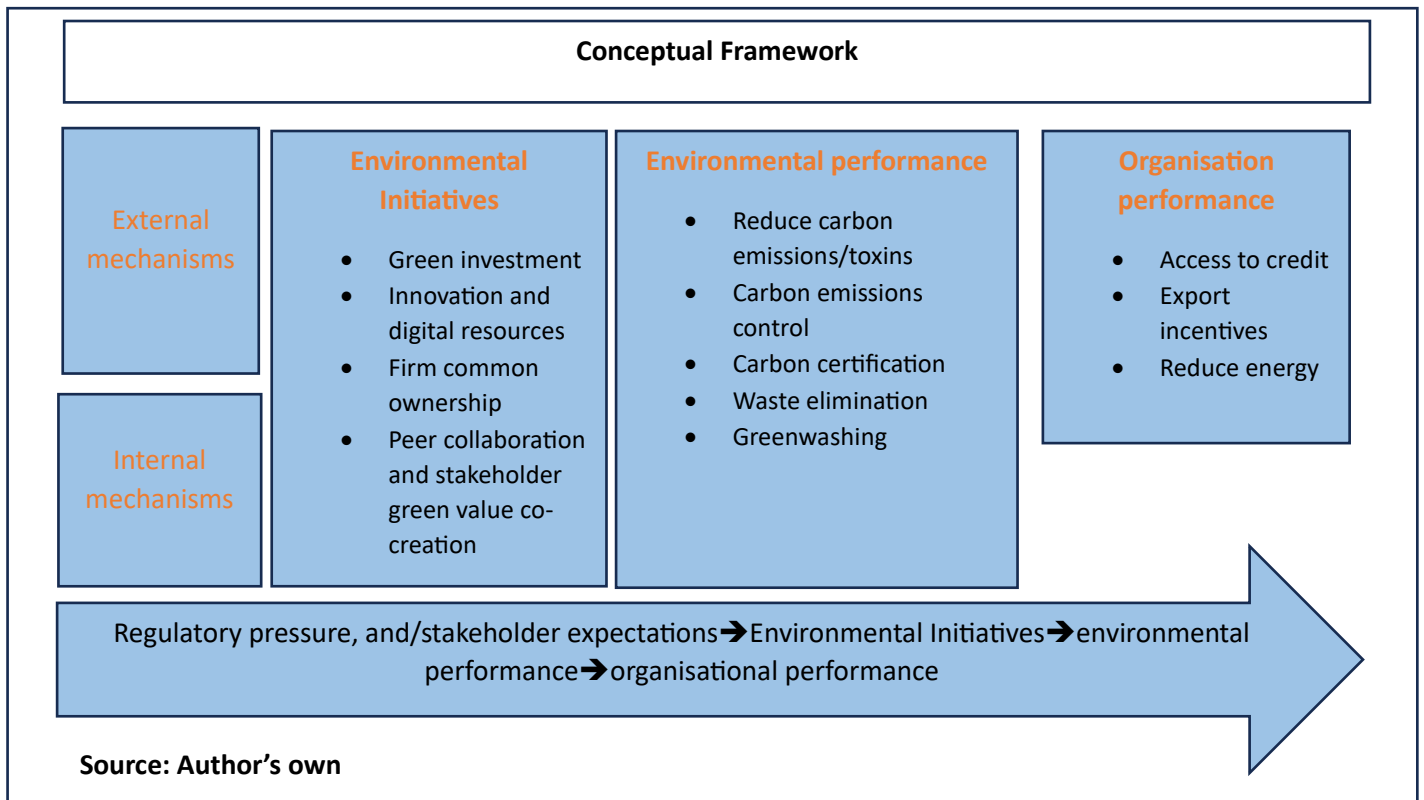
Despite significant advances, critical gaps remain in understanding the broader societal impacts of MNE sustainability initiatives beyond the confines of firm-level outcomes and primary stakeholder interactions. Additional research was therefore needed to explore the public goods dimension of MNE-environment-civil society relationships and the efficacy of multi-stakeholder collaborations in advancing both firm performance and societal well-being.

In conclusion, the intersection of stakeholder theory, institutional theory, and the resource-based view offers a robust foundation for the analysis of MNEs' environmental initiatives. The literature strongly advocates for integrative, context-sensitive, and innovation-driven approaches to sustainability management, emphasising the need for continual adaptation and multi-level collaboration to realise enduring environmental and organisational performance.

## 2.7 Conceptual Framework

In conclusion, Figure 2 presents a conceptual framework synthesised from the literature review, delineating the principal constructs and themes identified throughout the analysis. This framework highlights the key internal and external mechanisms, as well as environmental initiatives, that contribute to environmental and organisational performance.

Figure 2: Literature review conceptual framework



### 3. Chapter 3: Research Questions

The research questions underpinning this study were informed by the work of Asiaei et al. (2023), which examined the effects of ambidextrous green innovation and green intellectual capital on organizational environmental performance. Building upon the future research agenda outlined by Asiaei et al. (2023), this exploratory investigation focuses on the role of internal and external mechanisms and initiatives in advancing both environmental and organizational performance. Accordingly, this study sought to elucidate how such mechanisms and initiatives, when implemented by organizations, foster environmental and organisational performance dimensions.

To address the research directions highlighted by Asiaei et al. (2023), the following research questions have been formulated.:

#### **Main Research Question:**

**How do internal and external mechanisms translate environmental initiatives into environmental performance for organisational (firm) performance?**

The aim of this research question was to explore how internal external mechanisms lead organisations to initiate environmental initiatives to improve environmental and organisational performance by implementing concrete improvements in emissions reductions, waste, resource efficiency and compliance.

#### **Sub-questions 1:**

**What are the external and internal mechanisms that are used for environmental initiatives?**

This research question sought to identify and characterise the range of environmental initiatives that organisations implement in order to monitor, control and enhance their environmental performance

#### **Sub-questions 2:**

**How do environmental initiatives improve environmental performance?**

This research question sought to ascertain whether the environmental initiatives implemented by organisations are associated with improvements in their environmental performance.

#### **Sub-questions 3:**

**How does environmental performance improve organisational performance?**

This research question sought to examine whether improvements in firms' environmental performance are associated with subsequent improvements in overall organisational performance.

## 4. Chapter 4: Methodology

### 4.1 Introduction

This section outlines the research methodology and design implemented in this study, providing an account of the research strategy that guided the investigation. The adoption of a research method, design, and strategy was deemed suitable and effective in addressing the research questions formulated in Chapter 3, supporting the collection, analysis, interpretation, and discussion of empirical findings.

The central aim of the research was to examine how organisations use internal and external mechanisms and implement environmental initiatives to enhance both environmental and organisational performance. An exploratory research design was considered most appropriate, as it was tailored to exploring “how” questions. While the identification of a research gap in existing literature, an essential prerequisite for any scholarly inquiry (Makri & Neely, 2021), prompted the formulation of the research question, the study prioritised understanding the research problem from the perspective of practitioners as outlined in Chapter 1. This approach, informed by the guidance of Ahmed et al. (2016), and Makri and Neely (2021), was intended to yield practical and contextually relevant insights, thereby supporting more targeted and actionable solutions through an appropriately selected methodology.

This qualitative study utilised a case study research design to explore the knowledge and lived experiences of managers within firms, aiming to understand how these organisations respond to environmental challenges through internal and external mechanisms to enhance both environmental and organisational performance. According to Yin (2018), case study research is well-suited for explaining contemporary phenomena by addressing questions of “how” and “why.” Central to Yin’s (2018) approach are the clear delineation of the “case” and the triangulation of multiple sources of evidence. In this study, data gathered from semi-structured interviews with managerial informants (the primary data) were triangulated with content and textual analysis of publicly available non-human data (secondary data), including firms’ environmental, sustainability, and ESG reports.

This approach emphasised understanding the role of individuals confronting systemic challenges (Boussebaa, 2023) and connecting empirical findings to real-world managerial implications (Benischke et al., 2017). It further highlights the social impact of organisational actions (Tihanyi, 2020) and their practical and managerial relevance (Delios, 2017). This study gains significance in light of escalating global environmental

and climate challenges, which arise from the intricate interactions of organisations and individuals across borders within the global business system (Benischke et al., 2017).

## **4.2 Choice of methodology and design**

### **4.2.1 Choice of research paradigm**

Research conducted scientifically must be grounded in clear philosophical assumptions that align with the research type, data, and methods employed (Federico et al., 2020). This study adopted an interpretivist paradigm as advocated by Harrison et al. (2010), which aligns with the understanding that social phenomena, such as organisational behaviour and markets, are complex, socially constructed, and context-dependent. According to Lewis et al. (2023), the interpretivist paradigm provides deep insights into complex experiences and practices situated within socially rich settings, shaped through culture, language, and multiple, often overlapping meanings. This understanding is pivotal when exploring organisational phenomena that cannot be reduced to simple, fixed categories or measurable variables.

Packard (2017, p. 536) further elaborates interpretivism as a “scientific philosophy where social order, markets and entrepreneurial activities included emerges from intentional actions and interactions at the individual level”. This perspective underscores the primacy of subjective meanings and sensemaking processes in understanding organisational life, rather than abstract, objective observations detached from lived realities. Given this, the interpretivist paradigm was particularly suitable for this study, which sought to explore how firms, through their managers, leverage internal and external mechanisms to transform environmental initiatives into both environmental and organizational performance outcomes in a South African context.

A key philosophical foundation of this interpretivist stance is the recognition that human beings differ fundamentally from physical phenomena, warranting approaches that capture the subjective construction of reality by organisational actors (Packard, 2017). This distinction allows for a meaningful investigation into how managers create meaning and act based on their intentions, experiences, and interpretations. Triangulating managerial insights with company environmental reports further ensured that the interpretivist approach was grounded in both subjective experiences and organisational artifacts, strengthening the study’s validity (Yin, 2018).

Consequently, the interpretivist philosophy aligns closely with the research aim to uncover and understand the lived experiences, intentions, and perspectives of managers regarding environmental and organisational performance improvement. It posits that

organisational phenomena are socially constructed through the active engagement of people, whose subjective interpretations inform their actions and the resulting organisational outcomes (Harrison et al., 2010; Lewis et al., 2023; Packard, 2017). This philosophical stance enables a rich, contextualised exploration of complex social realities, which positivist paradigms might overlook or overly simplify.

In sum, the interpretivist paradigm embraced in this study supports a qualitative, descriptive approach that prioritised understanding over quantification and acknowledges the multifaceted, socially enacted nature of organisational life (Federico et al., 2020; Harrison et al., 2010; Lewis et al., 2023; Packard, 2017). It thus provides a robust and coherent framework for studying environmental initiatives and organisational performance in the specific cultural and institutional setting of South Africa.

#### 4.2.2 Assumptions of research paradigm

This study adopted an interpretivist research philosophy, as outlined by scholars such as Barney et al. (2018) and Corley and Gioia (2011), which contrasts the more traditional management research approach of theorising based on fixed theoretical assumptions aimed at predicting and explaining managerial and organisational phenomena. Instead, the interpretivist paradigm foregrounds the socially constructed nature of organisational reality and emphasises understanding how organisational members actively construct and interpret their experiences. This shift in focus acknowledges that the study of organisations should prioritise the processes of meaning-making over merely quantifying the frequency or occurrence of measurable events (Corley et al., 2012).

Ontology and epistemology are fundamental and intertwined under this paradigm (Goldkuhl, 2012). Ontology addresses the question of what exists, “what is reality”, whilst epistemology concerns how knowledge about that reality is acquired (Barney et al., 2018). These foundational paradigms critically influence research decisions, including identifying research topics, determining what constitutes data, selecting methods for data collection and analysis, theorising, and the presentation of research findings (Bryman, 2006; Cunliffe, 2011). Becker and Niehaves (2007) further emphasise the role of ontology in understanding the nature of the objects being studied, which directly informs epistemological assumptions on how knowledge can be gained about these phenomena.

Qualitative research, an umbrella term encompassing a wide range of approaches with diverse epistemological underpinnings and empirical techniques, holds significant potential for producing deep and broad insights into organisational phenomena (Bansal et al., 2018; Alvesson & Gabriel, 2013). Through qualitative inquiry, the emphasis lies in

exploring how organisational realities are constructed and interpreted, moving beyond a reliance on measurement and counting towards uncovering the lived meanings and sensemaking processes of organisational actors (Corley et al., 2012). This approach addresses perceived gaps in knowledge resulting from traditional methods focused on construct elaboration and numerical measurement, which, while valuable, may constrain a more profound understanding of organisational dynamics (Corley et al., 2012).

Complementing this ontological stance, the interpretivist epistemology adopted here assumed that individuals within organisations are “knowledgeable agents” who possess awareness of their goals and can explain their thoughts, intentions, and actions (Alexander et al., 2025). This position diverges from objectivist perspectives that treat reality as independent and waiting to be discovered. Instead, knowledge arises through the researcher’s interpretive engagement with participants’ experiences and sensemaking (Alexander et al., 2025).

Accordingly, this study asserted that understanding cannot be achieved through distanced, impersonal observation of an external reality but rather through direct involvement and the interpretative process inherent in experience with phenomena (Alexander et al., 2025). A subjective ontology thus perceives reality as constructed through the interpretation of lived experiences and aligns with an interpretivist epistemology employing qualitative methods to explore and comprehend organisational and managerial phenomena (Bally et al., 2022). Central to qualitative research within this paradigm are sensemaking and interpretation, which Hardy et al. (2011) identify as essential activities for theory development. These interpretive acts enable researchers to generate rich, contextually grounded insights that go beyond surface-level description to reveal underlying meanings and dynamics.

In summary, the interpretivist paradigm adopted in this study shaped all facets of the research process, from selection of research questions, to how data was conceptualised, collected, analysed, theorized, and reported. By embracing the complexity and emergent nature of social realities in organisations, this approach provided a robust framework for gaining nuanced and profound understandings that advance management research (Bryman, 2006; Cunliffe, 2011; Goldkuhl, 2012).

The interpretivist research paradigm, which emphasises ontology and epistemology, guided the research study process of gaining understanding by highlighting various types of knowledge, on how firms, use internal and external mechanisms through environmental initiatives for environmental and firm performance. The comparison between ontology and epidemiology role in research is outlined in Table 1 below:

*Table 1: Tabular representation of Ontology and Epistemology its role in research*

<b>Aspect</b>	<b>Ontology</b>	<b>Epistemology</b>
Core question	What exists? What is reality	How is knowledge about reality acquired?
Nature of Reality	Reality is socially constructed and subjective; it is created through human interpretation and interaction (Barney et al., 2018; Corley & Gioia, 2011).	Knowledge arises through interpretive engagement with participants' experiences and sensemaking (Alexander et al., 2025; Corley et al., 2012).
Philosophical Stance	Subjective ontology: reality depends on lived experiences and meanings attributed by individuals (Bally et al., 2022; Goldkuhl, 2012).	Interpretivist epistemology: understanding is gained through interpreting meanings rather than objective measurement (Bryman, 2006; Cunliffe, 2011).
Role in Research	Influences what phenomena are considered real and worthy of study (Barney et al., 2018; Becker & Niehaves, 2007).	Determines how knowledge is gathered, the role of the researcher, and methods of analysis (e.g., qualitative data, interviews) (Alvesson & Gabriel, 2013; Bansal et al., 2018;).
Relation to Methods	Supports qualitative methods that explore meaning-making and social construction (Bansal et al., 2018; Corley et al., 2012).	Justifies the use of qualitative inquiry to uncover rich, contextually grounded insights (Alexander et al., 2025; Hardy et al., 2011).
Implications	Reality is fluid, multiple, and continuously recreated by individuals (Bally et al., 2022; Corley & Gioia, 2011).	Knowledge is co-created between researcher and participants rather than discovered independently (Alexander et al., 2025; Barney et al., 2018).
Contrast with Positivism	Rejects fixed, objective external reality (Bryman, 2006; Goldkuhl, 2012).	Rejects knowledge as mere objective fact; embraces subjective interpretation (Corley et al., 2012; Cunliffe, 2011).

**Source: Author's own**

#### 4.2.3 Research strategy

For this qualitative research, it was appropriate to adopt the case study method as the research strategy, consistent with the interpretivist paradigm guiding the study. Yin (2018) defines a case study as an in-depth inquiry into phenomena within their real-life contexts, emphasising the importance of boundaries and multiple data sources in the study of an organisation as a "case." In this research, the organisation serves as the bounded case, with two main datasets: primary data collected through interviews and

secondary data consisting of environmental reports, supporting triangulation and richer contextual understanding (Yin, 2018).

The study specifically targeted publicly listed multinational corporations in the mining sector, chosen due to their significant environmental impact and the critical role sustainability plays in their business strategies. This deliberate sector focus was crucial for understanding complex sustainability practices in industries where environmental performance is both operationally and reputationally significant (Ali et al., 2015).

Data collection relied primarily on semi-structured interviews with managerial personnel responsible for or actively involved in sustainability initiatives. These managers were carefully selected for their direct engagement with environmental strategies such as resource management, emissions reduction, waste minimisation, and regulatory compliance. This method aligns with interpretivist principles by enabling the collection of rich, detailed narratives about how sustainability is integrated into organisational decision-making and operations (Ponelis, 2015; Yin, 2018).

The interviews offered deep insights into managerial perspectives on incorporating environmental sustainability within the business model, revealing nuanced challenges, practices, and innovations specific to the mining sector. Using semi-structured interviews permitted flexibility for participants to express unique views while ensuring consistency across-cases for comparative analysis. Triangulating this qualitative data with documentary evidence, such as environmental reports, provided methodological rigour, enhancing the credibility and validity of the findings through corroboration (Corley et al., 2012; Ponelis, 2015; Yin, 2018).

In summary, the integration of an interpretivist paradigm with a case study research strategy allowed for a comprehensive exploration of how organisations navigate environmental sustainability. It facilitated understanding of the managerial meaning-making processes and contextualises them within real-world organisational settings, adhering to best practices in qualitative case-based research (Harrison et al., 2010; Lewis et al., 2023; Packard, 2017).

### **4.3 Research setting**

The setting of this research was situated in South Africa, with a focused examination of entities operating within the mining and automotive sectors. These sectors were strategically chosen due to their substantial economic contribution and significant environmental impact within the South African context. The study employed a purposive

sampling approach to ensure the representative selection of organisations from this specified population.

The research centred on automotive and mining companies primarily listed on the Johannesburg Stock Exchange (JSE). Some of these were subsidiaries of multinational corporations listed on the JSE or other recognised global stock exchanges. This setting was deliberately selected because JSE-listed companies are mandated under the JSE listing requirements to comply with established sustainability reporting standards. Notably, the JSE introduced the Sustainability Disclosure Guidance and Climate Disclosure Guidance in 2022, which require companies to report on approximately sixty environmental, social, and governance (ESG) factors (JSE, 2022; Maubane et al., 2014). These guidelines align with global frameworks such as the Global Reporting Initiative and the International Sustainability Standards Board, ensuring the rigour and comparability of sustainability disclosures within the South African market context.

Consequently, this regulatory environment provided a relevant and robust framework to investigate how organisations implement both internal and external mechanisms as part of their environmental initiatives. The availability of publicly accessible, standardised sustainability reports lends credence to the dual data sources used in this study, comprising primary qualitative data from interviews and secondary organisational data from sustainability disclosures. This setting was thus well-suited to addressing the research question concerning the role of these mechanisms in enhancing environmental and organisational performance.

#### **4.4 Time horizon**

Cross-sectional studies were employed in this multi-case qualitative research to provide a 'snapshot time horizon,' as described by Lewis et al. (2023). This design involved collecting data at a single point in time from multiple cases to understand the phenomenon under investigation comprehensively. Whilst a longitudinal approach could offer insights into how the phenomenon evolves over a longer period, it poses significant practical challenges related to increased cost and time commitments.

Despite these limitations, the cross-sectional design remained appropriate and capable of generating robust and high-quality findings. It enabled the study to focus on capturing the insights of organisations regarding how they deploy internal and external mechanisms to manage environmental pressures within a relatively short timeframe. This approach was particularly useful for exploring evolving organisational practices without the extensive resource demands of longitudinal research.

Therefore, the study concentrated on understanding firms' experiences and strategies at a specific moment, allowing for effective data collection and analysis that reveal meaningful patterns relevant to the research aims. The cross-sectional method aligns well with the interpretivist paradigm by providing rich, contextualised data that reflect managers' perspectives and organisational realities during the period of study (Lewis et al., 2023).

#### **4.5 Unit of analysis and level of analysis**

The organisational level of analysis in research focuses on understanding the overall structure, culture, systems, and processes within an organisation (Yurdusev, 1993). Therefore, the level of analysis is at the organisational level.

##### *4.5.1 Unit of analysis*

The unit of analysis in research refers to the main entity or "actor" being studied, such as individuals, groups, organizations, countries, social phenomena, or artifacts (Yurdusev, 1993). It answers the "what" or "who" question in a study and determines the primary subject about which conclusions will be drawn. The choice of unit of analysis is crucial as it guides data collection, methodology, and the interpretation of research findings

The unit of analysis for this study was a case(s), being the organisations studied in this research. The study followed a multi-case analysis to explore the phenomenon. Whilst the unit of analysis is the case (company/organisation), the case had to have two datasets (a requirement as per Yin, (2018)), primary data (interviews) and secondary data (the company's public environmental records).

##### *4.5.2 Level of analysis*

Level of analysis, on the other hand, relates to the broader context or scale at which the data is examined or the framework within which the analysis is conducted. It may be described as micro (individual), meso (groups or organizations), or macro (large-scale institutions, systems, or societies) (Yurdusev, 1993). Whilst unit of analysis defines the entity studied, level of analysis refers to the position or lens through which the phenomena are analysed (Yurdusev, 1993). A clearly defined level of analysis (Barrat et al., 2011) will help explain the phenomenon being studied. Simply put, the level of analysis refers to the data gathered and analysed to answer the research question. In this study, the phenomenon that was studied, was at the organisational level, was the environmental initiatives that are deployed to improve environmental and organisational performance.

## 4.6 Sampling method, sampling frame or criteria and sample size

### 4.6.1 Sampling method

This study's research approach was a multi-case study, in which businesses were chosen purposively to offer detailed information about the phenomenon in its actual context (Yin, 2018). According to Yin (2018), the process of selecting a sample for a multi-case study is contingent upon the complexity inherent in the research question or the phenomenon under investigation.

### 4.6.2 Sampling frame or criteria

The cases for this study were purposively selected from sectors of the South African economy known for their high levels of emissions, specifically the mining and automotive sectors. These sectors were recognised as the largest contributors to the country's greenhouse gas emissions, making them highly relevant for investigating environmental phenomena and sustainability initiatives. Selecting organisations within these sectors ensured that the study captured critical insights into how firms manage and respond to environmental pressures.

Managers within these organisations were selected based on their expertise, knowledge, and direct involvement with environmental matters, including the implementation of environmental initiatives and the monitoring of environmental and organisational performance. This purposive sampling approach ensured that participants possess the requisite experience to provide rich, meaningful data relevant to the research objectives.

To qualify for inclusion in this study, organisations and participants had to meet the following criteria:

1. Operate within South Africa, specifically in sectors characterised by high emissions;
2. Belong to either the mining or automotive sectors;
3. Have managerial staff with demonstrable experience and knowledge of the organisation's environmental management practices.

These criteria established a systematic and objective selection framework, guiding the sampling process to avoid subjective preferences or biases. The clarity and transparency of the inclusion requirements allowed for consistent identification of suitable organisations, facilitating the collection of relevant and credible data. Given this systematic, criteria-based approach, no explicit organisational permission was required

for case inclusion, as the study relied on publicly available data and voluntary participation from knowledgeable managers.

This rigorous selection process ensured the research focused on entities that are both strategically and operationally significant to South Africa's environmental performance landscape, lending robustness and relevance to the study's findings.

#### *4.6.3 Sample size*

Sampling is central to the process of theorising in qualitative inquiry, as emphasised by Budhwar and Plakoyiannaki (2021). Contrary to the traditional belief that larger sample sizes always yield better outcomes, recent scholarly discussions challenge this notion by highlighting the value of single-site studies for advancing process thinking, facilitating comparison, replication, and variance-based theorising (Bansal et al., 2018). In this pursuit of alternative approaches to theorising that reconcile the tension between context and explanation, Eden and Nielsen (2020) advocate for the concept of 'contextualised explanation.' This approach aims to capture the generative mechanisms embedded within specific contexts and temporal frames, thereby shifting focus from generalised explanations towards idiographic and richly contextualised understandings.

This evolving perspective underscores the importance of carefully considering sample size and selection strategies in qualitative research, prioritising depth and contextual richness over mere numerical breadth. The aim is to enable comprehensive and nuanced theorising that is sensitive to the idiosyncrasies of research settings and participant experiences.

In determining the appropriate number of cases to be included in the study, the researcher was careful to consider the depth and intricacy of the subject matter. Yin (2018) recommends that, for multi-case study designs, the sample size typically falls within a range of three to six cases. This range allows for a balanced approach that facilitates analytical rigour while ensuring manageability and comparability across-cases. The planned sample size was originally four companies with two managers per company, and triangulated to four environmental/sustainability reports, which would have amounted to 16 datasets.

Due to companies only having one individual manager available who shared insights about their organisations, an additional company meeting the selection criteria as per the pre-set selection criteria was added to increase the cases and datasets, and therefore five (5) companies were purposively selected, which aligns to the upper-level range of six cases as recommended by Yin (2018). This upper level allowed for a

balanced approach that facilitates analytical rigour while ensuring within-case manageability and cross-case comparability. This chosen sample for the study was therefore appropriate to capture sufficient variation to address the research study's objectives of how organisation's environmental initiatives to improve organisational performance, comprehensively, without rendering the study unfeasible due to excessive complexity or scale. The planned and actual sample is as per the below Table 2 and Table 3:

*Table 2: Planned research participants and ESG reports*

No.	Unique identifier	Participant coding	Public non-human report coding	Industry
1	Green: Company A	Participantx3	Company A ESG report	Mining
2	Gold: Company B	Participantx3	Company B ESG report	Mining
3	Orange: Company C	Participantx3	Company C ESG report	Mining
4	Blue: Company D	Participantx3	Company D ESG report	Mining

**Source: Author's own**

*Table 3: Actual interviewed research participants and reviewed ESG reports*

No.	Unique identifier	Participant coding	Public non-human report coding	Industry
1	Green: Company A	Participant 1	Company A ESG report	Mining
2	Gold: Company B	Participant 1	Company B ESG report	Mining
3	Orange: Company C	Participant 1	Company C ESG report	Mining
4	Blue: Company D	Participant x2	Company D ESG report	Mining
5	Yellow: Company E	Participant 1	Company E ESG report	Mining

**Source: Author's own**

In this study, five cases (organisations) were therefore selected to study the phenomenon, and semi-structured interviews with managers (primary data) were conducted and triangulated with public non-human data (companies' publicly available environmental-related reports), yielding 11 data points (6 interviews and 5 publicly available records). The interviews with the managers and the review of public non-human data created two data sets for each case (organisation) selected, and each with its own instrument, data gathering, and data analysis. The interpretive information from research participants was triangulated with content analysis of the organisation's environmental reports, which enhanced the primary data. The selection of five cases was purposive,

and the cases being from the mining were considered sufficient to provide a rich and nuanced understanding of the phenomenon under study, as the companies in this sector generate high emissions in South Africa.

#### **4.7 Research instrument**

This qualitative study was conducted through an interpretivist philosophy, and with an exploratory aim to provide insights and lived experiences of the managers of the organisations in dealing with environmental sustainability.

##### *4.7.1 Primary data (interviews)*

To enable research participants, specifically senior managers, to provide rich insights into their experiences, skills, and knowledge regarding their firm's processes, a semi-structured interview approach was employed as the primary data collection instrument. The semi-structured interview provided the researcher with the flexibility to probe and encourage participants to elaborate on or clarify their initial responses, thereby eliciting deeper and more nuanced understandings (Lewis et al., 2023). The interviews were guided by a carefully developed interview guide, which contained the requisite questions approved as part of the Ethical Clearance Form (specifically question 7), and this guide is appended as an annexure to this submission. The interviews were scheduled for sixty minutes (60 minutes) and lasted anything between forty-five minutes to sixty minutes.

In adherence to ethical considerations, the study excluded vulnerable populations from participation, as affirmed by compliance with question 5 of the Ethical Clearance Form. Participation was entirely voluntary, with no coercion exerted on potential/actual participants. This ethical commitment was reinforced by obtaining signed consent forms from all participants, who were continuously reminded of their right to withdraw from the interview at any point if they felt uncomfortable, in accordance with question 6 of the Ethical Clearance Form.

There were instances where participants chose to discontinue their interviews upon learning that the sessions would be audio-recorded. Despite being reassured that recordings were solely for transcription and analytic purposes, participants exercised their right to opt out of recording, illustrating the study's respect for participant autonomy and confidentiality.

This methodological approach, combining a structured framework with flexibility for deeper exploration, ensured the collection of comprehensive and ethically sound qualitative data.

#### 4.7.2 Secondary data (public non-human records of the companies)

The interviews conducted with the managers of the organisations constituted the primary dataset for this study, collected in an open-ended and unprescribed manner, consistent with qualitative inquiry principles (Josselson, 2013). Complementing this, the firms' publicly available environmental documents served as the secondary dataset. These documents, including environmental reports and sustainability disclosures, were subjected to systematic content analysis to extract insights into the environmental initiatives employed by organisations to enhance environmental performance, ultimately contributing to organisational performance.

The content analysis involved coding the organisational environment, sustainability, and governance (ESG) reports to identify recurring themes and patterns relating to environmental initiatives and governance practices. This methodological combination enabled a robust triangulation of data by integrating rich, experiential insights from managerial interviews with objective (Yin, 2018), documented information provided in the environmental reports. This approach strengthens the study's validity and provides a comprehensive understanding of how environmental management is operationalised within these firms.

By leveraging both primary and secondary qualitative data sources, the study ensured a nuanced and well-rounded exploration of organisational environmental strategies, aligning with best practices in qualitative research methodology. The organisational environment, sustainability and governance (ESG) reports were coded as per below:

*Table 4: Coding of public non-human information*

No.	Unique identifier	Public non-human report coding	Industry
1	Green: Company A	Company A ESG report	Mining
2	Gold: Company B	Company B ESG report	Mining
3	Orange: Company C	Company C ESG report	Mining
4	Blue: Company D	Company D ESG report	Mining
5	Yellow: Company E	Company E ESG report	Mining

**Source: Author's own**

## 4.8 Data gathering process

### 4.8.1 Primary data (interviews)

The interviews with senior managers were conducted over a period of eight weeks, providing ample time to accommodate scheduling challenges such as cancellations and rescheduling. These interviews took place online via the Microsoft Teams platform,

facilitating convenient and flexible engagement with participants. The primary data collection technique employed was semi-structured interviews, which allowed the researcher to use a combination of predetermined open-ended questions and explore emerging themes through follow-up probes. This method enabled the collection of rich, detailed data centred on the managers' experiences and knowledge of their organisations' environmental and sustainability practices.

This semi-structured approach strikes a balance between structure and flexibility, ensuring the research objectives were addressed while allowing participants to elaborate freely on relevant issues. Conducting the interviews online was particularly effective in reaching senior managers who possess specialised expertise in environmental and sustainability matters, thus ensuring the data captured was both relevant and insightful.

This methodological approach aligns with best practices for qualitative data collection, maximising data richness and participant engagement under contemporary research conditions (Lewis et al., 2023).

#### *4.8.1.1 Consent form*

Prior to data collection, each research participant provided written informed consent by signing a Consent Form, in accordance with the requirements outlined in question 8 of the Ethical Clearance Form. Participants selected for the interviews were identified based on their expertise and knowledge of environmental matters within their organisations, ensuring that only well-informed individuals contributed to the study.

In response to questions 10, 11, and 12 of the Ethical Clearance Form, the study ensured that participants fully understood the nature and purpose of the research, mitigating any risk of misunderstanding. This was achieved through the rigorous application of systematic participant selection criteria. Furthermore, no harm was posed to participants during the research process. All data collected have been anonymised to protect participant confidentiality and stored securely without any identifying information, consistent with ethical standards. No name of individual or organisations are identified, and the reporting of data is on an aggregated basis. As a response to question 14 of the Ethical Clearance Form, confidentiality document was signed for the information gathered through interview process, and commitment to store and analyse data with no identifiers as outlined in the proforma Consent Form.

This comprehensive approach to informed consent, participant protection, and data confidentiality aligns with best practices in qualitative research ethics.

#### *4.8.2 Secondary data (public non-human data)*

The insights derived from the six interviews, as described above, along with the content analysis of five publicly available organisational documents, were critical for establishing background context, enriching analysis, and providing data triangulation. The secondary data comprised publicly accessible non-human sources, including Integrated Financial Reports, Climate Reports, Sustainability Reports, Environmental Reports, and ESG (Environmental, Social, and Governance) Reports. These documents were systematically content analysed to gain a deeper understanding of the internal and external mechanisms organizations employ to enhance environmental performance, thereby contributing to overall organizational performance.

Content analysis focused on thematic areas arising from primary data, which detail key environmental governance and sustainability issues pertinent to the study. This methodological triangulation using multiple data sources enhanced the validity and comprehensiveness of the findings by cross-verifying evidence from managers' interpretations alongside documented organisational practices and disclosures. Such a triangulated approach aligns with established qualitative research methodologies that advocate integrating diverse data sources to strengthen credibility and contextual richness (Lewis et al., 2023).

By combining primary interview data with secondary document analysis, this study ensured an enriched, multi-faceted understanding of firm-level environmental initiatives and their relationship with organisational outcomes.

### **4.9 Data analysis approach**

#### *4.9.1 Data quality*

This study employed an inductive analysis approach to examine both the interviewer notes and full transcriptions of the interviews. All analysis was conducted using the original language of the participants to preserve the authenticity and intended meaning of their responses within the interview context. Audio data were converted to text through Microsoft Teams transcription capabilities, followed by meticulous verification for accuracy and correction of typographical errors. Both the original audio files and notes were securely backed up to safeguard against data loss.

Thematic analysis was utilised as the primary method for identifying and reporting patterns and themes within the data, as outlined by Braun and Clarke (2020). According to Lewis et al. (2023) the essential purpose of thematic analysis in qualitative research is to uncover relevant themes and patterns that directly address the research questions.

The data were coded into three broad categories: environmental initiatives, environmental performance and organisational performance, which illustrate how MNEs contribute to solutions around greenhouse gas emissions and environmental sustainability.

Secondary data, sourced from publicly available non-human data such as environmental and sustainability reports, were likewise vetted for accuracy and quality to complement the primary data. In line with ethical compliance, as detailed in question 13 of the Ethical Clearance Form, the transcription process was conducted using Microsoft Teams tool, negating the need for an independent transcriber.

This thorough inductive thematic analytic approach ensured that findings emerged organically from the data, maintaining fidelity to participants' perspectives while generating meaningful, context-sensitive insights relevant to the study's objectives.

#### *4.9.2 Data analysis approach*

As outlined above, the research philosophy for this study was premised on interpretivism paradigm. With this interpretivism paradigm data was collected for the study on the firm's manager insights, experience, skill and knowledge. For the data to be of quality through this lived experience, it must be reliable and be valid. Validity is the extent that the research has gained access to participants knowledge and experience and can infer their intended meanings from the language used by that person (Lewis et al., 2023). There should not be bias and mishandling of data to preserve data quality. As this was an interpretive, as research progressed and was narrowed or changed, all changes were recorded to ensure that the study still produced reliable data, through an iterative process data was analysed for theme generations.

According to DeSantis and Ugarriza (2000, p. 363) "a theme is an abstract entity that brings meaning and identity to a recurrent experience and its variant manifestations."

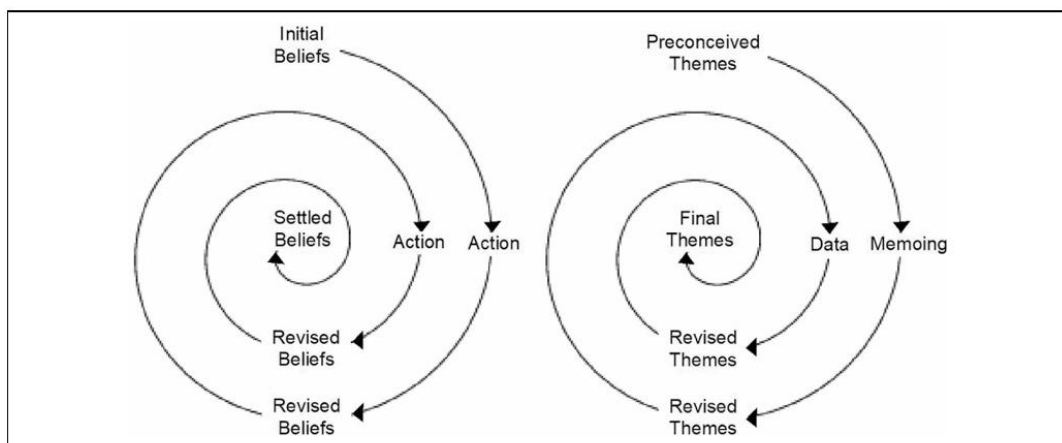
According to Morgan and Nica (2020), qualitative data analysis involves repeated cycles of thematic generation and revision, which constitute an "iterative thematic inquiry"; this process enables researchers to distill complex, multi-faceted data into concise and coherent units of meaning that facilitate structured reporting and analysis. Themes, in this context, serve as central organising principles, functioning as data reduction devices that transform raw qualitative data into manageable and interpretable constructs for scholarly dissemination (Braun & Clarke, 2019).

Braun and Clarke (2019) conceptualise themes as interpretive indicators that encapsulate patterned responses or meanings connected to the research question,

thereby reflecting salient aspects of participants' experiences or perspectives. Thematic analysis is typically employed after the completion of data collection; however, it may also be integrated during the data gathering phase, a practice that supports the ongoing refinement and adaptation of analytical categories (Braun & Clarke, 2023). The reflexive and iterative thematic analysis framework, as articulated by Udayanga (2025), reinforces this ongoing engagement, allowing researchers to alter focus and account for emerging phenomena as data analysis progresses. This adaptability is further underscored by the work of Srivastava and Hopwood (2009), who emphasise the methodological value of iterative analysis in responding to emergent concerns within the research context.

Importantly, in reflexive thematic analysis, themes are not viewed as inherent properties of the data, but rather as interpretive outputs shaped by the researcher's sustained interaction and conscious reflection throughout the analytical process (Braun & Clarke, 2023). The researcher followed an iterative process as outlined by Morgan and Nica (2020), depicted in the below schematic, Figure 3.

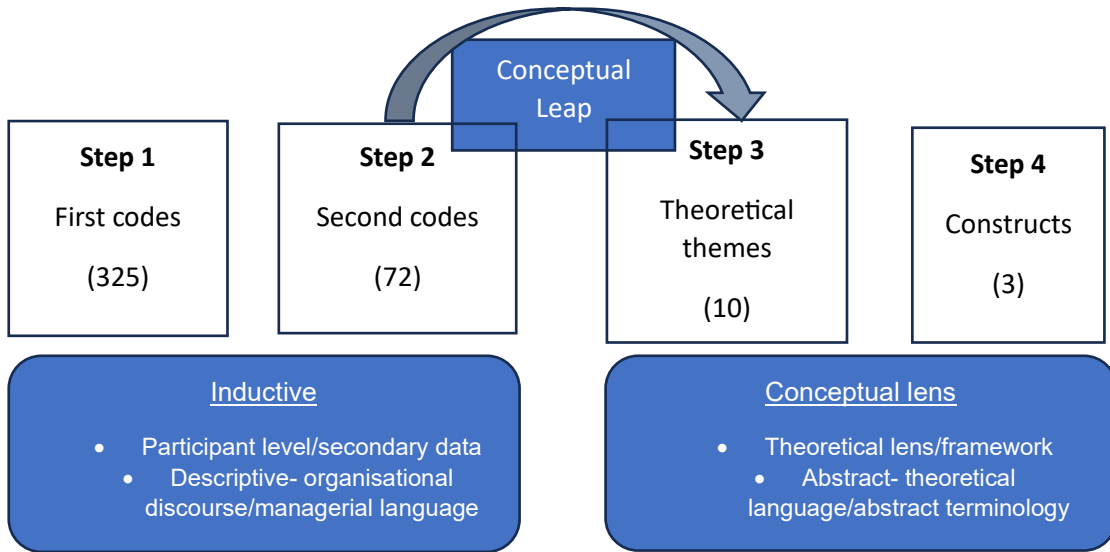
*Figure 3: The process of revising initial beliefs and pre-conceived themes*



**Source: Morgan and Nica (2020)**

The coding of the data comprising primary data and secondary data was done in ATLAS.ti and transferred to excel for ease of analysis. The first order codes, second order codes and third order codes were as below in Figure 4:

Figure 4: Systematic process of data analysis

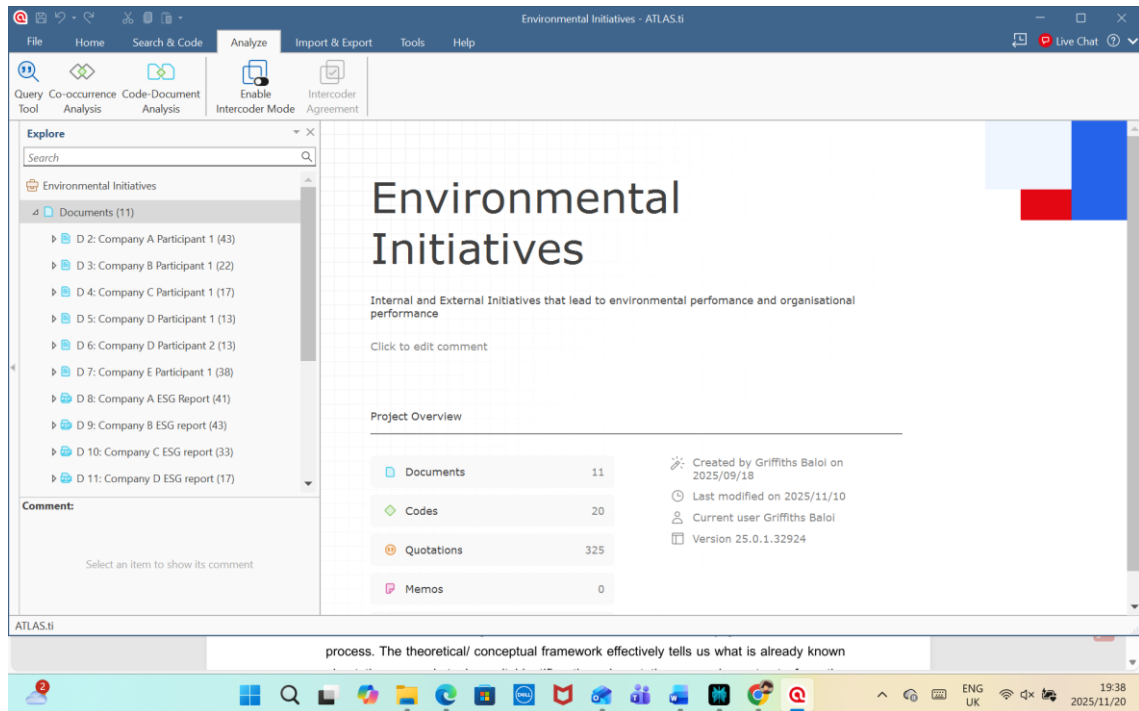


**Source: Author's own**

#### 4.9.3 Organising data

The interview transcripts generated from participant interactions formed the principal dataset for analysis, while secondary data in the form of Environmental, Social, and Governance (ESG) reports for the selected companies were subjected to content analysis to triangulate the primary findings. Both data sources were imported into ATLAS.ti, a qualitative data analysis application, to enable systematic coding and interpretation, with the researcher structuring the project by creating organised folders for each company–participant combination (for example, Company A – Participant 1; Company B – Participant 1) to maintain consistency and traceability throughout the analysis. Figure 5 illustrates the manner in which the primary and secondary datasets were grouped.

Figure 5: Excerpt from the ATLAS.ti coding analysis



#### 4.9.4 Step 1: First order coding

The analysis of each interview transcript and ESG report was conducted through an iterative process (Morgan & Nica, 2020), applying a consistent analytical procedure across all cases. During analysis, the researcher systematically identified and highlighted significant insights emerging from the data, whether manifesting as recurrent patterns or underlying meanings within the dataset (Braun & Clarke, 2006). Each highlighted excerpt, phrase, or statement was subsequently assigned a descriptive label that captured its inferred meaning. These labels constituted the initial set of codes, which collectively amounted to more than 325 distinct codes in the preliminary coding phase.

#### 4.9.5 Step 2: First order categories

The first-order coding approach involved generating first-order concepts anchored in participants' own language, expressions, and lived experiences, thereby preserving their authentic meanings with minimal researcher interference (Corley et al., 2013). As a crucial preliminary stage in inductive theory building, it facilitates a systematic organisation of the raw data while maintaining close alignment with participants' viewpoints prior to the abstraction and synthesis of higher-order themes. Corley et al (2022) conceptualises these first-order concepts as informant-centric codes derived directly from empirical data through participants' terminology and interpretations. In line with this, Corley et al (2022) emphasises that a rigorous qualitative analysis should

integrate both first-order (informant-based) and second-order (researcher-based) insights within a coherent data structure that reflects the interplay between participants' perspectives and the researcher's conceptual interpretation. The researcher identified over 325 first-order codes which we subsequently grouped researcher-based insights to 72.

#### *4.9.6 Conceptual leap*

In qualitative research, Klag and Langley (2013) describe a conceptual leap as a deliberately recognised abstract idea that emerges during the empirical phase of a study. Such a leap represents an interpretive movement that connects empirical observations with theoretical understanding and may, though not necessarily, evolve into a formal theoretical contribution in the completed research (Klag & Langley, 2013). Achieving this leap involves bridging the interpretive distance between empirical data and conceptual theorisation (Klag & Langley, 2013).

#### *4.9.7 Applying conceptual leap*

In qualitative research, making a conceptual leap entails the deliberate and reflective process of transforming empirical observations into abstract theoretical ideas. This process, as emphasised by Klag and Langley (2013), involves iteratively bridging the gap between concrete data and conceptual frameworks, thereby facilitating theory development. Such a leap is not necessarily linear or guaranteed to culminate in a finalised theoretical contribution however it represents an important act of theoretical abstraction within an empirical study (Klag & Langley, 2013). According to Klag and Langley (2013, p 151) conceptual leap "emerge over time through connections between data and ideas suggests broadening the focus beyond the conceptual leap as a singular magical event to consider conceptual leaping as a process".

In leaping from the empirical findings into a conceptual framework, the researcher referred to conceptual framework that facilitated the literature review as outlined in Chapter 2.

#### *4.9.8 Step 3: Theoretical themes*

The second order analysis as outlined under "applying conceptual leap" were at level of theoretical lens. This aligns with Klag and Langley (2013) conceptual leap of moving from empirical data to theoretical abstraction.

The phrase "researcher-as-instrument" denotes the researcher's role as an active participant and primary tool in the research process (Miller-Day et al., 2012). In this

capacity, researchers employ their sensory faculties to directly engage with and apprehend the phenomena under investigation (Miller-Day et al., 2012). These sensory experiences are subsequently internalised and reflected upon within the researcher's consciousness, where they are transformed into phenomenological representations.

The researcher successfully aligned most of the themes derived from the first-order categories with the pre-existing theoretical themes, while those that could not be accommodated within the existing framework were consolidated into newly defined themes.

#### 4.9.9 Step 4: Mapping themes to constructs

In this phase of the analysis, the researcher aligned the identified themes with the overarching constructs outlined in Chapter 1.

Table 5 presents the outcome of this mapping process, illustrating how subthemes were organised under corresponding themes, and how these themes were subsequently linked to the main constructs.

*Table 5: Second order codes, theoretical themes and constructs*

Constructs	Themes	Sub-themes
Environmental initiatives	Peer collaboration and stakeholder green value co-creation	National collaboration (MCSA/DMPR)
		International industry body collaboration (ICMM)
		Interorganisational collaborations
		Inter-sectoral partnership models
		Regional multi-infrastructure governance
	Green investment	Organizational Renewable Energy Investments
		Third-Party Renewable Energy Procurement
		Operational Eco-Efficiency Initiatives
		Power Purchase Agreement (Renewable)
		Integrated Water Resource Management Strategies
		Circular Process Engineering Innovations
		Transitional Low-Carbon Energy Generation
		Energy Demand Reduction Technologies
		Adoption of Electrified Machinery
		Strategic Green Technology Investment
		Air Quality and Particulate Matter Mitigation Strategies
		Circular Economy Integration Models
		Extended Supply Chain Decarbonization Initiatives
		Innovation and digital technology
	Digital Environmental Data Reporting Systems	
	Automation-Driven Environmental Monitoring	
	Advanced Engineering for Environmental Sustainability	
	Resource Optimization Technologies	
	Bioremediation technologies	
	Sulfuric Emission Reduction Technologies	
	Digital Sustainability Analytics and Disclosure Practices	
	Artificial Intelligence-Enabled Environmental Management	
	Extended Reality Applications in Sustainability	
	Digital Twin Modelling for Sustainability	
	Public Private Partnerships	
		Municipal Water Efficiency Initiatives
		Local Government Sustainability Projects

		Environmental Regulatory Compliance and Stakeholder Engagement
<b>Environmental Performance</b>	Carbon capture and carbon offset	Natural Gas to Electricity Conversion Initiatives
		Carbon offset strategy embedded
		Corporate Carbon Offset Programs
	Waste management	Tailings Facility Risk Optimization Strategies
		Waste repurposing
		Integrated Waste Minimization Approaches
		Sustainable Supplier Sourcing Policies
		Regulatory Waste Management Compliance
	Greenwashing	Sector-Specific ESG Disclosure Frameworks
		International ESG Reporting Standards Implementation
		IFRS Sustainability Standards Adoption
		United Nations Global Compact Affiliation
		Strategic Integration of UN SDGs
		Sectoral ESG Reporting Supplements (Mining/Metals)
	Nature-based solutions	GHG Emissions Protocols and Disclosure Instruments
		Biodiversity Mainstreaming Practices
		Strategic Biodiversity Management Frameworks
		Ecosystem Conservation Initiatives
		Ecological Restoration and Rehabilitation Programs
Nature–Climate Synergy Models		
Protected Area Stewardship Practices		
Ecologically Responsible Tourism Support		
Corporate Wildlife Management Programs		
Landscape-Scale Ecosystem Restoration		
Habitat Creation and Management Practices		
Cultural and Ecological Heritage Protection Policies		
Water, land and air quality management		
<b>Organisational performance</b>	Access to credit/funding	Environmental Due Diligence in Sustainable Finance
	Reduce costs/increase value	Sustainability Performance as Capital Access Enabler
		Operational Resource Efficiency Programs
		Continuous Improvement in Production Sustainability
		Green Product Innovation Initiatives
		Reduction of Environmental Rehabilitation Liabilities
		Supplier Engagement for Low-Impact Product Sourcing
		Cost effective and efficient technologies
		Renewable energy (electricity cost reduction)
		Access to funding
		Waste Monetization and Value Recovery Mechanisms
Demand-Side Load Shifting Programs		

**Source: Author’s own**

#### 4.10 Research rigour and quality

Methodological decisions fundamentally influence the quality of knowledge produced in research (Welch et al., 2022). The concept of rigour-in-context asserts that rigour should be evaluated based on the intrinsic logic and merits of the research project itself, rather than by adhering rigidly to external rules or predefined templates (Corley et al., 2022). Rigour, therefore, emanates from the “internal logic” of the study, as articulated by Feldman et al. (2022) emphasising coherence and systematic reasoning throughout the research process.

According to Cornelissen and Harley (2022), rigour arises from researcher’s deliberate and reflective reasoning in inferring theoretical claims from their empirical data. This approach confers an objective ontological status to qualitative data such as interviews,

facilitating systematic and unobtrusive revelation of pre-existing themes. It minimises contamination from subjective biases by adhering to analytic procedures that meet standards of scientific rigour (Bakhoo et al., 2022; Klag & Langley, 2019).

The cases selected considered aspects such as access to data and cases selected enabled illumination of the research questions (environmental initiatives that intervene in environmental performance, and leads to organisational performance), and ensure (a) construct validity, (b) internal validity, (c) external validity, and (d) reliability (Yin, 2018).

In essence, rigour in qualitative research is demonstrated through sustained, transparent, and disciplined analytic rigour, where theoretical insights are carefully and logically derived from data while remaining aware of and managing the researcher's interpretive influence. This conceptualisation reinforced the reliability and trustworthiness of the knowledge generated in this qualitative inquiry.

#### **4.11 Ethical clearance**

Ethical considerations constitute a fundamental aspect of formulating a sound research design, as underscored by Lewis et al. (2023). At its core, ethics in research are concerned with safeguarding participants from harm, preserving their dignity, and ensuring moral integrity throughout the research process. The concept of harm, deeply rooted in centuries of moral philosophy and ethical theory (Reynolds, 2006), encompasses potential risks such as physical or psychological harm, embarrassment, and violations of privacy or confidentiality.

In the context of business ethics research, the focus extends to ethical decision-making within organisational settings with the goal of enhancing business managers' ethical thinking and behaviour (Brenkert, 2009). This study, therefore, incorporated key ethical safeguards by ensuring that the research did not expose participants to harm or embarrassment, protected their privacy through stringent confidentiality measures, and upheld integrity in data handling and reporting.

Practical ethical measures included responsible access negotiation with firms, conducting interviews with respect and transparency, careful management of sensitive firm data, and fully informing participants of their voluntary participation rights. Anonymity was rigorously maintained to protect participant identities, reinforcing trust and ethical compliance.

*Ethical Clearance Form Question 14: Confidentiality and Anonymity*

Data collected during this study were stored without any identifying information to protect participant confidentiality. Pseudonyms were systematically assigned to participants, effectively safeguarding their identities while maintaining the integrity and confidentiality of the data. Where necessary, appropriate paraphrasing was employed to preserve the original meaning of responses without compromising participant anonymity or intent.

All data were securely stored in encrypted, password-protected folders with restricted access to ensure data security.

This rigorous approach to data anonymisation and security reinforces the ethical integrity of the research and ensures that participants' privacy and trust are maintained throughout the research process.

#### *Ethical Clearance Form Question 15: Organisational permission*

Any organisation that fulfilled the criteria outlined in the sampling method and sampling frame, specifically purposive sampling, operating within South Africa's high emission sectors of mining and automotive industries, and with participants possessing experience and knowledge of environmental performance, was considered suitable for inclusion in this research. Consequently, question 15 of the Ethical Clearance Form was answered in the negative, as formal organisational approval or permission was not required; the sample comprised all organisations meeting the defined criteria.

Primary data derived from interviews were anonymised to protect company and participant identities, and no identifying information was included. Secondary data sourced from publicly available organisational documents were paraphrased to further ensure anonymity and prevent disclosure of sensitive information. This methodological approach upholds ethical research standards while enabling comprehensive inquiry into environmental performance within these critical economic sectors.

#### **4.12 Public non-human data**

##### *Ethical Clearance Form Q16: Records to be used*

The secondary data used in this study comprised purposively selected reports related to environmental performance from high-emission companies operating within the South African mining and automotive sectors. These records included Integrated Financial Reports, Climate Reports, Sustainability Reports, Environmental Reports, and Environmental, Social, and Governance (ESG) Reports. These documents, published by the organisations under study, served as valuable sources for content analysis aimed at

elucidating how internal and external initiatives contribute to environmental performance improvements and, consequently, organisational performance.

The content analysis focused on extracting themes and insights related to environmental governance, sustainability practices, emissions reduction efforts, and related strategic initiatives as detailed in the reports. By purposefully including these documents as secondary data sources, the study ensured that the contextual background, substantiating evidence, and complementary information could be integrated with the primary interview data. This integrative approach fostered a comprehensive understanding of the organisations' environmental performance within the focused sector.

Such secondary data sources offer authentic, publicly disclosed information essential for robust qualitative inquiry and enhance the methodological triangulation underpinning the study's findings (Lewis et al., 2023).

*Ethical Clearance form Q17: Legal accessibility and copyright of the reports*

The reports accessed for this research comprised solely publicly available documents, with no legal restrictions on their use. These reports were produced by companies required to disclose their environmental affairs publicly under Johannesburg Stock Exchange (JSE) listing requirements. To ensure compliance with copyright and legal use restrictions, a systematic review was conducted, including a word search within the documents to identify any copyright statements or limitations on use. By adhering to these guidelines and conducting due diligence related to legal and copyright compliance, this research ethically and responsibly utilised high-quality corporate environmental reports for content analysis. As detailed in the accompanying table, each report was checked to confirm the absence of legal barriers or copyright claims that would restrict their use in this study.

*Table 6: Copyrights and legal restrictions checks*

No.	Unique identifier	Public report coding	Non-human	Legally Restricted?	Copyright restrictions?
1	Green: Company A	Company A ESG report		No	No
2	Gold: Company B	Company B ESG report		No	No
3	Orange: Company C	Company C ESG report		No	No
4	Blue: Company D	Company D ESG report		No	No
5	Yellow: Company E	Company E ESG report		No	No

**Source: Author's own**

#### **4.13 Confidentiality of the research report**

In response to question 23 of the Ethical Clearance Form, this research report has no limitation of publication and can therefore be published in any medium, as per the Gordon Institute of Business Science (GIBS), with no limitations/restrictions.

#### **4.14 Data storage and dissemination of the research report**

##### *Data storage*

As a response to questions 24 and 25 of the Ethical Clearance Form, the data gathered has been stored safely, in an appropriate format, encrypted, and in a password-protected folder to ensure there is restricted access. The collected data (primary and secondary) will be stored for a minimum of 10 years, with no identifiers.

##### *Research Report Dissemination*

As a response to question 26 of the Ethical Clearance Form, the research report produced from this study have no restrictions for dissemination and can therefore be distributed through any medium/media with no limitations. As a response to question 27, the consent that was obtained from the research participants this aligns with the response provided in question 26 of the Ethical Clearance Form.

#### **4.15 Limitations of the research design and methods**

A key limitation of this study relates to the time constraints under which the research was conducted and the novice status of the researcher. As this was the researcher's first study of this nature, there may have been inherent limitations in the design and execution of the research process. However, to mitigate these challenges, the researcher adhered closely to established research methodology guidelines from academic literature and actively participated in university-provided workshops designed to enhance research skills.

Additionally, the interpretive nature of the study introduces a potential limitation in that qualitative data can be open to multiple interpretations. This interpretive flexibility is inherent in qualitative inquiry and invites diverse understandings of the data and findings. Recognising this, the researcher endeavoured to apply rigorous analytic procedures and methodological transparency to strengthen the credibility and trustworthiness of the study's outcomes.

## 5. Chapter 5: Findings

### 5.1 Presentation of findings

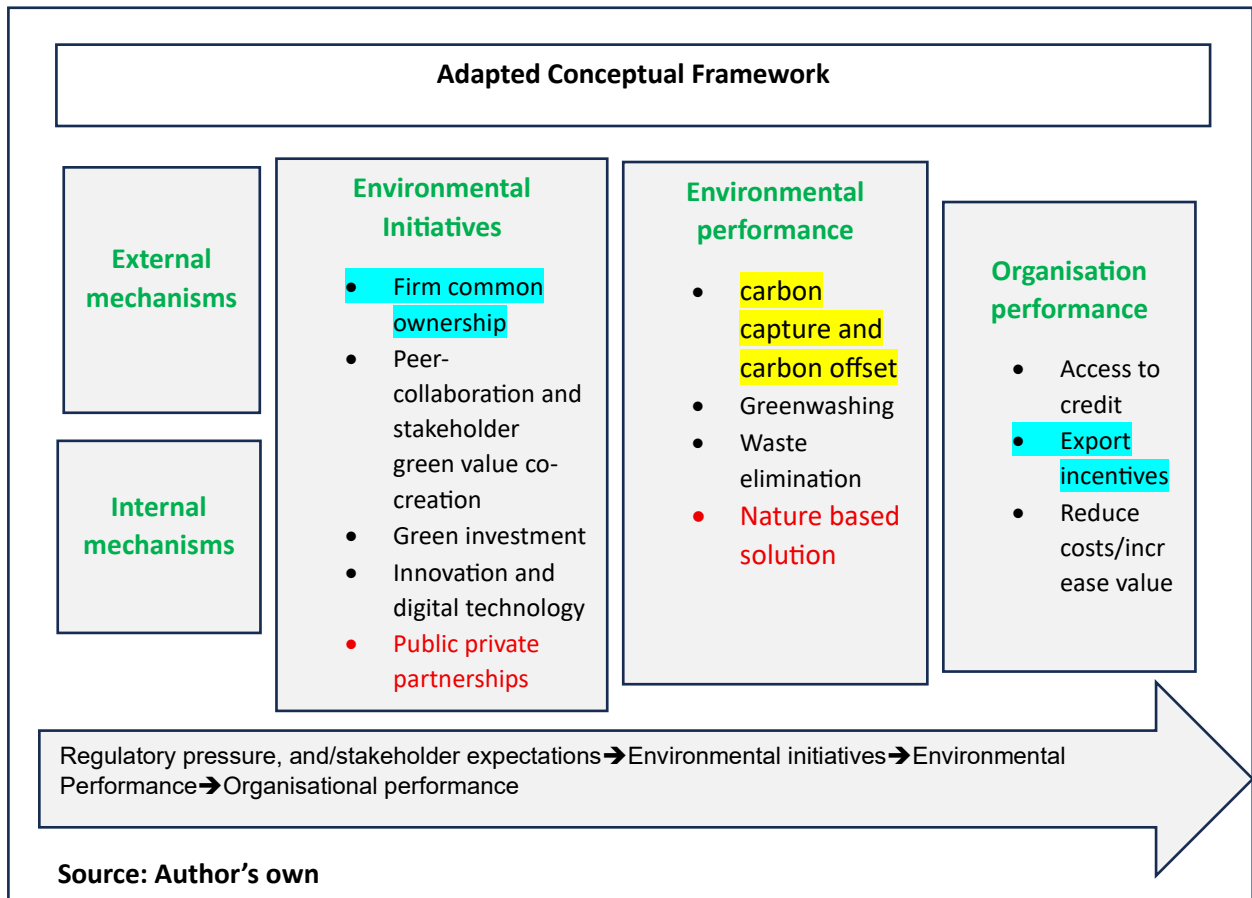
The subsequent section presents the findings generated from the analysis of the data collected, as outlined in the methodology chapter. The results, incorporating both primary and secondary data, are depicted in Figure 6. From this integrated analysis, twelve themes were initially discerned, corresponding to the key constructs in the original conceptual framework developed at the end of Chapter 2, which was itself formulated in alignment with the study's research questions.

During the process of data analysis, no evidence was found to substantiate two anticipated themes, namely, "firm common ownership" under the construct of environmental initiatives and "export incentives" under the organisational performance construct. Consequently, these themes are excluded from further discussion in this chapter.

Furthermore, amongst the remaining twelve themes, three themes, "reduced carbon emissions/toxins," "carbon emissions control," and "carbon certification", were observed to reflect closely interrelated activities. These have therefore been consolidated and redefined under a unified theme titled "carbon capture and carbon offset."

In addition, two emergent themes arose exclusively from the primary data analysis, which were subsequently corroborated through secondary data triangulation. These new themes are considered to provide novel insights and a deeper understanding of the research phenomenon. Accordingly, they have been integrated into the adapted conceptual framework, where they are highlighted in red under their respective constructs, as depicted in Figure 6.

Figure 6: Adapted Conceptual Framework



The findings are systematically organised into ten discrete themes, each mapped onto the corresponding research questions detailed in Chapter 3. The ensuing discussion addresses each theme in relation to its associated research question, and the chapter closes with a tabulated synthesis of the sub-themes generated from the analysis of the data.

For analytical rigour and clarity, participants were grouped according to the companies they represented, with each company anonymised and designated as Company A (Green) through Company E (Yellow). Where multiple participants from a single company were interviewed, they were assigned sequential codes (e.g., Participant 1, Participant 2), thereby facilitating both in-depth single-case (company-level) analysis and robust comparative-case (inter-company) comparisons. This systematic coding scheme was similarly applied to all participants and documentary sources, ensuring ease of reference throughout the analysis:

Table 7: Coding of companies, participants and reports

<b>Company coding</b>	<b>Green:</b> Company A	<b>Gold:</b> Company B	<b>Orange:</b> Company C	<b>Blue:</b> Company D	<b>Yellow:</b> Company E
<b>Participant coding</b>	Company A Participant 1	Company B Participant 1	Company C Participant 1	Company D Participant 1	Company E Participant 1
<b>Report coding</b>	Company A ESG Report	Company B ESG Report	Company C ESG Report	Company D ESG Report	Company E ESG Report

While the frequent mention of a particular topic or theme by participants may indicate its prevalence within the dataset, such repetition should not be construed as an indicator of its relative significance. In the context of qualitative research, the emphasis rests on the nuanced experiences and perspectives of individual participants as they pertain to the studied phenomenon and the research questions at hand. Accordingly, this study does not quantify the frequency of thematic references; rather, it characterises the occurrence of each topic using qualitative descriptors such as “multiple,” “some,” or “low to none,” reflecting the degree to which themes were articulated during the data collection process.

## 5.2 Thematic analysis of findings

The subsequent section elaborates on the thematic analysis pertaining to the research question: What are the environmental initiatives leveraged to advance environmental performance and organisational performance?

Through rigorous data analysis, ten (10) distinct themes emerged, eight representing established themes from prior literature and two newly identified in this study. Table 8 systematically displays each theme across Research Questions 1, 2, and 3, presenting the principal topics explored in each company within these thematic areas. The relative prevalence of each topic is visualised using a heat map: grey signifies minimal or absent discussion; sky blue denotes moderate engagement; and light green reflects frequent and substantive mention by the respective company.

*Table 8: Topic frequency by participant group on Research Questions 1, 2 and 3*

<b>Themes</b>	<b>Green:</b> Company A Participant 1	<b>Gold:</b> Company B Participant 1	<b>Orange:</b> Company C Participant 1	<b>Blue:</b> Company D Participant 1 & 2	<b>Yellow:</b> Company E Participant 1
Peer collaboration and stakeholder green	ICMM, VPSHR, National		Through DMR and MCSA forums	Partnering with other mines,	Neighbouring mines, water management

Themes	Green: Company A Participant 1	Gold: Company B Participant 1	Orange: Company C Participant 1	Blue: Company D Participant 1 & 2	Yellow: Company E Participant 1
value co-creation-RQ1	chambers of commerce			through industry bodies	
Green investment-RQ1	Eco/Environmentally friendly products, Process optimisation, Renewable energy investment, dust management, supply chain engagement	Eco/Environmentally friendly products, Process optimisation, Renewable energy investment, waste circular projects, furnace efficiency	Process optimisation, Renewable energy investment, Energy efficiency, fuel efficiency, AI driven business operations	Process optimisation, Renewable energy investment, Retrofits, energy management, renewable projects	Renewable projects 500mv, close water loop, tech-driven loss minimisation
Innovation and digital technology-RQ1	Efficiency related technologies, Emissions mitigation technology, GIS and digital tools, optimisation through technologies	Artificial intelligence technology,	AI for operational insights	Artificial intelligence technology, metaverse, generative AI	Technology for efficiency, water management technology
Public private partnership-RQ1			Public Private partnership on water,		
Carbon capture and carbon offset-RQ2					
Greenwashing-RQ2	Assurance providers to certify the ESG, Accurate,		Transparent data reporting		Internal and External ESG verification, Industry group participation, Transparent reporting, Systematic reporting, Data assurance,

Themes	Green: Company A Participant 1	Gold: Company B Participant 1	Orange: Company C Participant 1	Blue: Company D Participant 1 & 2	Yellow: Company E Participant 1
Waste Elimination -RQ2	Waste optimisation	Waste minimisation, prevent environmental burden, circular economy	Waste minimisation, efficiencies, waste reduction	Compliance-driven waste management, hazardous waste control	Compliance-driven waste management, safety and efficiencies
Nature based solution- RQ2	Biodiversity, conservative initiatives, rehabilitation initiatives, protecting natural areas, balance between climate and nature			Nature reserve, wildlife management, ecosystem restoration, habitat creation, Heritage protection, Water stewardship, Land and air management	Biodiversity
Access to credit-RQ3		Environmental due diligence, sustainability performance as enabler to funding			
Reduce costs/increase value- RQ3	Efficiency in resource utilization (reduce water), Production process optimisation, Environmentally friendly products, Reduce long-term liabilities (environmental liabilities) Influencing suppliers to adopt efficient, low emissions processes, Adoption of cost effective	Efficient processes, Renewable energy, Supplier partnership for value add, Access to funding, Monetisation of waste	Operational efficiency, Cost reduction (LED & battery electric vehicles), Resource efficiency, Expected long-term benefit	Efficient processes, Renewable energy, Cost reduction (LED & water), Continuous process improvement	Efficient processes, Renewable energy, water management, resource optimisation

Themes	Green: Company A Participant 1	Gold: Company B Participant 1	Orange: Company C Participant 1	Blue: Company D Participant 1 & 2	Yellow: Company E Participant 1
	and efficient technology				

Table 9: Topic frequency on Research Question 1, 2 and 3 on review of Environmental Social and Governance (ESG) reports

Themes	Green: Company A ESG Report	Gold: Company B ESG report	Orange: Company C ESG report	Blue: Company D ESG Report	Yellow: Company E ESG Report
Peer collaboration and stakeholder green value co-creation-RQ1	Peer collaboration locally and at multinational level		Collaborate through MCSA, Industry bodies, directly with peers	Collaborating with industry peers	
Green investment-RQ1	Eco/Environmentally friendly products, Process optimisation, Renewable energy investment,	Eco/Environmentally friendly products, Process optimisation, Renewable energy investment	Eco/Environmentally friendly products, Process optimisation, Renewable energy investment	Eco/Environmentally friendly products, Process optimisation Renewable energy investment	Eco/Environmentally friendly products, Renewable projects
Innovation and digital technology-RQ1	Efficiency related technologies, Emissions mitigation technology	Artificial intelligence technology,		Artificial intelligence technology,	Technology for efficiency
Public private partnership-RQ1			Public private partnership		Public private partnership
Carbon capture and carbon offset-RQ2		Replacing natural gas boilers with		Developed clear carbon offset	ESG report commits to offsets as last

Themes	Green: Company A ESG Report	Gold: Company B ESG report	Orange: Company C ESG report	Blue: Company D ESG Report	Yellow: Company E ESG Report
		green or bioenergy sources		management framework.	resort to neutralize hard-to-abate emissions in pursuit of full carbon neutrality.
Greenwashing-RQ2	ICMM's Socio-Economic Reporting Framework, IFRS, International Sustainability Standards Board	GRI, SASB standards, UNGC signatory, UN SDG in strategy, monitoring	Leverages ICMM, IFRS, GRI, mining sector reporting supplements	ESG proactive management, transparent report to meet shareholder expectations, avoid greenwashing	Reporting as per CDP, GHG Reporting protocols
Waste Elimination -RQ2	Waste repurposing, waste reduction, waste optimisation	Waste minimisation, prevent environmental burden, circular economy	Waste minimisation, efficiencies, waste reduction	Compliance-driven waste management, hazardous waste control	Compliance-driven waste management, safety and efficiencies
Nature based solution-RQ2	Multi-dimensional, air quality, dust, biodiversity,	Nature related, biodiversity	Biodiversity, heritage sites, endangered species	Nature reserve, wildlife	Biodiversity
Access to credit-RQ3					
Reduce costs/increase value-RQ3	Efficiency in resource utilisation (reduce water), Production process optimisation, Environmentally friendly products, Reduce long-term liabilities	Efficient processes, Renewable energy, Supplier partnership for value add, Access to funding, Reduce rehabilitation	Operational efficiency, Cost reduction (LED & battery electric vehicles), Resource efficiency, Rehabilitation liabilities, reduce power costs	Efficient processes, Renewable energy, Cost reduction (LED & water), Continuous process improvement	Efficient processes, Renewable energy, water management, resource optimisation, reduce power costs

Themes	Green: Company A ESG Report	Gold: Company B ESG report	Orange: Company C ESG report	Blue: Company D ESG Report	Yellow: Company E ESG Report
	(environmental liabilities) Influencing suppliers to adopt efficient, low emissions processes, Adoption of cost effective and efficient technology	liabilities, Water reuse, Recycling, emissions reduction			

## 5.2.1 RQ1: Theme 1: Peer collaboration and stakeholder green value co-creation

### 5.2.1.1 Empirical evidence of Peer collaboration and stakeholder green value co-creation

Table 10: Evidence of Peer collaboration and stakeholder green value co-creation

<p><b>Company A Participant(s):</b> <i>“So you’re not going to claim that you’re leading, you’re adopting leading practise by meeting your legal limits. Then you start pursuing performance that are leading practise. Now you collaborate with experts in the field trying to reduce or improve your performance if it’s emissions to zero. So I mean a good example here. It will be on climate change. You may have seen it in our climate report that there is a commitment to net zero and reducing emissions”</i></p>
<p><b>Company A ESG Report</b> <i>“At both global and national levels, we engage with our peers through various platforms. These include ICMM and the Voluntary Principles on Security and Human Rights (VPSHR). These initiatives provide an opportunity to share practical examples and become informed of best practices. At an operational level, we often work with other multinational and domestic mining companies through nationally run chambers of commerce to deliver a consistent industry voice during engagement on industry topics.” Page 20</i></p> <p><i>“We are committed to the principles of water stewardship across our industrial assets, solutions within our water catchments. Indigenous Peoples Social performance base and catchment context of the identified gaps. Our water microsite provides further information on activities in this space. Our industrial assets located in water through the application of strong and transparent water governance, effective management of water, and collaboration with stakeholders as part of our efforts to improve our performance and achieve responsible and sustainable water use.” Page 35</i></p>

**Company B Participant(s):** *“In terms of the machinery, for example, that we used at the Namaqua mine, where we generate emissions from the earth moving vehicles, there is a forward process on how best we can operate those machines as efficiently as possible. Again to minimise the emissions. There we do work with our suppliers in that front.”*

**Company B ESG Report:** *“We also purchased 200 goats and built a stable for the Zungu Community Cooperative and will be providing community members with training in collaboration with the Department of Agriculture. Page 63 of ESG report*

*“More than 220 supplier companies attended to hear about how Company B is approaching sustainable development, tour our plants and brainstorm best practices with our team and other suppliers. Suppliers provided more than 150 ideas of ways we can improve how we work together, such as reducing carbon emissions in transport by optimizing deliveries, using biofuel and converting to electric vehicles; reducing waste by returning pallets; and reducing grammage in paper bags. We also recognized 20 suppliers across the globe for their outstanding commitment to sustainability, cost, innovation and safety.” Page 71 of ESG report*

**Company C Participant 1** *“But it’s not only greenhouse gas. I mean, even the water. We also identify water savings projects because water is a scarce resource, particularly in our Northern Cape operations. So, we also have a lot of partnerships, particularly with the surrounding mines to save water.”*

**Company C ESG Report:** *“Engagement through forums in collaboration with other mines via MCSA and DMPPR”. Page 29*

*“In collaboration with peers and industry bodies, approving appropriate capital and expertise to address key infrastructural risks, i.e. logistics, water and energy.” Page 87*

**Company D Participant(s):** *“And then the other one, the last one which was, access at the time was to our property was a challenge, we also look at the protection of the heritage sites which are existing within the operations’ boundaries, and we do this in collaboration with the local tribes that are sort of attached to those heritage sites and although they get permission to come in as at the moment is still is under management of our operations, and this administers under the Heritage Act.”*

**Company D ESG Report:** *“Drive systems change through engagement with suppliers to ensure cross sector collaboration to achieve social and environmental outcomes that will strengthen relationships, increase efficiency and save costs.” Page 49 of ESG report*

*“Industry associations serve as a valuable platform for collaboration, knowledge-sharing and collective advocacy on issues impacting our industry and community. We recognise the value in aligning with organisations that represent similar interests to raise industry standards to keep our industry safe, competitive and sustainable”. Page 86*

*“Engage with industry peers and government to drive policy development that aids in delivering long-term benefits for future generations”. Page 69*

**Company E Participant(s):** *“The company is also a member in groups like the World Gold Council and Minerals Council South Africa, and these memberships assist the company in as far as collaborations and shared commitments on climate action, resource stewardship, and community engagement. We also learner from other industry participants in these memberships we have.*

*The company also engages continuously with regulators, local communities, industry associations, and environmental NGOs. These stakeholders influence priorities on air quality (community complaints), water stewardship, biodiversity conservation, dust control, waste management, and environmental rehabilitation. ”*

**Company E ESG Report:** *“In the last year we have worked with our peer neighbours to understand our interfaces and longer-term water programmes so that we can understand and manage our regional context collectively. From an operational perspective, our emphasis was on strengthening and executing our sealing programme which is designed to close the ingress into operational areas. This is an ongoing initiative, and we anticipate seeing improvements in our pumping volumes.” Page 197*

*“Our site specific biodiversity action plans are developed in collaboration with local communities. (See Biodiversity management fact sheet for more on integrated catchment initiatives with stakeholders). We promote awareness around biodiversity (internally and externally) through local and international platforms.” Page 207 of ESG report*

#### *5.2.1.2 Within-case analysis of evidence of peer collaboration and stakeholder green value co-creation*

##### **Green: Company A**

Company A's ESG report mentions peer collaboration through various global and national platforms such as the International Council on Mining and Metals (ICMM) and the Voluntary Principles on Security and Human Rights (VPSHR). These platforms serve as opportunities to share best practices and practical examples. Additionally, Company A engages with multinational and domestic mining companies at an operational level via nationally run chambers of commerce, which help to provide a consistent industry voice on relevant topics.

Regarding water stewardship, Company A emphasises its commitment across its industrial assets by applying strong water governance, effective management, and collaboration with stakeholders. It highlights the importance of context-specific water stewardship, including the social performance aspects related to Indigenous Peoples and local water catchment conditions. Furthermore, the company provides further detailed information through their water microsite, which covers activities aimed at responsible and sustainable water use within their operations.

### **Gold: Company B**

Company B's stakeholder engagement centers around operational collaboration and supplier partnerships. Its stakeholder map comprises, local suppliers (innovation workshops, joint sustainability goal-setting), government departments (community development and agricultural projects), local communities (social investment and skills development), and internal stakeholders (workforce consultation on operational efficiency). Supplier summits and community training projects highlight Company B's emphasis on direct, participatory engagement, with feedback loops used to co-create environment and development initiatives

### **Orange: Company C**

Company C is involved in water savings projects in the Northern Cape, a region where water is scarce. The company collaborates closely with surrounding mines to implement water conservation and savings initiatives. This is reflected in their ESG report, which highlights engagement through forums in collaboration with other mines via the Minerals Council South Africa (MCSA) and the Department of Mineral Resources and Energy (DMPR) to address key infrastructural risks including water. In addition to infrastructural risk, Company C collaborates with peers and industry bodies in approving appropriate capital and required experts for key infrastructure projects for instance logistics, water and energy.

Company C's strategy emphasises regional resource management and peer partnerships, particularly to address environmental constraints like water scarcity. Engagement mechanisms include peer mining companies (joint water savings and infrastructure forums), local communities (operational partnership on shared resources), industry forums (policy alignment and collective advocacy), and employees (internal communication and operational implementation of sustainability). The engagement is characterised by formal forums for shared environmental problem-solving, as well as ongoing local dialogue about operational impacts.

### **Blue: Company D**

Company D's participant highlighted the stakeholder engagement for heritage site management (local tribes), and the ESG report acknowledges the importance of industry associations and peer engagement. The report highlights that these associations provide valuable platforms for collaboration, knowledge-sharing, and collective advocacy to raise industry standards for safety, competitiveness, and sustainability. It also emphasises

engaging with industry peers and government to influence policy development aimed at long-term benefits for future generations.

**Yellow: Company E**

Company E leverages membership in global (World Gold Council) and national (Minerals Council) bodies, and ongoing dialogue with industry peers (joint planning for water and biodiversity), regulators (compliance and input into standards), local communities (site-specific biodiversity and land stewardship) and environmental NGOs (input into environmental priorities and action plans). Engagement is iterative and participatory, with a focus on understanding regional context (water, biodiversity) and addressing air quality, dust, and waste issues raised by community and NGO stakeholders.

Company E's ESG Report on page 197 notes that in the last year, the company worked with peer neighbours to understand their interfaces and implement longer-term water programs aimed at collectively managing their regional water context. Operationally, they focused on strengthening and executing a sealing program to close water ingress into operational areas, expecting to see improvements in pumping volumes as a result

*5.2.1.3 Comparative-case analysis of evidence of peer collaboration and stakeholder green value co-creation*

*Table 11: Comparative-case analysis, stakeholder collaboration*

<b>Companies</b>	<b>Peer Platforms/Industry Forums</b>	<b>Government/Policy Collaboration</b>	<b>Community/NGO Engagement</b>	<b>Operational Mechanisms</b>	<b>Focus Themes</b>
<b>Green: Company A</b>	ICMM, VPSHR, chambers of commerce	National and global advocacy	Indigenous, local context in water	Peer forums, best practice sharing	Water, human rights, governance
<b>Gold: Company B</b>	Innovation workshops, supplier summits	Gov. agencies for community projects	Direct with suppliers, communities	Participatory initiatives, co-creation	Supplier, community development, efficiency
<b>Orange: Company C</b>	MCSA, DMPR forums, peer mines	Policy forums for infrastructure, Risk	Local operational partnerships	Formal forums, risk management	Water, infrastructure, resource

Companies	Peer Platforms/Industry Forums	Government/Policy Collaboration	Community/NGO Engagement	Operational Mechanisms	Focus Themes
					management
<b>Blue:</b> Company D	Industry associations, peer engagement	Policy influence, government partnerships	Heritage tribes, future generation focus	Advocacy platforms, knowledge sharing	Heritage, safety, collective advocacy
<b>Yellow:</b> Company E	World Gold Council, MCSA, peer dialogue	Regulatory input, compliance standards	Local/NGO forums on biodiversity	Regional water programs with peers	Water, biodiversity, air quality

### *Summary Insights of peer collaboration and stakeholder green value co-creation*

The comparative analysis of Companies A–E reveals both convergence and divergence in their stakeholder collaboration strategies on environmental initiatives, outlined in Table 11. Each company's approach reflects unique operational contexts, regulatory expectations, and strategic priorities, but all demonstrate evolving, multi-stakeholder engagement dynamics, particularly around resource stewardship, collective advocacy, and regional environmental challenges.

#### **Peer collaboration and industry platforms**

All five companies leverage peer collaboration, but the modalities and focus areas differ:

**Green:** Company A foregrounds global (ICMM, VPSHR) and national (chambers of commerce) platforms for peer learning, best-practice exchange, and unified industry voice on sustainability and human rights, especially in mining contexts. These platforms facilitate transnational knowledge sharing while also embedding industry-wide norms through operational engagement with multinationals and domestic firms.

**Orange:** Company C and **Yellow:** Company E focus on joint industry forums, particularly with the Minerals Council South Africa (MCSA), to address region-specific infrastructural risks such as water scarcity and logistics. Collaboration extends to peer resource management and project approvals, underlining the importance of regional adaptation.

#### **Engagement with government and policy advocacy**

Blue: Company D highlights influencing policy through engagement with industry associations and governmental bodies, emphasizing collective advocacy to drive sustainability standards and safeguard heritage sites. This reflects a policy-oriented, future-focused stakeholder stance where collective voice aims to shape a conducive regulatory environment.

Yellow: Company E also notes ongoing dialogue with regulators to co-design environmental standards and compliance frameworks, integrating both operational needs and emerging environmental priorities.

### **Local community and indigenous engagement**

Green: Company A incorporates context-specific water stewardship, noting the social performance aspects interwoven with Indigenous Peoples and localized catchment management. This indicates a nuanced, community-centered approach within its broader water governance agenda.

Gold: Company B operationalizes direct engagement through innovation workshops, co-creation of sustainability initiatives, and participatory feedback loops with local suppliers and communities, focusing on skills development and social investment at the grassroots level.

Yellow: Company E incorporates site-level stakeholder input into biodiversity and water planning, with iterative dialogue involving local communities and NGOs to address land stewardship, air quality, and waste issues.

### **Operational forums and problem-solving mechanisms**

Orange: Company C is distinguished by formal water savings projects and peer forums in a water-stressed area, fostering shared problem-solving and infrastructural coordination with both peers and local communities. Engagement mechanisms here include joint forums, collective advocacy, and embedded community dialogue aimed at managing shared ecological constraints.

Blue: Company B utilizes supplier summits and community training as platforms for operational feedback and partnership, reflecting a participatory, co-creative approach to environmental and development initiatives.

### **Iterative and participatory engagement**

Yellow: Company E's iterative, participatory model bridges operational planning with ongoing regional context understanding, especially as it relates to water, biodiversity, and

interface management with neighbouring peers. This is grounded in both collective action on environmental priorities and practical site-level problem-solving (such as sealing water ingress and monitoring outcomes).

Blue: Company D values association-driven knowledge-sharing and the standard-setting function of peer organisations for continued improvement in safety, competitiveness, and sustainability.

#### *5.2.1.4 Conclusion on comparative-case of evidence of peer collaboration and stakeholder green value co-creation*

The company analysis demonstrates distinct variations in the degree and nature of peer collaboration across the examined companies.

All companies recognise the necessity of peer collaboration (formal industry bodies, operational partnerships) and stakeholder dialogue (local communities, government, NGOs) as central for sustainable environmental initiatives.

Approaches differ in formality, scope, and focus—ranging from policy-driven advocacy and industry norm-setting (A, D), operational co-creation (B, C), to iterative, participatory regional engagement (E). Sectoral context, such as water scarcity or heritage concerns, shapes each company’s engagement methods and thematic emphasis.

In conclusion, the comparative-case analysis of stakeholder collaboration among Companies A–E demonstrates that effective environmental stewardship in this study of the mining companies is underpinned by both multilateral and context-specific approaches that blend global standards with operational realities. Across cases, robust peer collaboration, transparent engagement mechanisms, integration of community voices, including Indigenous and vulnerable groups, and active participation in industry and regulatory forums emerge as key pillars that support the achievement of sustainability objectives.

### **5.2.2 RQ1: Theme 2: Green Investment**

#### *5.2.2.1 Evidence of green investment*

*Table 12: Theme 2: evidence on the Green Investment*

<p><b>Company A Participant 1</b> <i>“So, across the business you know different. Whether it’s an engineering department, they’re always on a lookout of what are the technologies that are available and. You know, you always sometimes get consultants and agents coming to site and says this is what we have. I’ll give you a practical example. Let’s just say it’s water treatment. You know, there is always even in universities.</i></p>
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*That, for example, we're working with the University of Free State in one of our sites to implement a bioremediation technology and that technology treats, call it."*

*"So yeah, the last component deals with continuous improvements on matters of sustainability across the business. So mainly that involves identification of initiatives. And supporting those initiatives that are implemented by the sites, and objectives are realised. So that's the role, so yeah."*

*"There are instances where internally you look at optimising your production. To see how best do you generate less dust that needs to be abated, whether it's, you know, production mixing ratio, making sure that you have less call it products that have higher ash content.*

*So you can look at such process optimization, but in the main, if you are addressing emissions from a receiving post production, it involved your different suppliers."*

**Company A ESG Report:** *"Renewable energy sources, bundled or unbundled with energy attribute certificates, delivered 4.3%\* of our industrial energy needs (2023 restated: 3.5%)."*  
Page 5

*"In our approach we seek to work together with governments, other businesses, communities and other stakeholders to mitigate impacts and accelerate the social benefit potential that the energy transition facilitates." Page 17*

*"To optimise the buttress construction, we explored the use of slag as a construction material. This approach not only met Company A's design criteria but also improved waste management practices at the site." Page 26*

**Company B Participant 1** *"We did get into a power purchase agreement with the solar company that has solar facilities and there we managed to replace approximately 40% of our electricity needs."*

*"On top of that, we do have now a contract with what we call, an aggregator for wind energy and solar as well, so that's going to give us almost an additional 30% of our needs. So, we're looking roughly, probably by the end of next year we'll have, we would have replaced our energy needs".*

*"If you look at the programme, I can take maybe just the one of the furnaces that we have in Saldanha, the Western Cape for the CO2 gas that we emit from the furnace that we actually reuse to generate electricity."*

**Company B ESG Report:** *"Solar project in South Africa is now online and providing power to Company B operations. In addition, a second significant renewable project in South Africa is underway." Page 9*

*"A second project in South Africa is expected to contribute 200 MW of wind and solar power, which we anticipate will increase our South African operations to 70% renewable electricity.*

*Additionally, Company B's Brazilian operations operate with 99% renewable wind energy." Page 30*

*"In addition, Company B received the Paint and Pintura National Award in Brazil and was a finalist for the Innovation and Sustainability Award for our unreacted ore project in Brazil, which transforms 50% of our TiO2 production waste into valuable construction materials." Page 68*

*"We also intend to commence the conversion of natural gas-fired industrial boilers at our TiO2 facilities to green electricity or bio-sources." Page 30*

**Company C Participant 1** *"no mention of information technology."*

**Company C ESG Report:** *"Company C has made significant progress in its journey to wheel renewable energy, especially notable in the construction of the 100MVA solar facility. Once operational, this will supply approximately 30% of Company C's Platinum's energy requirements." Page 45*

*"Since then, we have developed operation specific decarbonisation pathways and associated short-term and medium-term targets that prioritise three main mitigation options – energy-efficiency measures, renewable energy and emission reducing new energy vehicles." Page 44*

**Company D Participant 1** *"Managing the groundwater pollution and at our tailings dams. And it's also we also looking at, doing more of a a pumping of a seepage water and making use of a solar powered pumps and that we had a company representing the pumps that they have."*

*"Managing the groundwater pollution and at our tailings dams. And it's also we also looking at, doing more of a a pumping of a seepage water and making use of a solar powered pumps and that we had a company representing the pumps that they have."*

**Company D Participant 2** *"So we got some of the examples and then of course we are busy with a renewable energy project which will supply in the region of about 40% of the electricity of what the Organisation consumes and that's be where it would be supplied by solar or solar PV at the moment we're in the as you know, we're in the, we're in the financial close process which is due to be completed by the end of the year. And we would probably then receive the 1st power in 2027 from the solar plant."*

*"At least I can share in terms of initiatives that we have launched. And so, we've got an energy management programme in the mine, which is basically a combination of, all the energy management, energy and water management projects that we've got on the mine and those projects relating to electricity optimization or efficient use of electricity and efficient use of water.*

*So, we have projects like the efficient lighting retrofits, efficient air conditioning. We've also got fridge plant optimization which comes down to efficient use of power when we, when we cool the air that's been sent down on the underground section, you also have power factor correction projects on our main incoming substations, which basically helps us to, to use the, use the power effectively that we consume from Eskom side."*

**Company D ESG Report:** *“The Power Strategy involves a three-staged approach. Stage 1 transitions thermal generation from predominantly diesel to natural gas and Battery Energy Storage System (BESS). Stage 2 aims to increase renewable power generation capacity, and Stage 3 plans the addition of emerging wind power generation should it become available via grid connection.” Page 70*

*“Our approach to decarbonisation is aimed at reducing emissions from electricity generation, heavy mining equipment (HME) as well as fleet operations over the short, medium and long-term.” Page 70*

**Company E Participant 1** *“Yes, our company has several environmental initiatives. I will just mention a few. The initiatives include a major renewable energy program aimed at decarbonisation and enhancing energy security. The initiative features a approximately 500 MW pipeline of solar and wind projects designed to replace approximately 25% of the current coal-based electricity supply from Eskom by 2027. These initiatives includes a number of wind farms and solar photovoltaic plant, that are supplying operations.”*

**Company E ESG Report:** *“Energy supply and security have improved following the implementation of several renewable energy alternatives and an improvement in Eskom generation performance. However, we remain focused on reducing energy costs and carbon emissions, and we remain committed to reducing our risk exposure to Eskom’s coal-intensive supply, with its high GHG emissions. This is to be achieved through the implementation of our energy and decarbonisation strategy.” Page 185*

*“We are actively seeking to link carbon offsets with our local agri-industrial and rehabilitation programmes; and we will leverage advances and innovations in the field of offsets to derive the intended benefits.” Page 193*

#### 5.2.2.2 Within-case analysis of evidence: Green Investment

##### Green: Company A

Green: Company A invests in its own and third-party solar and wind energy projects to reduce Scope 2 emissions tied to electricity consumption. This aligns with the ESG report showing renewable sources (solar, wind) covered 4.3% of total industrial energy needs in 2024 (up from 3.5% in 2023). The sustainability function focuses on identifying, managing, and supporting site-level environmental initiatives to meet strategic objectives, and continuous improvement mechanisms are embedded in ESG performance management. Production and process optimisation as part of internal improvements aimed to minimise dust and particulate emissions through optimised mixing ratios and managing ash content, thereby reducing the need for post-production abatement and supplier engagement is integral for emissions mitigation across the supply chain.

### **Gold: Company B**

Gold: Company B entered into a power purchase agreement covering solar facilities, replacing around 40% of its electricity requirements with renewables, on a direct contractual basis. An additional aggregator contract is expected to provide another 30%, aiming for nearly complete offset of conventional electricity use by next year. Solar and wind initiatives will increase South African operations to 70% renewable electricity, with Brazilian sites already at 99% renewable wind energy. Implementation of automated control systems across the Group enables more efficient furnace operations, reducing waste and emissions per unit of product by ensuring optimal production parameters. At one site, CO<sub>2</sub> off-gas from the furnace is captured and reused for generating electricity, exemplifying closed-loop process innovations. The group plans to convert natural gas-fired industrial boilers to operate using green electricity or bio-sources, further reducing Scope 1 GHG emissions.

### **Orange: Company C**

Orange: Company C built a 100 MW solar facility in the platinum region, moving away from grid-based (Eskom) power to on-site renewable generation for its major operations. The new solar plant will provide approximately 30% of Orange: Company C's division electricity requirements, marking substantial progress in renewable energy wheeling and supply diversification. Orange: Company C promotes the replacement of conventional lighting with LED energy-saving bulbs across its sites to immediately cut electricity consumption. Energy efficiency measures and process improvements are actively developed and implemented at various sites, highlighted as a key strategy for lowering the carbon footprint and improving operational efficiency. Underground mining operations in the Northern Cape have transitioned away from diesel, adopting battery-electric vehicles to cut Scope 1 greenhouse gas emissions. The group's decarbonisation roadmap focuses on three primary mitigation options: energy efficiency, renewables, and new-energy vehicles, with defined short and medium-term targets.

### **Blue: Company D**

Blue: Company D manages groundwater pollution at tailings dams by deploying solar-powered pumps for seepage water recovery, incorporating clean energy into site remediation practices. Regulatory compliance drives comprehensive air quality modelling and the establishment of a dust fallout monitoring system, which combines activity mapping, local climatic data, and continuous measurement to mitigate airborne pollution. A solar PV project is expected to replace up to 40% of the organisation's total

electricity consumption, with financial closure expected by year-end and initial power delivery targeted for 2027. The ESG report outlines a staged energy transition: moving from diesel to natural gas and battery storage (Stage 1), expanding renewables (Stage 2), and planning grid wind generation if available (Stage 3). Short-, medium-, and long-term programmes focus on lowering emissions from electricity generation and fleets, with a clear strategic commitment to the UN Global Compact and precautionary environmental management. Mine-wide initiatives include efficient lighting and air conditioning retrofits, fridge plant (air cooling) optimisation, and power factor correction at substations—each reducing total energy draw and improving operational reliability. Integrated water management is positioned alongside energy management for holistic, resource-efficient operation.

**Yellow: Company E**

Yellow: Company E is rolling out a series of wind and solar projects expected to replace 25% of the Eskom coal-based electricity supply for its operations by 2027, significantly lowering carbon emissions. This renewable energy programme directly supports energy security and aligns with the company’s energy and decarbonisation strategy. ESG reporting highlights strategic efforts to cut dependence on Eskom’s coal-intensive grid and associated GHG emissions, with marked improvements in supply and security already achieved. Verified, externally audited reporting strengthens trust with stakeholders and supports regulatory and ESG commitments. Water use is managed to minimise reliance on purchased water, operating a closed-loop system to reduce losses (especially to tailings), and supporting responsible water stewardship. New water management techniques were implemented in 2024 and further enhancements, including real-time daily water performance visualisation across sites, will be widely accessible in 2025 for improved efficiency. ESG strategy includes linking carbon offsets with local agri-industrial and rehabilitation programmes to maximise positive landscape and community impacts while achieving regulatory and voluntary climate goals.

*5.2.2.3 Comparative-case analysis of evidence: Green Investment*

*Table 13: Comparative-case analysis, Green Investment*

<b>Theme</b>	<b>Green: Company A</b>	<b>Gold: Company B</b>	<b>Orange: Company C</b>	<b>Blue: Company D</b>	<b>Yellow: Company E</b>
Renewable, energy % target	4.3% (2024), solar & wind, internal &	70% SA, 99% Brazil by next year,	100 MW solar plant for 30%	40% by 2027, solar PV (staged rollout)	25% by 2027, 500

Theme	Green: Company A	Gold: Company B	Orange: Company C	Blue: Company D	Yellow: Company E
	external projects	solar PPA + aggregator	Platinum site supply		MW pipeline solar/wind
Process & Resource Optimisation	Mixing ratios/ash management for dust; supply chain engagement	Furnace efficiency; TiO <sub>2</sub> waste circular project	Energy/fuel efficiency; AI-driven business operations	Lighting, A/C retrofits; mine-wide energy & water management	Closed water loop; tech-driven loss minimisation
ESG Management & Reporting	Continuous improvement; initiative support via technical database	External recognition; boiler conversion programme	Decarbonisation pathways, targets; real-time AI monitoring	Precautionary, staged decarbonisation; external ESG commitments	Audited, real-time disclosures; water stewardship advances

### *Key insights from comparative-cases analysis*

#### **Renewable Energy Integration**

All companies prioritise the transition away from coal-based or Eskom grid power, often via multi-year renewable energy pipelines (solar, wind), with targets ranging from 4.3% (2024 actual for A) to up to 99% at Brazilian B sites and 40% at D by 2027, outlined on Table 13. Onsite projects (Orange: Company C, Green Company A) and third-party PPAs/aggregators (Gold Company B, Blue Company D, Yellow Company E) reflect a blend of procurement and asset-based models.

#### **Process Innovation**

Centralised databases (Green: Company A), automated process controls (Gold: Company B), LED retrofits (Orange: Company C, Blue: Company D), and advanced pollutant abatement are prominent. Several companies leverage digital tools for both operational and environmental efficiency, with Orange: Company C and Blue: Company D explicitly integrating these into broader business processes.

#### **Resource Efficiency and Circular Economy**

Examples include TiO<sub>2</sub> waste-to-product transformation (Gold: Company B), closed-loop water systems (Yellow: Company E), water and energy management integration (Blue: Company D), and production optimisation to reduce dust and ash emissions (Green:

Company A). Energy and emission co-benefits are pursued through intelligent operational design and continuous improvement.

### **Collaborative and Research-Driven Mechanisms**

Academic partnerships (Green: Company A), employee innovation (Gold: Company B), agri-industrial offset integration (Yellow: Company E), and international best practice commitments (Blue: Company D—UN Global Compact) reinforce the value placed on stakeholder engagement, co-creation, and knowledge transfer for sustainability outcomes.

### **Governance, Reporting, and External Assurance**

Continuous improvement frameworks (Green: Company A), externally audited data systems (Yellow: Company E), clear decarbonisation pathways, staged rollouts, and industry/state aligned strategy commitments (Blue: Company D) strengthen accountability, ensure regulatory compliance, and improve stakeholder confidence in reported outcomes.

#### *5.2.2.4 Conclusion on analysis of evidence on theme 2: green investment*

Companies in this study are actively making green investments as central components of their sustainability and decarbonisation strategies. These initiatives vary in scale and approach but collectively demonstrate a strong commitment to reducing reliance on coal-based electricity, enhancing energy security, and lowering carbon emissions.

#### *Key conclusions include:*

**Diverse Approaches:** firms adopt different strategies, ranging from incremental increases in renewables (Green: Company A) to aggressive near-term scaling with large PPAs and operational projects (Gold: Company B), targeted regional solar plants (Orange: Company C), and multi-stage, technology-diverse power strategies including natural gas and battery storage (Blue: Company D).

**Significant Renewable Shares:** Renewable energy contributions range from modest current shares (4.3% for Green: Company A) to ambitious targets up to 70% or more (Gold: Company B), reflecting varied maturity levels and investment horizons.

**Integration Beyond Generation:** Companies incorporate renewables not only for electricity supply but also operational applications such as solar-powered water pumps (Blue: Company D), indicating innovation in embedding sustainability within core processes.

**Risk and Cost Focus:** Reducing exposure to Eskom’s coal-intensive supply and associated risks is a consistent driver, alongside efforts to manage energy costs and improve supply reliability.

**Medium- to Long-Term Timelines:** Most renewable projects target significant milestones by 2027 and beyond, reflecting the capital-intensive nature of energy transitions in multinational enterprises.

**Process optimisations:** All companies engage in process optimisation targeting emissions and resource efficiency. Several adopt circular economy approaches (Gold: Company B) or renewable energy transitions (Orange: Company C). Blue: Companies D and Yellow: Company E focus on efficiency and offsets, respectively, indicating a spectrum from operational improvements to broader environmental linkage strategies. Strategic timelines vary from short- to medium-term actions, reflecting differing maturity levels and focus areas in sustainability pathways.

Overall, these findings reflect organisations that are conducting projects signify a pivotal shift towards cleaner, more secure, and resilient energy systems within South Africa’s capital-intensive mining sector.

### 5.2.3 RQ1: Theme 3: Innovation and digital technology

#### 5.2.3.1 Evidence of Innovation and digital technology

Table 14: Evidence of innovation and digital technology

**Company A Participant 1** *“So it’s it’s mainly let’s take an example of. Emissions. Particulate method to be specific so. I mean, in many instances you have to go into the market, look at the latest technology that’s available, that has a OEM guarantee that it will emit or it will be able to abate your equipment and comply to the emission limit.”*

*“So, across the business you know different. Whether it’s an engineering department, they’re always on a lookout of what are the technologies that are available and. You know, you always sometimes get consultants and agents coming to site and says this is what we have. I’ll give you a practical example. Let’s just say it’s water treatment. You know, there is always even in universities.*

*That, for example, we’re working with the University of Free State in one of our sites to implement a bioremediation technology and that technology treats, call it.”*

*“So, there is a website where from corporate they build a lot of. Call it the build a module with a list of different technologies that are out there and what their capabilities are, and also related cost, whether it’s OpEx or CapEx.”*

**Company A ESG Report:** *"We configure geographical information systems (GIS) as a tool to display, manage and evaluate geospatial data within collaborative platforms.*

*Adopting GIS platforms, dashboards and advanced spatial tools has supported efficient decision-making, strengthened reporting and enhanced access to data for a wider range of users. This has improved the management of land and resources and supported sustainable practices and regulatory compliance." Page 10*

**Company B Participant 1** *"So, Scope One is it's mainly those two items that I've that I've mentioned. But what we're also doing is we have implemented, and this is now right across the Group, what we call automated process control.*

*So, you want the process of producing your product to be as efficient as possible so that there isn't any waste generated. Effectively it would and I'm I must just because again so that we're still trying to draw that out, but effectively it's going to make sure that your furnaces operate in the most efficient manner possible. To produce a product, you will emit less for what you're producing in the future".*

*"This environmental topic has evolved over the years as it's been, it's been incredible and what I see as well within our company, even the younger generation, you know they they're coming up with. It might be AI don't want to dismiss it as a small project, for example, they came up with a waste management type project where you know we will have bins that are dedicated to."*

**Company B ESG Report** *"In addition, Company B received the Paint and Pintura National Award in Brazil and was a finalist for the Innovation and Sustainability Award for our unreacted ore project in Brazil, which transforms 50% of our TiO<sub>2</sub> production waste into valuable construction materials." Page 68*

**Company C Participant(s):** *No mention of information technology.*

**Company C ESG Report** *"We are actively developing technology and processes to enhance energy efficiency at our operations while improving fuel efficiency and reducing our carbon footprint" Page 45*

*"Unlock new insights and improve how we operate • Deliver immediate benefits through artificial intelligence or AI in key strategic areas • Leverage AI to fast-track data cleanup and data-quality enhancement • Gain competitive advantage through data-driven decisions • Improve our business efficiency and profitability." Page 122*

**Company D Participant 1** *"The first initiative, which is a legislative requirement, is to conduct air quality modelling. We should we get the all the activities that generate dust. And then also considering the climatic condition which speaks to your wind and speed with direction to*

*understand where the prevailing with direction is coming from. And so that in that we are able to develop a what you call a dust fall out monitoring network which is in place.”*

**Company D Participant 2** *“Fortunate to have gone to China the past three weeks and in now this week and we’ve been introduced to the Metaverse and Metaverse technologies such as AI (artificial intelligence) and VR (virtual reality) digital twinning. And these type of initiatives, I’ll be focusing quite a lot of lot of my attention on that. Although it sounds very futuristic.”*

**Company D ESG Report** *“As a participant to the United Nations (UN) Global Compact, we are committed to integrating management principles relating to the environment into our business strategy, policies, and procedures by applying a precautionary approach to environmental challenges, implementing initiatives to promote greater environmental responsibility and promoting the development and implementation of environmentally friendly technologies.”*

*Page 73*

*“Adopting and managing rapid technological advancements, including generative artificial intelligence, automation, and digitalisation.” Page 47*

**Company E Participant 1** *“We have real-time reporting of using technology to efficiently manage resources. We also have these savings and reporting of data being externally verified. We also, have water management practices to ensure that the organization does not rely on purchase water. Additionally, we ensure that there is a close system in terms of our water use, by that I mean we minimize loss to tailings.”*

**Company E ESG Report:** *“Further advancements in water management techniques were implemented in 2024, with a more significant impact on responsible internal water use expected in 2025. By then, real-time visualisation of daily water performance will be more accessible across operations, enhancing efficiency and driving long-term sustainability.” Page 197*

### **5.2.3.2 Within-case analysis of the evidence theme 3 innovation and digital technology Green: Company A**

Company A integrates advanced, market-tested technological solutions supported by strong internal coordination (engineering departments) and external collaborations (universities, consultants). There is strong emphasis on sourcing latest technologies from the market or OEMs (Original Equipment Manufacturers) that meet emission limits and carry performance guarantees and innovation extends across departments, leveraging both internal scanning and collaboration with external consultants and research partners. Partnership with the university to implement bioremediation technology for water treatment at one site, demonstrating a commitment to applied sustainability research and

local institutional collaboration. Organisation maintains a central technical module or database listing available technologies, performance capabilities, and associated operational or capital costs, and this facilitates as an internal decision-making and improvement platform facilitating cross-site technology adoption. This is complemented by digital tools like GIS to optimize environmental resource management and reporting.

### **Gold: Company B**

Company B environmental initiatives and innovations focuses on two main emission automated process control (group-wide implementation), applied to optimise furnace operations and overall production efficiency, minimise waste generation and reduce emissions per unit of product by enhancing operational efficiency. Innovation culture and employee engagement, emphasis on younger workforce contributing innovative projects, for example, AI-driven waste management initiative with dedicated recycling bins promoting waste segregation and reduction. The company received recognition for transforming 50% of TiO<sub>2</sub> (titanium dioxide) production waste into valuable construction materials, supporting circular economy principles and receiving national awards in Brazil.

### **Orange: Company C**

Company C's participant mentions no direct reference to information technology in the interviews, however ESG report highlights a strategic emphasis on developing technology and processes for energy efficiency, fuel efficiency, and carbon footprint reduction (page 45). Furthermore, the report explicitly outlines the use of artificial intelligence (AI) to unlock operational insights, fast-track data cleanup, enhance data quality, and drive competitive advantage through data-driven decisions, which aims to improve business efficiency and profitability (page 122). This reflects a clear, formal commitment by Company C to integrate AI as a core element in its ESG strategy, especially in the realms of energy management and operational improvements.

Thus, while participant comments did not mention IT, Company C formally discloses significant AI-driven initiatives aimed at enhancing sustainability performance and leveraging digital innovation to meet environmental goals.

### **Blue: Company D**

Company D demonstrates a strong focus on both environmental compliance and technological innovation to improve sustainability and operational efficiency. Exposure to advanced technologies such as Metaverse, AI, VR, and digital twinning has captured Company D's attention. These technologies, while appearing futuristic, are a key focus area for development and strategic investment, and the company aims to leverage these

advancements to enhance operational monitoring and innovation. As part of the UN Global Compact, Company D commits to integrating environmental management principles into their business strategies and policies. The ESG report highlights managing rapid technological advancements like generative AI, automation, and digitalisation as central to their business transformation.

**Yellow: Company E**

Company E employs advanced water management practices that include real-time reporting and technology use to efficiently manage water resources, with external verification of water savings and related data. They have implemented water management strategies that ensure the organisation minimises reliance on purchased water by maintaining a closed system approach, particularly by minimising water loss to tailings. Further supporting these practices, Company E's ESG report highlights continued advancements in water management techniques introduced in 2024, with expectations of more substantial internal water use efficiency improvements in 2025. The report mentions the planned enhancement of real-time visualisation tools for daily water performance to be accessible across operations, which aims to drive operational efficiency and long-term sustainability goals.

*5.2.3.3 Comparative-case analysis of the evidence theme 3 innovation and digital technology*

*Table 15: Evidence of innovation and digital technology, company comparison*

<b>Company</b>	<b>Key Environmental Focus</b>	<b>Technology Integration</b>	<b>Innovation &amp; Collaboration</b>	<b>Reporting &amp; Future Plans</b>
<b>Green: Company A</b>	Advanced technology adoption for environmental resource management.	Uses GIS and digital tools; strong engineering coordination internally and externally with universities and consultants	Market-tested tech solutions; strong coordination and partnerships	Focused on optimising environmental resource use and reporting through digital tech
<b>Gold: Company B</b>	Emission process control, waste minimisation	Automated process control across group operations; AI-driven waste management	Active innovation culture; younger workforce involvement in sustainability projects	Emphasizes operational efficiency and employee-driven innovation

Company	Key Environmental Focus	Technology Integration	Innovation & Collaboration	Reporting & Future Plans
<b>Orange:</b> <b>Company C</b>	Energy efficiency, carbon footprint reduction	AI for operational insights and data management, though not mentioned by participants but disclosed in ESG	Formal strategic commitment to AI-led environmental goals	Uses AI to enhance energy management and operational efficiency, formal ESG disclosure
<b>Blue:</b> <b>Company D</b>	Environmental compliance, operational efficiency	Interest in Metaverse, AI, VR, digital twinning, generative AI, automation	Strategic development of emerging advanced digital tech	Committed to integrating environmental management within business transformation
<b>Yellow:</b> <b>Company E</b>	Advanced water management, closed system approach to minimise water loss	Real-time reporting and visualisation tools under development for water efficiency	Use of external verification for water savings	Planning real-time daily water performance visualisation accessible organization-wide

### *Summary Insights*

Technology and innovation are critical drivers across all companies but vary in focus: from GIS and process automation (Green: Company A, Gold: Company B) to advanced AI and emerging tech (Orange: Company C, Blue: Company D), and real-time water management (Yellow: Company E) as outlined on Table 15.

Collaborative networks (internal teams, universities, consultants) enhance Green: Company A's approach, while culture and employee engagement fuel innovation at Gold: Company B.

Formal ESG reporting highlights Orange: Company C's AI initiatives despite participant interview silence, showing a formalized corporate commitment.

Blue: Company D uniquely targets futuristic digital technologies alongside its commitments to compliance and sustainability frameworks like the UN Global Compact.

Yellow: Company E stands out for specialised technology use in water management with external validation, focusing on operational visibility and efficiency improvements.

### 5.2.3.4 Conclusion on analysis of the evidence theme 3 innovation and digital technology

The cases collectively illustrate that technological innovation in environmental sustainability is multifaceted, shaped by organisational culture, sectoral context, and strategic priorities. While all companies recognise the value of digital tools and advanced technologies, the depth and breadth of implementation vary significantly. Companies that combine internal coordination with external collaboration such as Green: Company A and Blue Company: D, tend to achieve broader and more sustainable outcomes. Meanwhile, those with strong employee engagement and circular economy initiatives such as Gold: Company B, demonstrate the potential for innovation to drive both environmental and business value. The formal commitment to digital transformation, as seen in Orange: Company C and Blue: Company D, suggests a growing trend toward integrating AI and digitalization as core elements of environmental strategy, even if operational realities lag behind strategic intent. Yellow: Company E stands out for specialised technology use in water management with external validation, focusing on operational visibility and efficiency improvements.

## 5.2.4 RQ1: Theme 4: Public Private Partnerships

### 5.2.4.1 Evidence of public private partnerships

Table 16: Evidence of public private partnerships

<b>Company A Participant 1</b> no mention of public private partnerships.
<b>Company A ESG Report:</b> No mention of public private partnerships in the ESG report
<b>Company B Participant 1</b> no mention of public private partnerships.
<b>Company B ESG Report:</b> No mention of public private partnerships in the ESG report
<b>Company C Participant 1</b> “We all form partnerships to make sure that we supply water to the mines and also to make sure that we also provide water to the communities.”
<b>Company C ESG Report:</b> “Participation in public-private collaborations to proactively mitigate risks associated with unreliable water supply, including the Vaal Gamagara Water Supply Scheme in the Northern Cape and the Lebalelo Water User Association in Limpopo.” Page 32
<b>Company D Participant 1</b> no mention of public private partnerships.
<b>Company D Participant 2</b> no mention of public private partnerships.
<b>Company D ESG Report:</b> No mention of public private partnerships in the ESG report
<b>Company E Participant 1</b> no mention of public private partnerships.
<b>Company E ESG Report:</b> “This public agreement was a result of years of collaboration under the GNA, as well as extensive community engagement before and during the permitting process. Additional work continues with the GNA on a similar permitting effort related to the next phase of tailings and waste rock storage at the Stillwater Mine.” Page 198

### **Green: Company A**

Green: Company A's ESG report does not mention any public-private partnerships (PPPs). In the case of Green: Company A, the absence of any mention of PPPs in their ESG report suggests that either they have not engaged in such partnerships, or they do not consider these collaborations relevant within their publicly reported ESG report.

### **Gold: Company B**

Gold: Company B's ESG report does not mention any public-private partnerships (PPPs). In the case of Gold: Company B, the absence of any mention of PPPs in their ESG report suggests that either they have not engaged in such partnerships, or they do not consider these collaborations relevant within their publicly reported ESG report.

### **Orange: Company C**

Orange: Company C's public-private partnerships around water supply reflect active participation in the Vaal Gamagara Water Supply Scheme and the Lebalelo Water User Association, as referenced in their ESG report and participant interview. Orange: Company C's involvement in these collaborations exemplifies their strategic approach to proactively mitigate water supply risks by partnering with government entities and other mining houses to enhance water security for both their operations and surrounding communities.

### **Blue: Company D**

Blue: Company D's ESG report does not mention any public-private partnerships (PPPs). In the case of Blue: Company D, the absence of any mention of PPPs in their ESG report suggests that either they have not engaged in such partnerships, or they do not consider these collaborations relevant within their publicly reported ESG report.

### **Yellow: Company E**

Yellow: Company E Participant 1 makes no mention of public-private partnerships (PPPs). However, Yellow: Company E's ESG Report on page 198 details a public agreement that resulted from years of collaboration under the Gujranwala-Nankana (GNA) agreement and extensive community engagement during the permitting process for tailings and waste rock storage at Company E.

#### *5.2.4.2 Within-case analysis of the evidence public private partnerships Public-Private Partnerships (PPPs) Overview by Company*

**Green: Company A (Green):** No mention of PPPs in ESG report, indicating either no engagement or irrelevance in public reporting.

**Gold: Company B (Gold):** Similarly, no PPPs referenced in ESG report, suggesting minimal or no engagement or a decision not to highlight these partnerships.

**Orange: Company C (Orange):** Actively engaged in PPPs, specifically in water supply schemes such as the Vaal Gamagara Water Supply Scheme and the Lebalelo Water User Association. This reflects a strategic collaboration with governments and other mining companies to manage water security risks.

**Blue: Company D (Blue):** No PPPs reported or mentioned, indicating no such partnerships or deemed non-material for ESG disclosure.

**Yellow: Company E (Yellow):** Participant interview does not mention PPPs. However, the ESG report details a public agreement under the Gujranwala-Nankana (GNA) agreement linked to community engagement efforts during environmental permitting for waste storage, signalling some level of public-private collaboration.

#### *5.2.4.3 Comparative-case analysis of public private partnerships*

Amongst the five mining companies analysed; Green: Company A, Gold: Company B, Orange: Company C, Blue: Company D, and Yellow: Company E, documented engagement in public-private partnerships (PPPs) varies significantly according to their ESG disclosures and supporting interview data

The evidence base indicates that Orange: Company C demonstrates the most transparent and strategic use of PPPs, specifically for water infrastructure and operational sustainability, positioning such collaborations as integral to their risk management and community value proposition.

Yellow: Company E also participates in public agreements resembling PPPs, primarily in the context of permitting and long-term stakeholder negotiation. However, this is noted more as a result of extensive regulatory and community engagement rather than a featured ESG strategy.

#### *5.2.4.4 Conclusion of evidence on public private partnerships theme 4*

This analysis compares the presence and nature of public-private partnerships (PPPs) as reported by five companies (A–E) in their ESG disclosures and participant interviews. PPP engagement varies significantly across the cases, highlighting diverse approaches to stakeholder collaboration in sustainability strategies.

## Key Findings

**Limited Disclosure Trend:** Three of the five companies (Green: Company A, Gold: Company B, Blue: Company D) provide no mention of PPPs within their ESG reports. This may reflect either a true lack of such partnerships or a reporting choice wherein only specific types of collaboration are considered publicly relevant.

**Proactive Engagement Models:** Orange: Company C demonstrates a clear, strategic use of PPPs to address a core operational risk (water supply). Membership and partnership in regional water management initiatives illustrate both sector collaboration and tangible community impact.

**Hybrid/Indirect Disclosure:** Yellow: Company E, while not highlighting PPPs in participant interviews, provides evidence in ESG reporting of structured, multi-year collaborations—particularly relating to environmental permits and stakeholder consultation (the GNA agreement), underscoring the sometimes-indirect nature of PPPs in formal reports.

**Reporting Practices:** The variability in PPP disclosure suggests that companies differ in their interpretation of PPP relevance for ESG reporting. The nature and strategic importance of partnerships may influence their visibility, with only transformative, high-impact collaborations typically making it into formal disclosures.

**Stakeholder Focus:** Where PPPs are reported (e.g., Companies: Company C-Orange and Company E-Yellow), the focus tends to be on partnerships directly addressing pressing operational risks (such as water security or regulatory permitting for waste storage), and where collaborative approaches visibly benefit both the firm and broader stakeholders.

### 5.2.5 RQ2: Theme 5: Carbon capture, and carbon offset

#### 5.2.5.1 Evidence on carbon capture, and carbon offset

Table 17: Evidence on carbon capture, and carbon offset

<b>Company A Participant 1</b> <i>“no mention”</i>
<b>Company A ESG Report:</b> <i>no mention of carbon capture, and carbon offset in the ESG report</i>
<b>Company B Participant 1</b> <i>no mention of carbon capture, and carbon offset</i>
<b>Company B ESG Report:</b> <i>“The 2030 target is based on the conversion of electricity supply in substantially all of the jurisdictions in which we operate to renewable energy sources. We also intend to commence the conversion of natural gas-fired industrial boilers at our TiO2 facilities</i>

<p><i>to green electricity or bio-sources. Finally, we are exploring the timing of carbon capture projects at several European facilities.” Page 30</i></p> <p><i>“Though we are not relying on purchasing third-party carbon offset credits, we may need to consider this as a last resort if feasible technologies are not available for “hard-to-abate” carbon sources.” Page 30</i></p>
<p><b>Company C Participant 1</b> <i>no mention of carbon capture, and carbon offset</i></p>
<p><b>Company C ESG Report:</b> <i>no mention of carbon capture, and carbon offset in the ESG report</i></p>
<p><b>Company D Participant 1</b> <i>no mention of carbon capture, and carbon offset</i></p>
<p><b>Company D Participant 2</b> <i>no mention of carbon capture, and carbon offset</i></p>
<p><b>Company D ESG Report:</b> <i>“As outlined in our Climate Change Position Statement, we recognise the role of carbon credits to offset hard to abate emissions where we cannot avoid or reduce emissions through our mitigation hierarchy. We developed a Carbon Offset Strategy to provide an integrated approach for the managing of carbon credits to meet legislative requirements and voluntary commitments over short, medium and long-term.</i></p> <p><i>The Carbon Offset Strategy will be implemented transparently and in accordance with robust standards and frameworks, ensuring environmental integrity and verifiable emissions abatement.” Page 71</i></p>
<p><b>Company E Participant 1</b> <i>no mention of carbon capture, and carbon offset</i></p>
<p><b>Company E ESG Report:</b> <i>“Securing responsible carbon offsets to neutralise our remnant emissions.” Page 189</i></p> <p><i>“We intend to reduce our absolute scope 1 and 2 emissions in line with the requirements of the Paris Agreement and the latest climate science. Offsets will be used as a last resort to neutralise remnant, hard-to-abate emissions and achieve full carbon neutrality.” Page 193</i></p>

#### 5.2.5.2 Within-case analysis of evidence on carbon capture, and carbon offset

##### **Green: Company A**

Company A's Participant 1 and its ESG report contain no mention of carbon capture or carbon offsets. This suggests that Company A may not currently engage in or highlight carbon capture and carbon offset initiatives within its environmental, social, and governance disclosures.

##### **Gold: Company B**

Company B's ESG report indicates that by 2030, the company aims to convert its electricity supply largely to renewable sources, including plans to convert natural gas-fired boilers at its TiO<sub>2</sub> facilities to green electricity or bio-sources. The participant from Company B did not mention carbon capture or carbon offset in their quotes, which may

indicate either a focus on other aspects of ESG or an early stage in their carbon capture initiatives.

**Orange: Company C**

Company B's Participant 1 and its ESG report contain no mention of carbon capture or carbon offsets. This suggests that Company B may not currently engage in or highlight carbon capture and carbon offset initiatives within its environmental, social, and governance disclosures.

**Blue: Company D**

Company D has explicitly developed a Carbon Offset Strategy, which is designed to manage carbon credits in an integrated, transparent manner following robust standards and frameworks to ensure environmental integrity and verifiable emissions abatement over the short, medium, and long term. However, there is no mention of specific carbon capture initiatives by Company D participants, and the absence of carbon capture in participant interviews suggests that the company might be focusing primarily on carbon offsetting rather than direct carbon capture and storage (CCS) technologies at this point.

**Yellow: Company E**

Company E's ESG Report states a commitment to securing responsible carbon offsets to neutralise remnant emissions and an intention to reduce absolute Scope 1 and 2 emissions in line with the Paris Agreement and latest climate science. The report emphasises that carbon offsets are to be used only as a last resort to neutralise remnant, hard-to-abate emissions in order to achieve full carbon neutrality.

Regarding carbon capture, there is no mention of it in the participant interview for Company E, nor is carbon capture explicitly referenced in the ESG report excerpts provided.

*5.2.5.3 Comparative-case analysis of evidence on carbon capture, and carbon offset*

*Table 18: comparative-case analysis of carbon capture, and carbon offset*

Company	Carbon Capture Mention	Carbon Offset Mention	Key Points Summary
<b>Green: Company A</b>	No mention	No mention	Neither participant quotes nor ESG report reference carbon capture or offsets, indicating no current engagement or disclosure on these initiatives.

Company	Carbon Capture Mention	Carbon Offset Mention	Key Points Summary
<b>Gold:</b> Company B	No mention	No mention	ESG focuses on renewable electricity transition by 2030, including replacing natural gas boilers with green or bioenergy sources; absence of participant mention suggests low emphasis or early stage of carbon capture and offsets.
<b>Orange:</b> Company C	No mention	No mention	Both participant and ESG report lack references to carbon capture or offsets, similar to Company A in this regard.
<b>Blue:</b> Company D	No mention	Explicit carbon offset strategy	Developed clear carbon offset management framework with robust standards for emissions abatement. No participant reference to carbon capture, implying focus is on offsets rather than CCS.
<b>Yellow:</b> Company E	No mention	Explicit commitment to responsible carbon offsets	ESG report commits to offsets as last resort to neutralize hard-to-abate emissions in pursuit of full carbon neutrality. Participant interviews and ESG excerpts do not mention carbon capture.

### *Summary Insights*

None of the five companies explicitly mention carbon capture initiatives in their ESG reports or participant interviews.

Carbon offsetting is acknowledged and integrated prominently in Companies D and E, with formalised strategies and commitments aligned with scientific climate goals.

Companies A, B, and C either do not engage in or do not disclose carbon capture and offset initiatives, instead focusing on other ESG priorities like renewable energy transition.

The data suggests a trend where carbon offsetting is more commonly prioritised over direct carbon capture technologies, at least as per current disclosures and participant narratives.

#### *5.2.5.4 Conclusion on comparative-case analysis of evidence on carbon capture, and carbon offset*

The findings reveal a consistent absence of explicit carbon capture (CCS) initiatives across all cases. Neither the participants nor the ESG reports for Companies A (Green), B (Gold), C (Orange), D (Blue), and E (Yellow) mention active deployment or strategic

plans related to carbon capture technologies. This indicates that carbon capture is either not pursued or not prioritised at present within these organisations stated environmental strategies.

Regarding carbon offsets, a differentiated pattern emerges. Companies D (Blue) and E (Yellow) demonstrate explicit commitments to carbon offsetting, embedding responsible offset strategies into their sustainability frameworks.

Company D (Blue) has developed a formal Carbon Offset Strategy guided by robust standards to ensure transparency, environmental integrity, and verifiable emissions abatement objectives across short, medium, and long-term horizons. Similarly, Company E (Yellow) commits to securing responsible carbon offsets specifically to neutralise remnant, hard-to-abate emissions, positioning offsets as a last-resort measure aligned with the Paris Agreement and latest climate science toward full carbon neutrality.

## 5.2.6 RQ2: Theme 6: Greenwashing

### 5.2.6.1 Evidence of greenwashing

Table 19: Evidence of greenwashing

<p><b>Company A Participant 1</b> <i>“And there is a whole lot of assurance programme that supports the data collection to make sure that the data is accurate and it's reviewed and verified. But generally speaking, it's in pursuit of global leading practises which considers. You know, legal compliance as as a minimum requirement. So meaning we need to disclose our performance of how we are managing our Storage facilities against the global standard”</i></p>
<p><b>Company A ESG Report:</b> <i>Through the launch of our Social Contribution Framework, we advanced the review of our approach to and management of our social contributions to incorporate requirements of ICMM's Socio-Economic Reporting Framework. Page 7 of ESG report</i></p> <p><i>We are reviewing the materiality assessment requirements set out by the IFRS's International Sustainability Standards Board, which are expected to be adopted in the UK through its Sustainability Reporting Standards. Page 12 of ESG report</i></p>
<p><b>Company B Participant 1</b> <i>“We are subscribed, look, as a Company is going to now comply especially on the accounting side there is this these IFRS”</i></p>
<p><b>Company B ESG Report:</b> <i>We report in-line with a number of global disclosure initiatives to meet the needs of our stakeholders, including the Sustainability Accounting Standards Board (SASB) and Global Reporting Initiative (GRI). Company B became a signatory to the United Nations Global Compact (UNGC) in 2021 and considers the United Nations Sustainable Development Goals (SDGs) when setting our strategy. Page 2 of ESG report. We continue to</i></p>

<i>monitor the EU Green Deal, the main regulatory framework relevant to the chemicals industry, and its component policy initiatives: the Chemical Strategy for Sustainability (CSS), Safe and Sustainable by Design (SSbD), the Ecodesign for Sustainable Products Regulation (ESPR), the Corporate Sustainability Reporting Directive (CSRD) and EU Taxonomy. Page 75 of ESG report</i>
<b>Company C Participant 1</b> <i>“So we do have that projection of reducing our emissions, and again, even if you look at our reports, you'll see that every year we also highlight the initiatives that we're implementing in order for us to realise those targets”</i>
<b>Company C ESG Report:</b> <i>Our ESG reporting process is informed by the relevant regulatory guidelines, frameworks, industry initiatives and codes of good practice applicable to the South African and global mining sector. International Council on Mining and Metals (ICMM), International Financial Reporting Standards (IFRS) Foundation International Framework, GRI Standards and GRI mining and metals sector supplement. Page 4 of ESG report</i>
<b>Company D Participant 1</b> <i>“It is the ESG framework, that Company has started and to report on”</i>
<b>Company D Participant 1</b> <i>no mention of greenwashing</i>
<b>Company D ESG Report:</b> <i>“Stakeholders demand proactive Environmental, Social and Governance (ESG) management. As a result, we must demonstrate effective management of all material sustainability matters. Accurate data and transparent reporting are critical to support meeting the rising stakeholder expectations and prevent greenwashing.” Page 30</i>
<b>Company E Participant 1</b> <i>“We also have sustainability policies in place. We have regular monitoring and reporting of our water, energy, emissions and waste. We have real-time reporting of using technology to efficiently manage resources. We also have these savings and reporting of data being externally verified”</i>
<b>Company E ESG Report:</b> <i>participated in the CDP (formerly the Carbon Disclosure Project) process which now entails one submission covering climate, water and nature. Page 187 of ESG report</i>  <i>Our energy consumption is accounted for through our carbon inventory, in line with the requirements of the GHG Reporting Protocol. Page 190 ESG report</i>

#### 5.2.6.2 Within-case analysis of greenwashing

##### **Green: Company A**

Green: Company A references the ICMM’s Socio-Economic Reporting Framework and the IFRS International Sustainability Standards Board, with expectations to align future reporting with evolving international materiality standards.

##### **Gold: Company B**

Gold: Company B reports in line with GRI and SASB standards, is a UNGC signatory, and considers the UN SDGs in strategy setting. The ESG report confirms ongoing monitoring of the EU Green Deal and related sustainability regulations (e.g., CSRD, EU Taxonomy), signifying active compliance vigilance.

**Orange: Company C**

Orange: Company C leverages the ICMM, IFRS Foundation, GRI Standards, and sector supplements for mining and metals, embedding these frameworks into its ESG reporting cycles while publicly disclosing annual performance and initiative updates.

**Blue: Company D**

The ESG report from Blue: Company D on page 30 emphasises the importance of proactive ESG management, accurate data, and transparent reporting to meet stakeholder expectations and specifically to prevent greenwashing. Despite the participant from Blue: Company D not mentioning greenwashing directly, the report acknowledges the risk and the need for credible management practices to avoid it.

**Yellow: Company E**

Yellow: Company E codifies the CDP and GHG Reporting Protocol within its reporting architecture, expanding beyond climate to water and nature, and utilizing externally verified inventories for energy and emissions. Whilst its participant had no mention of greenwashing related matters.

*5.2.6.3 Comparative-case analysis greenwashing*

A comparative-case analysis of Companies A–E reveals converging and diverging approaches to greenwashing management and ESG reporting in South Africa’s mining sector. While every company emphasises transparency, compliance, and performance credibility, they operationalise these priorities with varying depth and specificity across assurance mechanisms, framework adoption, and anti-greenwashing communication.

All five companies prioritise data verification and assurance—seen as critical to preventing greenwashing and ensuring accurate disclosures:

**Green: Company A** operates a robust data assurance programme with internal and external review and verification, treating legal compliance as a minimum baseline, and striving to meet or exceed global best practices.

**Yellow: Company E** combines technology-enabled real-time resource monitoring with routine external verification and adheres to the CDP and GHG Reporting Protocol.

**Orange: Company C** emphasises ongoing disclosure of environmental initiatives, targets, and annual performance projections, further supported by adherence to international frameworks.

Companies strive to align ESG reporting with evolving global standards, leveraging recognized frameworks both for standardization and to build stakeholder trust:

**Green: Company A** references the ICMM Socio-Economic Reporting Framework and ongoing review of ISSB materiality standards, aiming for global comparability.

**Gold: Company B** publicly discloses compliance with multiple frameworks—including GRI, SASB, IFRS—and actively monitors emerging regulations (e.g., EU Green Deal, CSRD).

**Orange: Company C** incorporates ICMM, IFRS, and GRI standards alongside industry sector guidelines into annual ESG reporting cycles.

**Yellow: Company E** references CDP and the GHG Reporting Protocol, with evidence of multi-dimensional disclosure (climate, water, nature).

Explicit reference to greenwashing management is rare in these ESG reports:

**Yellow: Company D** stands out by directly linking transparent data, accurate reporting, and proactive ESG management to the prevention of greenwashing as a stakeholder expectation.

Other companies primarily rely on the rigour of their assurance mechanisms and international framework adoption to implicitly address greenwashing risk—even if not naming it specifically.

#### *Key similarities and differences*

There is convergence on the importance of data credibility, third-party or independent verification, and use of global ESG frameworks to reinforce trust and compliance across all firms.

Only Company D directly names greenwashing in its stakeholder discourse and risk posture, while others focus on technical and governance solutions to underpin legitimacy.

Company E's adoption of real-time, technology-based monitoring and multi-dimensional reporting (beyond climate) reflects emerging best practices.

#### 5.2.6.4 Conclusion on comparative-case analysis on greenwashing

A comparative-case synthesis of Companies A–E indicates that while the mining firms exhibit collective recognition of transparency, data assurance, and compliance as integral to ESG credibility, their operationalisation of greenwashing management remains differentiated in both scope and explicitness. Convergence is evident in the institutional embedding of verification mechanisms and the adoption of international ESG frameworks, reflecting broader sectoral alignment with global sustainability norms and stakeholder expectations of reliability in environmental disclosure. Across all cases, the prioritisation of data accuracy through internal and third-party assurance represents a shared strategic response to the reputational and regulatory risks linked to greenwashing.

Despite this alignment, divergence emerges in how firms articulate and integrate anti-greenwashing principles. Blue: Company D demonstrates the most explicit engagement, directly framing transparent ESG reporting as a safeguard against greenwashing, a practice that signals a mature understanding of stakeholder accountability and reputational governance. In contrast, Companies A(Green), B(Gold), C(Orange), and E(Yellow) adopt implicit strategies that rely on procedural and technical credibility such as alignment with GRI, SASB, ICMM, CDP, and GHG Protocol frameworks, rather than explicit narrative acknowledgment of greenwashing risk.

Yellow: Company E’s integration of technology-enabled real-time monitoring and multi-dimensional disclosure (spanning climate, water, and nature domains) further illustrates an emerging trajectory within the sector, aligning digital verification and environmental analytics with ESG assurance innovation. Conversely, the more traditional assurance-driven strategies of Companies A–C, while robust, remain anchored in compliance rationales, suggesting an early-stage maturity relative to fully integrated, tech-enabled transparency systems.

### 5.2.7 RQ2: Theme 7: Waste elimination

#### 5.2.7.1 Evidence of waste elimination

Table 20: Evidence of waste elimination

**Company A Participant 1** *“So, to break down the environment is broken down into aspects. So, we’re talking about water. We’re talking about air emissions and dust. We’re talking about biodiversity, we’re talking about waste, and we lastly, we’re talking about greenhouse gas emissions and climate.”*

<p><b>Company A ESG Report:</b> <i>“To optimise the buttress construction, we explored the use of slag as a construction material. This approach not only met Glencore’s design criteria but also improved waste management practices at the site.” Page 26</i></p>
<p><b>Company B Participant 1</b> <i>“Particularly around where we source material, the quality of material that we source from them, but also in terms of some of the waste that we generate, we have suppliers that take it over and convert into, something else so it doesn’t become complete a burden to the environment”</i></p>
<p><b>Company B ESG Report:</b> <i>“Reducing waste in our mining and manufacturing processes not only minimizes our environmental impact – it also is smart business.” Page 35</i></p>
<p><b>Company C Participant 1</b> <i>“The other issue where we are collaborating with other operations is regarding the like, in terms of waste tyres specifically.”</i></p>
<p><b>Company C ESG Report:</b> <i>“Company C’s most material waste stream is mineral waste. This primarily comprises slag, waste rock and tailings, the main by-products of mining, beneficiation and smelting processes. Mineral waste is produced in proportion to production and we focus on improving mining and process efficiencies to minimise these volumes.” Page 48</i></p>
<p><b>Company D Participant 1</b> <i>“We also be looking at the initiatives as per the Waste Act in terms of the environmental management and then also they we also go with the issues of a waste licencing from the waste that is generated from all the activities on the mine.”</i></p>
<p><b>Company D ESG Report:</b> <i>“Responsibly managing waste and hazardous materials, including the safe management of tailings storage facilities.” Page 39</i></p>
<p><b>Company E Participant 1</b> <i>“No, thanks, In South Africa for example, our operation must meet the legal requirements carbon tax act, national water act and waste management, and if we do not comply with these external requirements we stand a risk of being stopped whether through Section 54 of Mining Health and Safety Act or our licence to operate gets impacted.”</i></p>
<p><b>Company E ESG Report:</b> <i>“Adheres to energy and water efficiency standards, employee safety protocols, and waste reduction practices.” Page 187</i></p>

### 5.2.7.2 Within-case analysis waste elimination

#### Green: Company A

Green: Company A reported in its ESG documentation that they explored the use of slag as a construction material to optimize buttress construction on site. This approach successfully met design criteria and also improved waste management practices at the site. Using slag in this way helps reduce waste by repurposing a by-product from industrial processes.

#### Gold: Company B

Gold: Company B's waste management approach focuses on minimizing environmental impact through reducing waste generation and smart business practices. Specifically, they source materials carefully, ensure the quality of inputs from suppliers, and have

arrangements where some suppliers take over waste to convert it into other usable materials, thus preventing the waste from becoming an environmental burden. This aligns with their ESG report statement acknowledging that reducing waste in mining and manufacturing processes not only helps the environment but also makes good business sense (Gold: Company B Participant 1; Gold: Company B ESG Report, page 35).

#### **Orange: Company C**

Orange: Company C focuses its waste management primarily on mineral waste, which includes slag, waste rock, and tailings generated in mining, beneficiation, and smelting processes. This waste is proportional to production volumes, and the company prioritizes improving mining and process efficiencies to reduce these waste volumes. In addition, there is collaboration mentioned by Orange: Company C participant specifically regarding waste tyres, indicating the company also addresses other waste streams beyond mineral waste.

#### **Blue: Company D**

Blue: Company D's waste management initiatives align with legislative requirements under the Waste Act, focusing on environmental management and waste licensing for all waste generated by mining activities. They responsibly manage waste and hazardous materials, including the safe management of tailings storage facilities, consistent with environmental standards and ESG principles.

#### **Yellow: Company E**

Yellow: Company E must comply with various legal environmental requirements including the Carbon Tax Act, National Water Act, and waste management regulations. Non-compliance with legal requirements such as the carbon tax or environmental permits could lead to operational risks, including stoppages through Section 54 of the Mining Health and Safety Act or impacts to the company's license to operate. Yellow: Company E's ESG report states formal adherence to energy and water efficiency standards, employee safety protocols, and waste reduction practices, aligning with these regulatory frameworks and aiming to mitigate environmental and operational risks.

### 5.2.7.3 Comparative-case analysis of evidence on waste elimination

Table 21: Comparative-case analysis of evidence on waste elimination

Company	Waste Management Focus	Environmental Impact Strategy	ESG Reporting Highlights	Innovation & Collaboration
<b>Green: Company A</b>	Innovative reuse of slag as a construction material to optimise buttress construction; enhances waste reduction by repurposing industrial by-products.	Focus on waste repurposing to reduce landfill waste and support sustainable construction on site.	Documented success in meeting design criteria and waste optimization using slag reuse.	Internal innovation using industrial by-product reuse in construction applications.
<b>Gold: Company B</b>	Minimization of waste generation via careful sourcing, supplier quality control, and supplier-led waste take-back for material reuse—integrating economic and environmental benefits.	Prevention of environmental burden through strategic supply chain arrangements and waste reuse by suppliers.	Explicit references to waste reduction as good business practice linked to environmental stewardship.	Supplier partnerships for circular economy practices and waste stewardship.
<b>Orange: Company C</b>	Minimising mineral waste (slag, waste rock, tailings) by improving mining and processing efficiency; includes collaboration on non-mineral waste (waste tyres).	Reduction of waste proportional to production with emphasis on operational efficiency and collaboration beyond mining waste.	Emphasis on improving operational processes to reduce waste and active engagements on additional waste types.	Collaborative approach to managing non-mineral waste alongside mineral waste reduction strategies.
<b>Blue: Company D</b>	Compliance-driven waste management aligned with Waste Act requirements, ensuring responsible handling of hazardous and mining wastes including tailings management.	Environmental management through regulatory compliance including waste licensing and hazardous waste control.	ESG efforts embedded within legislative compliance frameworks and best practice waste management.	Adherence to legal standards with less emphasis on innovation or partnerships in waste management stated.
<b>Yellow: Company E</b>	Compliance with multiple environmental laws (Carbon Tax, Water Act, waste regulations); formal	Risk mitigation through strict legal compliance to avoid operational stoppages and	ESG alignment with legal frameworks aiming to safeguard operational continuity and	Focus on compliance and operational risk management, less emphasis on

Company	Waste Management Focus	Environmental Impact Strategy	ESG Reporting Highlights	Innovation & Collaboration
	energy, water efficiency, and waste reduction practices to mitigate regulatory and operational risks.	license threats; includes safety and efficiency standards.	regulatory adherence.	innovation or external collaboration reported.

*Key notes on comparative-case analysis on waste elimination*

**Green: Company A** focuses on circular economy innovation with slag repurposing, directly reducing waste on site.

**Gold: Company B** fosters a collaborative supply chain model that turns waste into resources, integrating economic and environmental goals.

**Orange: Company C** prioritises efficiency-driven mineral waste reduction and broadens scope to other wastes via partnerships.

**Blue: Company D** primarily ensures waste management through strict regulatory compliance and environmental licensing.

**Yellow: Company E** emphasizes comprehensive legal compliance to mitigate risks, ensuring operational resilience and adherence to environmental standards.

This comparison highlights varying emphasis from innovation and collaboration to compliance and risk management across the five companies, reflecting diverse approaches to waste management within this study of mining context, as outlined on Table 21.

*5.2.7.4 Conclusion on comparative-case analysis of evidence on waste elimination*

The comparative-case analysis reveals differentiated approaches to waste management and circular economy practices across the examined companies.

Company A (Green) demonstrates a proactive orientation toward circular innovation by repurposing slag, reflecting a direct operational commitment to waste reduction and resource efficiency.

Company B (Gold) integrates waste transformation within a collaborative supply chain framework, aligning environmental objectives with economic value creation and industry-wide synergies.

Company C (Orange) adopts an efficiency-driven strategy that extends beyond mineral waste to encompass broader forms of material recovery through strategic partnerships, signalling a systemic approach to resource stewardship.

In contrast, Companies D (Blue) and E (Yellow) place stronger emphasis on regulatory compliance, environmental licensing, and risk mitigation, with their waste management practices primarily serving to ensure legal conformity and operational continuity rather than fostering innovation-led circularity.

Collectively, these findings suggest a spectrum of engagement ranging from compliance-oriented to innovation-oriented approaches, reflecting varying levels of strategic maturity and integration of circular economy principles into organisational environmental management frameworks.

## 5.2.8 RQ2: Theme 8: Nature based solution

### 5.2.8.1 Evidence of nature-based solution

Table 22: Evidence of nature-based solution

<b>Company A Participant 1</b> <i>“We're talking about air emissions and dust. We're talking about biodiversity, we're talking about waste, and we lastly, we're talking about greenhouse gas emissions and climate.”</i>
<b>Company A ESG Report:</b> <i>“We recognise that there is an opportunity for us to contribute to the protection of nature within the regions where we operate by implementing the mitigation hierarchy and offsetting some of our impacts that cannot be mitigated or restored.”</i> Page 43
<b>Company B Participant 1:</b> <i>No mention of nature-based solutions</i>
<b>Company B ESG Report:</b> <i>“Consider nature-related impacts, opportunities and dependencies when we determine where and how we mine.”</i> Page 42
<b>Company C Participant 1</b> <i>no mention of nature-based solutions</i>
<b>Company C ESG Report:</b> <i>“Biodiversity action plans are designed to protect and restore biological systems and include commitments to conserve protected areas such as wetlands, zones of endemism, archaeological and heritage sites, as well as protected and endangered species identified by the International Union for Conservation of Nature.”</i> Page 53
<b>Company D Participant 1</b> <i>“And then the other part which is not really common and in most of the mining houses and it's because of our geographic location of our organisation, and also our proximity to the nature reserve that we happen to have the privilege of having the wildlife existing or a coexisting with mining activities, and in that, we tend to be involved more on other environmental initiatives that business can we get us as a mine inducing safely our product, and as well as doing some work on conservation.”</i>

**Company D ESG Report:** *“Stakeholder engagement relating to nature-related issues is focused on collaboration with Traditional Owners, pastoralists, subject matter experts, and communication with government and regulatory agencies.” Page 74*

**Company E Participant 1** *“No thanks, our organisation looks at the environmental performance through a range of carefully monitored and reported metrics that reflect its impact on natural resources, emissions, and regulatory compliance.”*

**Company E ESG Report:** *“We are party to a strategic initiative to address nature loss in the Magaliesberg Biosphere Reserve (which includes the Cradle of Humankind World Heritage Site), near our SA PGM operations.” Page 207*

#### *5.2.8.2 Within-case analysis of nature-based solution*

##### **Green: Company A**

Company A addresses multiple environmental dimensions in its nature-based solutions as indicated by Participant 1’s emphasis on air emissions, dust control, biodiversity, waste management, greenhouse gas emissions, and climate considerations. According to Company A’s ESG report (page 43), it recognises the opportunity to contribute to protecting nature in its operational regions by applying the mitigation hierarchy framework and offsetting impacts that cannot be mitigated or restored.

##### **Gold: Company B**

The ESG report of Company B explicitly states on page 42 that they consider nature-related impacts, opportunities, and dependencies in determining where and how they mine. This indicates that while a specific participant (Participant 1) did not mention nature-based solutions (NbS) during interviews or discussions, Company B recognizes and integrates nature-based considerations within their environmental, social, and governance (ESG) framework

##### **Orange: Company C**

Company C’s ESG report on page 53 highlights their implementation of biodiversity action plans, which are designed to protect and restore biological systems through nature-based solutions (NbS). These plans include commitments to conserve protected areas such as wetlands, zones of endemism, archaeological and heritage sites, and protected and endangered species as identified by the International Union for Conservation of Nature (IUCN).

**Blue: Company D**

Company D engages in nature-based solutions (NbS) as part of its environmental initiatives due to its unique geographic location near a nature reserve, allowing co-existence of mining activities with wildlife conservation. Their ESG report highlights stakeholder engagement focused on nature-related issues involving collaboration with Traditional Owners, pastoralists, subject matter experts, and communication with government and regulatory agencies

**Yellow: Company E**

Company E's nature-based solution in the Magaliesberg Biosphere Reserve is part of a strategic, co-created initiative aimed at addressing nature loss in this sensitive biodiversity hotspot near their South African PGM operations. This reflects an integrated effort that measures environmental performance through careful monitoring of impacts on natural resources, emissions, and regulatory compliance, as emphasised by Company E's participant's view and the ESG report.

*5.2.8.3 Comparative-case analysis of nature-based solution*

*Table 23: Comparative-case analysis of nature-based solution*

<b>Company</b>	<b>Nature-based Focus</b>	<b>ESG Report Highlights</b>	<b>Approach to NbS Implementation</b>	<b>Geographic/Operational Context</b>
<b>Green: Company A</b>	Multi-dimensional: air emissions, dust, biodiversity, waste, GHG, climate	Mitigation hierarchy framework and impact offsetting (p.43)	Formal framework application with operational integration	Operational regions where nature can be protected by mitigation and offset
<b>Gold: Company B</b>	Recognizes nature-related impacts, opportunities, and dependencies	Integrates nature considerations in mining decisions (p.42)	Embedded within broader ESG framework despite absence in participant interviews	Mining site selection reflects nature-related risk and opportunity assessment
<b>Orange: Company C</b>	Implements biodiversity action plans including protected areas	Protects wetlands, zones of endemism, heritage and endangered species (p.53)	Biodiversity action plans aligned with IUCN classifications	Designated conservation sites within operational impact zones

Company	Nature-based Focus	ESG Report Highlights	Approach to NbS Implementation	Geographic/Operational Context
<b>Blue:</b> Company D	NbS driven by proximity to nature reserve, emphasizes co-existence with wildlife	Stakeholder engagement: Traditional Owners, pastoralists, experts, government	Collaborative engagement with local stakeholders and regulators	Unique location bordering nature reserve enables conservation mining
<b>Yellow:</b> Company E	Strategic initiative in biodiversity hotspot (Magaliesberg Biosphere Reserve)	Co-created initiative monitoring impacts on resources, emissions, compliance	Integrated, co-produced strategy with continuous environmental performance tracking	Biodiversity hotspot near PGM operations necessitating sensitive management

A comparative-case analysis of the five companies shows varied approaches to integrating nature-based solutions (NbS) within mining operations. Each company demonstrates different priorities and strategies in addressing nature-related impacts, with varying levels of stakeholder engagement, geographic focus, and the use of biodiversity frameworks as outlined on Table 23.

#### **Green: Company A: Multi-Dimensional Mitigation**

Green: Company A adopts a comprehensive approach, targeting air emissions, dust, biodiversity, waste, greenhouse gases, and climate issues through NbS. It applies the mitigation hierarchy; avoid, minimize, restore, and offset, to limit its operational impact and actively seeks opportunities for nature protection in operational regions, as highlighted in ESG reporting.

#### **Gold: Company B: Nature-Related ESG Integration**

While not explicitly discussed in participant interviews, Gold: Company B's ESG report indicates an integrated consideration of nature-related impacts and dependencies in mining decisions. The company incorporates these considerations directly into its ESG framework, guiding operational choices through a lens of nature opportunities and risks.

#### **Orange: Company C: Biodiversity Action Plans**

Orange: Company C centres its NbS work around biodiversity action plans focusing on the protection and restoration of critical biological systems. Its strategies involve

conserving wetlands, indigenous zones, heritage sites, and species recognised by the IUCN, showing a strong commitment to regulatory and ecological standards in project areas.

#### **Blue: Company D: Proximity-Driven Stakeholder Collaboration**

Blue: Company D's location near a nature reserve shapes a collaborative NbS strategy. The company engages with Traditional Owners, pastoralists, specialists, and regulators to enable wildlife conservation alongside mining. This approach reflects tailored stakeholder involvement and adaptation to geographic realities.

#### **Yellow: Company E: Biosphere Reserve Model**

Yellow: Company E pursues NbS within the Magaliesberg Biosphere Reserve, aiming for co-created solutions that address nature loss in a biodiversity hotspot. Its monitoring and compliance measures focus on natural resources, emissions, and ecological performance. The company's efforts are marked by both strategic initiative and active stakeholder input.

#### *5.2.8.4 Conclusion of comparative-case analysis of nature-based solution*

The comparative-case analysis reveals that all five companies are implementing nature-based solutions (NbS) as part of their environmental stewardship, but their approaches differ in scope, integration, and emphasis.

Each company recognises the operational and strategic importance of addressing nature-related impacts. While some, such as Green: Company A (targeting air emissions, dust, biodiversity, waste, greenhouse gases, and climate issues, and implementing: avoid, minimize, restore, and offset) and Orange: Company C (conserving wetlands, indigenous zones, heritage sites, and species), differ in approach and have detailed, multi-dimensional frameworks and robust biodiversity action plans, others, like Gold: Company B and Blue: Company D (engages with Traditional Owners, pastoralists, specialists, and regulators to enable wildlife conservation alongside mining), focus on integrating nature-related considerations via ESG frameworks and stakeholder-driven initiatives adapted to their unique geographic contexts. Whilst Yellow: Company E focuses on nature loss in a biodiversity hotspot

A common trend across the cases is the emphasis on active stakeholder engagement. Companies illustrate collaboration with local communities, Traditional Owners, ecological experts, and regulatory bodies, underpinning the necessity of inclusive, context-sensitive NbS strategies.

There is a strong focus on tailoring nature-based interventions to local contexts, such as working within biosphere reserves or adjacent to protected natural habitats, demonstrating that spatial and ecological realities shape both the risks and opportunities for NbS.

## 5.2.9 RQ3: Theme 9: Access to credit/funding

### 5.2.9.1 Evidence of access to credit/funding

Table 24: Evidence of access to credit/funding

<b>Company A Participant 1</b> <i>no mention of access to credit/funding</i>
<b>Company A ESG Report:</b> <i>no mention of access to credit/funding in the ESG report</i>
<b>Company B Participant 1:</b> <i>“Whether you are taking this topic quite seriously, so you have to be able to demonstrate what the impact of your business is on the climate is at the centre of you running the business. So, and on that basis, if we were doing nothing. It's unlikely that we'd have gotten any funds for those projects that we, we undertaking so it does force us in that work to move in that direction to make sure sustainability, climate change type topics are at the centre, of doing business”</i>
<b>Company B ESG Report:</b> <i>no mention of access to credit/funding in the ESG report</i>
<b>Company C Participant 1</b> <i>no mention of access to credit/funding</i>
<b>Company C ESG report</b> <i>no mention of access to credit/funding in the ESG report.</i>
<b>Company D Participant</b> <i>no mention of access to credit/funding</i>
<b>Company D ESG Report:</b> <i>no mention of access to credit/funding in the ESG report</i>
<b>Company E Participant 1</b> <i>no mention of access to credit/funding</i>
<b>Company E ESG Report:</b> <i>no mention of access to credit/funding in the ESG report</i>

### 5.2.9.2 Within-case analysis of access to credit/funding

#### Green: Company A

There is no mention of access to credit or funding in Company A's ESG report or from Participant 1's statements. This suggests that Company A's ESG disclosures and participant insights do not highlight or address the aspect of access to credit or financing in their sustainability or corporate governance reporting.

#### Gold: Company B

Company B's participant states that demonstrating the climate impact of their business is critical to securing project funding, implying that sustainability and climate change considerations are central to gaining access to funds for their projects. However, the ESG report for Company B does not explicitly mention access to credit or funding linked to ESG or climate-related factors.

### **Orange: Company C**

There is no mention of access to credit or funding in Company C's ESG report or from Participant 1's statements. This suggests that Company C's ESG disclosures and participant insights do not highlight or address the aspect of access to credit or financing in their sustainability or corporate governance reporting.

### **Blue: Company D**

There is no mention of access to credit or funding in Company D's ESG report or from Participant 1's statements. This suggests that Company D's ESG disclosures and participant insights do not highlight or address the aspect of access to credit or financing in their sustainability or corporate governance reporting.

### **Yellow: Company E**

There is no mention of access to credit or funding in Company E's ESG report or from Participant 1's statements. This suggests that Company E's ESG disclosures and participant insights do not highlight or address the aspect of access to credit or financing in their sustainability or corporate governance reporting.

#### *5.2.9.3 Comparative-case analysis of access to credit/funding*

Across the five companies reviewed (A through E), the treatment of access to credit or financing in the context of ESG and sustainability reporting reveals a notable pattern:

**Company B (Gold)** is the only case where participant insights explicitly link climate impact demonstration to securing project funding. This underscores the strategic importance of sustainability performance in accessing capital for projects. However, Company B's formal ESG report does not explicitly address access to credit or funding in relation to ESG or climate factors.

**Companies A (Green), C (Orange), D (Blue), and E (Yellow)** show no evidence in either ESG disclosures or participant statements that access to credit or financing is linked to their sustainability or corporate governance efforts. Their reports and interview data do not highlight this financial aspect as part of their ESG narrative.

#### *5.2.9.4 Conclusion on comparative-case analysis of access to credit/funding*

The comparative-case analysis indicates a limited and uneven integration of access to credit or financing within the sustainability and ESG discourse across the five companies examined. Company B (Gold) stands out as the sole case where participant perspectives directly connect the demonstration of climate impact and project-level sustainability

performance to enhanced opportunities for financing. This linkage highlights the emerging strategic relevance of environmental accountability as a determinant of capital access. Notably, however, this relationship is not reflected in Company B’s formal ESG reporting, pointing to a potential disconnect between operational practice and public disclosure. In contrast, Companies A (Green), C (Orange), D (Blue), and E (Yellow) exhibit no discernible reference, either in ESG documentation or in participant narratives, to the interplay between sustainability performance and financing mechanisms. This absence suggests that the financial implications of ESG performance remain largely underdeveloped or unarticulated within their sustainability frameworks. Collectively, these findings reveal that while the alignment between environmental responsibility and financial capital is beginning to emerge within select contexts, it remains inconsistently embedded across firms, indicating an opportunity for deeper integration of sustainability–finance linkages in corporate strategy and reporting practices.

### 5.2.10 RQ3: Theme 10: Reduce energy costs

#### 5.2.10.1 Evidence of reduces costs/financial benefits

Table 25: Evidence of reduces costs/financial benefits

<p><b>Company A Participant 1</b> <i>“It’s driven through efficiencies. So, it’s production tonne of a product produced by a volume of water used. So, the idea is you want to make sure that you’re as efficient as possible, it could be 5.5 cubic metres of water per tonne produced and in addition to that, when still on water you know it’s a target that drives the reuse of processed water”</i></p> <p><i>“any of other activities that I do, so that’s the second layer where you say I don’t just want to comply to emission limits. I just want to reduce my liability, the third layer. Which it’s actually now informed by environmental policy”</i></p>
<p><b>Company A ESG Report:</b> <i>In 2024, we received 33 water-related fines totalling approximately \$6.6 million (2023: 28 water-related fines totalling \$2.2 million). In some of our operating regions, the imposition of water-related fines can be a protracted process and around \$4.1 million of these fines relate to infractions that occurred over five years ago. We continue to focus our efforts on minimising our impact on water and the environment. Page 36 ESG report</i></p>
<p><b>Company B Participant 1:</b> <i>“We did get into a power purchase agreement with the solar company that has solar facilities and there we managed to replace approximately 40% of our electricity needs.”</i></p> <p><i>“So we’re looking roughly, probably by the end of next year we’ll have, we would have replaced our energy needs. 70% of that will be replaced by renewables. So, we’re no longer going to contribute to Emissions from Eskom because they use coal largely, which is the bad for the environment”</i></p>

**Company B ESG Report:** *“In 2024, our absolute energy consumption increased by 9%, and energy intensity decreased by 2% compared to the previous year. This reduction is due in large part to the following actions, all of which build on our previous work to reduce energy use or reuse process emissions.*

*In 2024, Company B entered into a power purchase agreement with Pacific Energy to design and deliver a new 26 MW hybrid renewable power system for our Atlas Mine site in New South Wales, Australia. This power system is expected to provide up to 40% renewable energy to the mine site’s power supply, which would reduce our annual carbon emissions by approximately 13,000 tonnes and diesel usage by nearly 5 million liters per year.” Page 31 ESG report*

**Company C Participant 1** *“But we realise obviously when we implement this, there is cost implications which is very huge in terms of short term, but the long-term benefits are great. I mean if you look at the cost of these big electric vehicles, is very high, i mean, you're talking millions there, but if you look at the long-term impact of reducing those diesel emissions, I mean those are long term benefits”*

**Company C ESG report** *“Company C has made significant progress in its journey to wheel renewable energy, especially notable in the construction of the 100MVA solar facility. Once operational, this will supply approximately 30% of Company C’s energy requirements. Company C is investigating a possible energy blend for our Northern Cape operations to combine solar, battery storage, wind and gas.” Page 45 ESG Report.*

**Company D Participant** *“So we done the same with dollarite, right now and can be used in the road construction and so our stakeholder department also in in discussions with other entities that can actually take the dollarite right and make use in road construction action whether it will bring in monetary value or not.*

*we have achieved an accumulated energy and water cost savings worth R631 million year to date.*

*And like I said, that stretches across all energy disciplines, whether it's be coal, catbot, electricity and water from a from a CO2 perspective, of course, all the electricity projects has CO2 impacts”*

**Company D ESG Report:** *During FY24, the solar plant at the Pilgangoora Operation generated approximately 11.8GWh and contributed 9.5% of the total electricity produced for on site electricity consumption. As a result of the improved efficiencies, more than 9,700 large scale generation certificates were created and approximately 3ML of diesel fuel was displaced which reduced net emissions by approximately 8,000tCO2-e. Page 72 of ESG report*

**Company E Participant 1** *“The renewable portfolio reduces costs by more than 20% compared to Eskom tariffs and significantly lowers the company’s greenhouse gas emissions, supporting their target of achieving carbon neutrality by 2040.*

*I will give an example, we see savings in form of energy savings, for instance in 2024 for instance we achieved energy savings of more than 100GWh, which then translated well for our financial performance. We also have seen benefits coming through, from, from our reduction in greenhouse gases, reduction of water purchase by implementing improvement initiatives in our operations.”*

**Company E ESG Report:** *Our diesel consumption decreased by 22%, mainly due to a reduced need for standby electricity generation and we are continuing to trial battery electric vehicles, covering a range of applications, to further reduce our diesel usage and associated emissions. Page 203 of the ESG report*

*Our foremost decarbonisation lever is a more than 600MW portfolio of renewable energy projects in South Africa, where electricity consumption contributes 92% of our Group operational emissions. 407MW of solar and wind projects are currently under construction. Accelerated decarbonisation will enable enhanced sustainability, and shared value creation for our stakeholders. Page 186 of the ESG report*

#### **5.2.10.2** *Within-case analysis of the evidence of reduces costs/financial benefits*

##### **Green: Company A**

Company A's environmental performance centers on water efficiency, driven by quantitative production targets and operational reuse as outlined by Participant 1. Efforts to exceed basic compliance reflect a policy-informed approach to resource management. Nevertheless, ESG reporting for 2024 documents a significant financial liability, with water-related fines totaling \$6.6 million, which triple the previous year's amount, partly attributable to infractions dating back over five years.

##### **Gold: Company B**

Company B's participant notes a transition to solar energy, with power purchase agreements enabling replacement of up to 70% of the company's electricity needs by the following year. The ESG report details a hybrid renewable project expected to cut annual carbon emissions by 13,000 tonnes and reduce diesel use by 5 million liters. Although absolute energy use increased by 9% in 2024, energy intensity fell by 2%, suggesting efficiency gains. These investments are projected to lower long-term operational costs and reduce exposure to carbon-intensive energy markets, illustrating both environmental and economic advantages.

##### **Orange: Company C**

Company C's participant describes substantial capital expenditure on electrically powered vehicles and renewable projects, viewing the initial costs as justified by anticipated long-term benefits. ESG disclosures confirm progress on a large solar facility

that will meet 30% of energy requirements once operational, signalling future reductions in fossil fuel dependence and operating costs.

#### **Blue: Company D**

Company D's resource efficiency programs have yielded accumulated cost savings of R631 million, spanning energy and water usage, as reported by the participant. ESG documentation supports these claims with evidence of emission reductions, diesel displacement, and operation of a solar plant contributing 9.5% of on-site power.

#### **Yellow: Company E**

Company E's renewable energy initiatives have reduced electricity costs by over 20% relative to Eskom tariffs and delivered more than 100GWh in savings for 2024, as described by a participant. ESG reports detail diesel consumption reductions by 22%, ongoing battery electric vehicle trials, and construction of 407MW solar and wind capacity. These actions are directly linked to improved financial and environmental metrics, supporting Company E's pursuit of carbon neutrality by 2040 and operational resilience through resource optimisation.

#### **5.2.10.3 Comparative-case analysis of the evidence of reduces costs/financial benefits**

A comparative review across Companies A to E highlights both convergence and divergence in the financial and operational impacts of environmental performance initiatives.

Green: Company A demonstrates an evolution toward policy-driven water efficiency, integrating production-based targets and water reuse as part of operational best practice. Nonetheless, significant financial exposure remains due to water-related fines.

In contrast, Gold: Company B exemplifies the integration of large-scale renewables and power purchase agreements into its operational model, where a projected replacement of up to 70% of grid electricity delivers both environmental and economic value. ESG disclosures show measurable reductions in diesel use and carbon emissions, establishing a robust business case for investment in hybrid energy systems.

Orange: Company C's strategy centres on significant upfront investment in renewable-powered assets, particularly electric vehicles and solar facilities, with the explicit expectation that long-term operational savings and reduced liability will outweigh initial costs.

Blue: Company D offers clear evidence of cumulative cost savings (R631 million) and improved resource efficiency spanning energy and water domains. Certified emission reductions and expanded solar capacity have resulted in measurable decreases in diesel consumption and enhanced regulatory compliance, supporting the proposition that resource stewardship initiatives yield quantifiable financial returns.

Yellow: Company E's decarbonisation strategy has produced a direct reduction in electricity costs, exceeding 20% versus conventional tariffs, and delivered substantive energy savings (exceeding 100GWh in 2024). With substantial renewable capacity in development and ongoing diesel reduction, Company E exemplifies the pronounced financial and operational benefits available to firms committed to the full integration of sustainability into strategic planning.

#### *5.2.10.4 Conclusion comparative-case analysis of the evidence of reduces costs/financial benefits*

The comparative-case analysis of Companies A(Green) to E (Yellow) reveals both commonalities and distinguishing features in the financial and operational impacts of environmental performance initiatives.

Green: Company A's evolution towards policy-driven water efficiency is undermined by recurring financial exposure tied to water-related fines, illustrating that governance gaps can offset operational improvements.

By contrast, Gold: Company B's large-scale integration of renewable energy and structured power purchase agreements has delivered clear environmental and financial gains, positioning hybrid energy investment as a resilient business strategy.

Orange: Company C's substantial upfront investment in electrified assets and solar facilities underscores the anticipated long-term savings and risk reduction central to contemporary decarbonisation strategies.

Blue: Company D demonstrates quantifiable cost savings and regulatory compliance, showing that resource stewardship can yield measurable financial returns.

Finally, Yellow: Company E's comprehensive decarbonisation efforts have produced both significant energy savings and operational cost reductions, affirming the organisational benefits of embedding sustainability within strategic planning.

Together, these cases substantiate the argument that environmental performance, when systematically and strategically managed, consistently drives positive organisational outcomes, albeit with varying degrees of immediate financial risk and long-term benefit.

### 5.3 Conclusions

In summary, multiple sub-themes emerged from the analysis of the findings. Table 26 synthesises these sub-themes under each overarching theme, organised according to the relevant research question or construct.

*Table 26: Summary of subthemes emerging from the findings:*

Constructs	Themes	Sub-themes
Environmental initiatives-RQ1	Peer collaboration and stakeholder green value co-creation	National collaboration (MCSA/DMPR)
		International industry body collaboration (ICMM)
		Interorganisational collaborations
		Inter-sectoral partnership models
		Regional multi-infrastructure governance
	Green investment	Organizational Renewable Energy Investments
		Third-Party Renewable Energy Procurement
		Operational Eco-Efficiency Initiatives
		Power Purchase Agreement (Renewable)
		Integrated Water Resource Management Strategies
		Circular Process Engineering Innovations
		Transitional Low-Carbon Energy Generation
		Energy Demand Reduction Technologies
		Adoption of Electrified Machinery
		Strategic Green Technology Investment
		Air Quality and Particulate Matter Mitigation Strategies
		Circular Economy Integration Models
		Extended Supply Chain Decarbonization Initiatives
	Innovation and digital technology	Centralized Digital Governance Platforms (Headquarter platforms)
		Digital Environmental Data Reporting Systems
		Automation-Driven Environmental Monitoring
		Advanced Engineering for Environmental Sustainability
		Resource Optimization Technologies
		Bioremediation technologies
		Sulfuric Emission Reduction Technologies
		Digital Sustainability Analytics and Disclosure Practices
		Artificial Intelligence-Enabled Environmental Management
		Extended Reality Applications in Sustainability
		Digital Twin Modelling for Sustainability
		Public Private Partnerships (new)
	Municipal Water Efficiency Initiatives	
	Local Government Sustainability Projects	
	Environmental Regulatory Compliance and Stakeholder Engagement	

<b>Environmental Performance-RQ2</b>	Carbon capture and carbon offset	Natural Gas to Electricity Conversion Initiatives
		Carbon offset strategy embedded
		Corporate Carbon Offset Programs
	Waste management	Tailings Facility Risk Optimization Strategies
		Waste repurposing
		Integrated Waste Minimization Approaches
		Sustainable Supplier Sourcing Policies
		Regulatory Waste Management Compliance
	Greenwashing	Sector-Specific ESG Disclosure Frameworks
		International ESG Reporting Standards Implementation
		IFRS Sustainability Standards Adoption
		United Nations Global Compact Affiliation
		Strategic Integration of UN SDGs
		Sectoral ESG Reporting Supplements (Mining/Metals)
		GHG Emissions Protocols and Disclosure Instruments
	Nature-based solutions (new)	Biodiversity Mainstreaming Practices
		Strategic Biodiversity Management Frameworks
		Ecosystem Conservation Initiatives
		Ecological Restoration and Rehabilitation Programs
Nature–Climate Synergy Models		
Protected Area Stewardship Practices		
Ecologically Responsible Tourism Support		
Corporate Wildlife Management Programs		
Landscape-Scale Ecosystem Restoration		
Habitat Creation and Management Practices		
Cultural and Ecological Heritage Protection Policies		
Water, land and air quality management		
<b>Organisational performance-RQ3</b>	Access to credit/funding	Environmental Due Diligence in Sustainable Finance
		Sustainability Performance as Capital Access Enabler
	Reduce costs/increase value	Operational Resource Efficiency Programs
		Continuous Improvement in Production Sustainability
		Green Product Innovation Initiatives
		Reduction of Environmental Rehabilitation Liabilities
		Supplier Engagement for Low-Impact Product Sourcing
		Cost effective and efficient technologies
		Renewable energy (electricity cost reduction)
		Access to funding
		Waste Monetization and Value Recovery Mechanisms
		Demand-Side Load Shifting Programs

## 6. Chapter 6: Discussion of findings and literature

### 6.1 Introduction

This chapter presents a comparative analysis of the findings outlined in Chapter 5 by relating them to the literature reviewed in Chapter 2. The structure of this chapter mirrors that of Chapter 5, which was organised according to the research questions. Chapter 5 identified ten main themes. Each theme is examined against the existing literature to establish areas of convergence, divergence, and contribution to the broader body of knowledge. For clarity and coherence, each section begins with a summary of the key findings from Chapter 5, followed by a comparative discussion with the relevant literature, and concludes with interpretative insights and implications for each theme or sub-theme.

For emergent themes identified during data analysis, a systematic, consistent, and replicable procedure was applied to uphold research rigour and internal validity. This procedure, outlined in the subsequent sections, entailed a three-stage process whenever differences or subtle divergences were observed between the study's findings and the reviewed literature, involving a focused search for additional scholarly sources to corroborate, refine, or contextualise these differences. While not exhaustive, this approach reflects a deliberate and methodical effort to corroborate the results and to locate them appropriately within the existing academic discourse.

Each section closes by presenting the outcomes in relation to its associated research question, and the chapter culminates in a revised conceptual framework that synthesises the findings and insights generated through the comparative analysis.

The three steps followed by the researcher are as follows:

#### **Step 1**

The researcher selected three articles used in the literature review in Chapter 2 and conducted key word searches of themes to identify if the subject was covered in these sources but not included in the literature review.

#### **Step 2**

Where a particular theme was not addressed in the initial phase of comparative analysis (Step 1), the researcher implemented a targeted strategy to identify authoritative perspectives. Specifically, three prominent scholars whose work had been included in the literature review were selected for further examination. For each scholar, a comprehensive search was undertaken to locate relevant and recent peer-reviewed

publications from the past five years that addressed the theme in question, thereby expanding the scope of considered sources beyond those already discussed.

Following the identification of these scholars, an additional keyword search was conducted to locate pertinent literature on the specific theme. When this search yielded relevant academic sources, the findings from the current study were systematically compared and analysed against this literature to ascertain whether there were notable similarities, distinctions, or refinements. In instances where the keyword search did not produce substantial literature related to the theme, the researcher advanced to Step 3 of the verification procedure, thereby maintaining consistency and academic rigour in the approach.

### **Step 3**

In Step 3, the researcher implemented a targeted keyword search for each relevant construct and theme within three leading academic journals. When this search produced pertinent literature, the subsequent analysis closely mirrored the approach taken in Step 2, involving a detailed comparison of the study's findings with those reported in the newly retrieved sources to ascertain both similarities or differences. Conversely, if the search did not yield relevant literature, this was interpreted to signify a potential contribution to the existing body of knowledge, highlighting the novelty or originality of the findings.

The specific keywords utilised at each stage of the search process have been explicitly stated to promote transparency and enable replicability. Any literature newly identified during these additional search steps was considered and discussed exclusively within this chapter, with full citations provided in the reference list. Such sources are supplementary to, and distinct from, the body of literature reviewed in Chapter 2.

## **6.2 Research question 1: Internal and external environmental initiatives**

### **6.2.1 RQ1: Theme 1- Peer Collaboration and Stakeholder Green Value Co-creation**

#### *6.2.1.1 Recap of findings on peer collaboration and stakeholder green value co-creation*

The company analysis demonstrates distinct variations in the degree and nature of peer collaboration across the examined companies.

All companies recognise the necessity of peer collaboration (formal industry bodies, operational partnerships) and stakeholder dialogue (local communities, government, NGOs) as central for sustainable environmental initiatives.

Approaches differ in formality, scope, and focus—ranging from policy-driven advocacy and industry norm-setting (A, D), operational co-creation (B, C), to iterative, participatory regional engagement (E). Sectoral context, such as water scarcity or heritage concerns, shapes each company's engagement methods and thematic emphasis.

In conclusion, the comparative-case analysis of stakeholder collaboration among Companies A–E demonstrates that effective environmental stewardship in this study of the mining companies is underpinned by both multilateral and context-specific approaches that blend global standards with operational realities. Across cases, robust peer collaboration, transparent engagement mechanisms, integration of community voices, including Indigenous and vulnerable groups, and active participation in industry and regulatory forums emerge as key pillars that support the achievement of sustainability objectives.

#### *6.2.1.2 Recap of literature on peer collaboration*

The study by Annan et al. (2025) of small manufacturing firms in Ghana reveals that green value co-creation, a process whereby firms engage customers and suppliers in jointly developing and implementing green initiatives, serves as a critical moderator of the relationship between green process innovation and financial performance. Specifically, the benefits of green process innovation on financial outcomes are maximised when firms cultivate intensive green value co-creation but exercise restraint with overt customer-driven green strategies. This suggests that resource orchestration, actively coordinating and leveraging both internal and external capabilities, enables the organisation to optimise the financial returns from green innovation investments (Annan et al., 2025). Corroborating these findings, Cabigiosu et al. (2025) demonstrate that collaborative mechanisms and customer engagement strategies substantially enhance innovation performance within service industry firms in Italy. However, their study cautions that excessive customer involvement can diminish innovation gains, indicating a threshold beyond which value co-creation becomes inefficient. Similarly, Lei et al. (2025) showed that, in multinational enterprises (MNEs), the parent company's superior innovation performance positively filters down to subsidiaries via nurturing mechanisms and motivational support, driving overall organisational innovation outcomes and improve environmental performance.

These studies underscore that green innovation and value co-creation, when precisely orchestrated and contextually moderated, yield significant financial and innovation benefits for firms. The implications are clear: balancing internal and external stakeholder

collaboration is essential for maximising the impact of green process innovation, and spillover effects within MNEs can catalyse broader performance improvements.

### *6.2.1.3 Discussion of findings with literature on peer collaboration and stakeholder green value co-creation*

The comparative analysis of peer collaboration and stakeholder green value co-creation within multinational enterprises (MNEs) studied in South Africa's mining sector revealed both similarities and differences in the substantive embedding and communication of collaborative environmental strategies across organisational levels. This empirical evidence resonates with key insights from the extant literature on peer collaboration and green innovation value co-creation.

#### *Mapping Study Findings to Extant Literature*

The study demonstrates that Companies A (Green), D (Blue), and E (Yellow) formally acknowledge collaborative partnerships, primarily in relation to water stewardship initiatives; however, the disconnect between reported collaboration and participant recognition underscores the importance of not merely instituting collaborative frameworks but also fostering internal awareness and shared ownership among employees. Company C (Orange), which exhibits robust alignment between documentary and experiential accounts, exemplifies substantive multi-stakeholder partnerships in resource-constrained contexts, attesting to the positive impact that embedded peer collaboration can have on critical areas such as water management, logistics, and energy infrastructure. Conversely, Company B (Gold) stands at the opposite end of the spectrum, with negligible evidence of peer collaboration, pointing to missed opportunities for synergy and innovation in environmental initiatives.

These empirical patterns parallel Annan et al. (2025), who argue that green value co-creation acts as a powerful moderator of the relationship between process innovation and financial performance, particularly when firms orchestrate both internal and external capabilities. The optimal scenario is resource orchestration that leverages the strengths of both peer partnerships and stakeholder engagement. Customer-driven collaboration, as noted, can impede innovation outcomes, a cautionary insight mirrored in the study's finding that some firms overemphasise strategic narratives in ESG disclosures while lacking operational depth or coherence in collaborative practices (Cabigiosu et al., 2025).

Furthermore, Lei et al. (2025) highlight the role of organisational mechanisms in transmitting innovation gains throughout MNE subsidiaries, stressing that motivational support and nurturing channels from parent to subsidiary firms are essential conduits for

innovation and environmental performance improvements. The pronounced peer collaboration observed in Company C (Orange) through multi-level engagement provides an illustrative example of how such mechanisms can facilitate knowledge spillover and operational synergy within MNE structures.

#### *6.2.1.4 Conclusion of the discussion of findings for RQ1- Theme 1 Peer Collaboration and stakeholder green value co-creation*

The study's findings also aligned with the scholarly literature on peer collaboration and stakeholder green value co-creation.

This finding suggests that firms with high internal-external alignment in collaboration are well-positioned to realise both innovation gains and environmental performance benefits, echoing the literature's emphasis on value co-creation and intrafirm spillover effects (Annan et al., 2025). Peer collaboration and stakeholder green value co-creation across the examined multinational enterprises is characterised by marked heterogeneity in both its formal articulation and operational integration within organizational practice. The strongest manifestation of alignment is observed in contexts where multi-stakeholder engagement is deeply embedded across strategic and operational domains, demonstrating the catalytic role of peer collaboration in resource stewardship (Annan et al., 2025; Cabigiosu et al., 2025) particularly in water governance, logistics, and infrastructure-sharing efforts.

Collectively, these findings suggest that the strategic value of peer collaboration and stakeholder green value co-creation lies not merely in its documentation but in the extent to which collaborative practices are coherently embedded and actively communicated throughout multiple organisational levels. Thus, achieving optimal environmental and innovation outcomes necessitates both authentic cross-firm engagement and the dynamic alignment of partnership strategies with internal organisational realities.

## **6.2.2 RQ1: Theme 2- Green Investment**

### *6.2.2.1 Recap of findings on green investment*

Companies in this study are actively making green investments as central components of their sustainability and decarbonisation strategies. These initiatives vary in scale and approach but collectively demonstrate a strong commitment to reducing reliance on coal-based electricity, enhancing energy security, and lowering carbon emissions.

Key conclusions include:

**Diverse Approaches:** Firms adopt different strategies, ranging from incremental increases in renewables (Green: Company A) to aggressive near-term scaling with large PPAs and operational projects (Gold: Company B), targeted regional solar plants (Orange: Company C), and multi-stage, technology-diverse power strategies including natural gas and battery storage (Blue: Company D).

**Significant Renewable Shares:** Renewable energy contributions range from modest current shares (4.3% for Green: Company A) to ambitious targets up to 70% or more (Gold: Company B), reflecting varied maturity levels and investment horizons.

**Integration Beyond Generation:** Companies incorporate renewables not only for electricity supply but also operational applications such as solar-powered water pumps (Blue: Company D), indicating innovation in embedding sustainability within core processes.

**Risk and Cost Focus:** Reducing exposure to Eskom's coal-intensive supply and associated risks is a consistent driver, alongside efforts to manage energy costs and improve supply reliability.

**Medium- to Long-Term Timelines:** Most renewable projects target significant milestones by 2027 and beyond, reflecting the capital-intensive nature of energy transitions in multinational enterprises.

**Process optimisations:** All companies engage in process optimisation targeting emissions and resource efficiency. Several adopt circular economy approaches (Gold: Company B) or renewable energy transitions (Orange: Company C). Blue: Companies D and Yellow: Company E focus on efficiency and offsets, respectively, indicating a spectrum from operational improvements to broader environmental linkage strategies. Strategic timelines vary from short- to medium-term actions, reflecting differing maturity levels and focus areas in sustainability pathways.

Overall, these findings reflect organisations that are conducting projects signify a pivotal shift towards cleaner, more secure, and resilient energy systems within South Africa's capital-intensive mining sector, in addition to focusing on process innovation and digital technologies.

#### *6.2.2.2 Recap of literature on green investment*

Zaheer (2025) sustainability of multinational enterprise (MNE) sustainability initiatives depends on the interplay of both extrinsic (stakeholder pressures from investors, consumers, activists; regulatory requirements; access to green financing and incentives)

and intrinsic motivations (alignment with firm strategy, pursuit of competitive advantage, and the need to maintain organisational legitimacy in the eyes of society and employees). MNEs possess the resources, technology, and international reach to significantly advance climate action, their engagement in sustainability efforts is fundamentally driven by strategic self-interest, legitimacy concerns, stakeholder pressures, and regulatory frameworks rather than pure selflessness.

Li and Ramanathan (2020) outlined that organisation's environmental initiatives focused on environmental investments, generally improve environmental performance, especially when investments are directed toward pollution prevention rather than pollution control. Li and Ramanathan distinguishes the types of environmental investments that the organisation makes to improve environmental performance, and these includes process, technology and management related investments, which collectively they authors regards as pollution prevention investments. Whilst Li and Ramanathan (2020) found that the investments that are focused on the process control, which are involved in treating or abating pollutants after their creation, showed no significant positive impact on overall environmental performance.

Asiaei et al. (2022) found that environmental initiatives related to green intellectual capital (GIC) components; green human capital, green structural capital, and green relational capital, do not have a direct relationship with environmental performance. Instead, their influence on environmental performance is fully possibly through both exploratory and exploitative green innovations. This means that GIC enhances environmental performance only when companies effectively mobilise these green assets through ambidextrous green innovation strategies.

Almandoz et al. (2021) outlined that green investing, positively influences corporate environmental performance, primarily through normative, cultural, and indirect mechanisms rather than direct governance. Almandoz et al. (2021) further noted that green investing impact to environmental performance was stronger in countries with robust shareholder protection and weaker in countries with stringent state environmental policies, highlighting the importance of institutional logics and their compatibility.

Hagendorff et al. (2025) found that corporate investment in green skills, measured through job postings emphasising environmental competencies, is associated with subsequent and substantive reductions in toxic chemical releases at operating plants, particularly chemicals harmful to humans. The environmental benefits of green skill investment are beneficial when skill-building (green investment) is targeted at local

establishments (plants), rather than corporate headquarters, reinforcing the need for site-specific capability development.

### *6.2.2.3 Discussion of findings with literature on green investment*

Findings support Li and Ramanathan (2020): pollution prevention investments such as process innovation (LED retrofits, battery-electric vehicles), direct renewable energy procurement, and water recycling, dominate these firms' sustainability programmes, with less reliance on end-of-pipe pollution control technologies. For instance, Company C and D's focus on energy efficiency and water management illustrate investments that improve overall environmental performance. Conversely, investments strictly focused on abating pollutants after creation (e.g. dust abatement only) are less emphasised, aligning with literature's argument that such investments alone do not significantly enhance performance.

Asiaei et al. (2022) highlight the mediating role of green innovation in translating green human, structural, and relational capital into performance gains. In practice, the cases show this through innovation strategies: Company A's university partnership, Company D's digital twin and AI initiatives, and Company B's employee-led circular economy projects each leverage firm-level green assets to stimulate innovations. Environmental performance improvements are realised only when these capacities are purposefully mobilised through innovation.

Consistent with Almandoz et al. (2021) the impact of green investment appears culturally and normatively mediated. Companies reduce Eskom dependence and embed green procurement to manage institutional exposure (energy risk, GHG policy), but indirect mechanisms—such as verified reporting (Company E) and collaborative initiatives (Company A's cross-site improvement platform)—drive change more than direct governance alone.

Hagendorff et al. (2025) argue that investment in local green skills yields tangible reductions in harmful emissions. Across the studied firms, site-specific investments, such as Company B's circular waste innovations or Company D's remote water and dust management, demonstrate the importance of building green competencies and capabilities at individual operations rather than confining such initiatives to headquarters. Localised implementation is thus critical for achieving substantive environmental outcomes.

These cases further illustrate that investments in technology, skills, and collaborative innovation (Green: Company A, Gold: Company B, Blue: Company D) build dynamic organisational capabilities for sustained ESG performance.

#### *6.2.2.4 Conclusion of the discussion of findings for RQ1- Theme 2 Green Investment*

There were similarities between the study's findings and literature on environmental initiatives.

The findings reveal that companies in this study are actively integrating green investment as a core aspect of their sustainability and decarbonisation strategies. Across the cases, firms deploy diverse approaches, ranging from incremental renewable adoption and targeted operational improvements to aggressive scaling via large PPAs and multi-stage, technology-driven energy transitions to reduce their reliance on coal-based electricity, manage risk, and lower carbon emissions.

Firms' green investments are consistently driven by a combination of strategic self-interest, legitimacy concerns, and external stakeholder pressures, paralleling the findings of Zaheer (2025) and Almandoz et al. (2021).

Companies generally prioritise pollution prevention strategies (energy efficiency, renewables, process optimisation) over end-of-pipe abatement, reflecting the literature's consensus that prevention-oriented investments deliver greater environmental performance improvements (Li & Ramanathan, 2020).

All cases demonstrate the importance of innovation and green intellectual capital in achieving sustainability goals. Ambidextrous innovation, leveraging digital tools, collaborative research, and employee-driven projects, is vital in enhancing overall environmental performance (Asiaei et al., 2022).

Site-specific investments and skill-building are repeatedly shown to be critical. Company-level initiatives usually target operational sites for maximum impact, matching Hagendorff et al. (2025)'s observation that local capability yields more substantive results.

### **6.2.3 RQ1: Theme 3- Innovation and Digital Technologies**

#### *6.2.3.1 Recap of findings on innovation and digital technologies*

The cases collectively illustrate that technological innovation in environmental sustainability is multifaceted, shaped by organisational culture, sectoral context, and strategic priorities. While all companies recognise the value of digital tools and advanced technologies, the depth and breadth of implementation vary significantly.

Companies that combine internal coordination with external collaboration, such as Green: Company A and Blue Company: D, tend to achieve broader and more sustainable outcomes. Meanwhile, those with strong employee engagement and circular economy initiatives, such as Gold: Company B, demonstrate the potential for innovation to drive both environmental and business value. The formal commitment to digital transformation, as seen in Orange: Company C and Blue: Company D, suggests a growing trend toward integrating AI and digitalization as core elements of environmental strategy, even if operational realities lag behind strategic intent. Yellow: Company E stands out for specialised technology use in water management with external validation, focusing on operational visibility and efficiency improvements.

#### *6.2.3.2 Recap of literature on innovation and digital technologies*

Innovation and digital resources have become foundational to modern environmental initiatives and the advancement of sustainable corporate strategies, especially for achieving Sustainable Development Goals (George & Schillebeeckx, 2022; Guandalini, 2022). Technological innovation, including green production techniques, advanced monitoring, and eco-design, directly drives emission reduction, energy efficiency, and the broad adoption of low-carbon processes (Makismov et al., 2022; Zaheer, 2025). The role of institutional frameworks is pivotal in this context, as they generate R&D incentives, provide policy support and subsidies, and establish regulatory mechanisms that reinforce the development and deployment of sustainable technologies (De Funtès et al., 2024).

Digitalisation, as highlighted by George and Schillebeeckx (2022), and Ren and Zuo (2025), fundamentally reshapes resource management and operational structures, making digital services more accessible through technologies like cloud computing. Digital technologies such as blockchain, IoT, and AI further enhance energy sector efficiency, streamline resource allocation, and enable integration of renewable energy into major grids (Ren & Zuo, 2025). These advancements also play a crucial role in scaling sustainability across multinational supply chains by supporting standard diffusion and progress monitoring. Both custom and off-the-shelf digital solutions, as evidenced by Kocoglu and Mithani (2025), have proven effective in achieving environmental objectives from a resource-based management perspective.

Nevertheless, the literature acknowledges risks associated with technological complexity. Research by Nygaard and Silkoset (2022) indicates that intricate supply chains and sophisticated production technologies can increase information asymmetry, limiting consumer ability to verify green claims. Relatedly, Chen et al. (2025) found that corporate digitalisation may amplify greenwashing by enabling impression management,

information manipulation, and operational opacity. However, contrary evidence from Johan et al. (2024), drawing on affordance theory, demonstrates that well-applied financial technology can mitigate greenwashing through enhanced transparency, managerial efficiency, and greener innovation.

In conclusion, technology and digitalisation offer both significant pathways for progress, facilitating eco-efficiency, regulatory compliance, and organisational resilience, and present new risks, including the potential misuse of innovation for greenwashing. The direction of impact depends greatly on the specific applications, institutional settings, and the degree of transparency and accountability governing technological adoption.

### *6.2.3.3 Discussion of findings with literature on innovation and digital technologies*

Empirical evidence from the cases affirms that the adoption and integration of digital technologies are highly conditioned by organisational culture, sectoral priorities, and the maturity of environmental governance structures.

While all companies acknowledge the strategic value of digital tools, ranging from AI-enabled resource management to specialised monitoring platforms, the extent of operationalisation is inconsistent, echoing Guandalini's (2022) assertion that digital resources are foundational yet unevenly embedded within sustainability practices.

The study aligns with literature highlighting the catalytic role of technological innovation in driving emission reductions, energy efficiency, and low-carbon process adoption (Makismov et al., 2022; Zaheer, 2025). For example, Gold: Company B's internally driven circular economy programmes reflect how employee engagement can operationalise eco-design and advanced monitoring in ways that deliver both environmental and economic benefits, a practical affirmation of George and Schillebeeckx's (2022) resource-based perspective on innovation.

Sectoral variation emerges as a critical theme. Companies that fuse internal coordination with external collaboration (e.g., Green: Company A and Blue: Company D) not only expand the scale of their digital initiatives but also achieve higher sustainability outcomes. This empirical pattern extends Makismov et al. (2022) findings on how institutional frameworks, through R&D incentives and supportive policy regimes, facilitate the deployment of advanced technologies, particularly where cross-boundary partnerships are present (De Funes et al., 2024).

The literature's emphasis on digitalisation reshaping operational management (George & Schillebeeckx, 2022; Ren & Zuo, 2025) finds resonance in cases where AI, blockchain, and IoT streamline resource allocation and augment the integration of renewables. Case

evidence demonstrates, however, that not all strategic intentions translate immediately to operational realities. Orange: Company C and Blue: Company D, which articulate strong commitments to digital transformation, illustrate the lag between institutional intent and technological embedding highlighted by Guandalini (2022). Conversely, Yellow: Company E exemplifies the efficacy of targeted digital interventions in water management, supported by external validation mechanisms, strengthening Ren and Zuo's (2025) argument for technology's role in enhancing operational visibility and sustainability metrics.

#### *6.2.3.4 Conclusion of the discussion of findings for RQ1- Theme 3 Innovation and digital technologies*

There were similarities between the study's findings and literature on innovation and digital technologies initiatives.

The integration of innovation and digital technologies across the case study companies underscores a transformative yet uneven trajectory in corporate environmental sustainability. Digitalisation has emerged not only as a technical enabler but as an organisational capability that amplifies coordination, transparency, and process efficiency.

However, the findings also point to persistent gaps between strategic intent and operational realisation, particularly where digital tools are adopted symbolically rather than substantively. This reinforces literature concerns regarding technological complexity and the potential misuse of digitalisation for impression management and greenwashing (Chen et al., 2025; Nygaard & Silkoset, 2022). At the same time, evidence of transparency-enhancing applications and external validation, as seen in select cases, illustrates how digital innovation can mitigate these risks through improved data integrity and accountability (Johan et al., 2024).

#### *6.2.4 RQ1: Theme 4- Public Private Partnerships environmental initiatives*

##### *6.2.4.1 Recap of findings on public private partnerships environmental initiatives*

This analysis compares the presence and nature of public-private partnerships (PPPs) as reported by five companies (A–E) in their ESG disclosures and participant interviews. PPP engagement varies significantly across the cases, highlighting diverse approaches to stakeholder collaboration in sustainability strategies.

## *Key Findings*

**Limited Disclosure Trend:** Three of the five companies (Green: Company A, Gold: Company B, Blue: Company D) provide no mention of PPPs within their ESG reports. This may reflect either a true lack of such partnerships or a reporting choice wherein only specific types of collaboration are considered publicly relevant.

**Proactive Engagement Models:** Orange: Company C demonstrates a clear, strategic use of PPPs to address a core operational risk (water supply). Membership and partnership in regional water management initiatives illustrate both sector collaboration and tangible community impact.

**Hybrid/Indirect Disclosure:** Yellow: Company E, while not highlighting PPPs in participant interviews, provides evidence in ESG reporting of structured, multi-year collaborations—particularly relating to environmental permits and stakeholder consultation (the GNA agreement), underscoring the sometimes-indirect nature of PPPs in formal reports.

**Reporting Practices:** The variability/differences in PPP disclosure suggests that companies differ in their interpretation of PPP relevance for ESG reporting. The nature and strategic importance of partnerships may influence their visibility, with only transformative, high-impact collaborations typically making it into formal disclosures.

**Stakeholder Focus:** Where PPPs are reported (e.g., Companies: Company C-Orange and Company E-Yellow), the focus tends to be on partnerships directly addressing pressing operational risks (such as water security or regulatory permitting for waste storage), and where collaborative approaches visibly benefit both the firm and broader stakeholders.

### *6.2.4.2 Recap of literature on public private partnerships environmental initiatives*

The theme Public Private Partnership was not part of the theme that was identified as a theme in Chapter 2 of the literature review.

Given that this theme was not part of the literature review in Chapter 2 and the theme being considered a new theme, a three-step approach as outlined in 6.1 of this chapter was followed. In the first steps step, Step 1, the following articles as outlined in the table below were selected for the search of the words “public private partnership”, “public private collaboration”, “government private partnership” or “government private collaboration”.

Author(s)	Article title	Returned positive result of search
Lei et al., 2025	Common institutional ownership and carbon emissions	No
Budhwar et al., 2025	Linking HRM with sustainability performance through sustainability practices: Unlocking the black box	No
De Funes et al., 2024	The determinants of multinational enterprises' sustainable innovations	Yes

De Funes et al. (2024) study found that governments and public institutions are frequently identified as crucial actors providing the enabling environments for MNEs to innovate for environmental improvement. Typical examples as stated by De Funes et al. (2024) include innovation incentives such as tax breaks for R&D, sustainable technology grants, the establishment of institutional support ecosystems (like green funds), and direct partnerships for co-developing technologies and practices that address country-specific sustainability challenges.

The study by De Funes et al. (2024) further highlights that the concept of PPP is operationalised through collaboration among governments, MNEs, local enterprises, research institutions, and NGOs as parts of innovation ecosystems. These ecosystems are described as networks wherein government agencies provide the regulatory framework, financial incentives, and policy coordination necessary to bring together disparate actors for sustainable innovation (De Funes et al., 2024).

In summary the study by De Funes et al. (2024) indicated that government and public partnerships with MNEs for environmental improvements are a central, recurring theme in the referenced research, typically framed through the concept of innovation ecosystems and stakeholder engagement involving national policy, incentives, and collaborative platforms for sustainability.

#### *6.2.4.3 Discussion of findings with literature on public private partnerships environmental initiatives*

The comparative analysis reveals that public-private partnership (PPP) engagement among the five companies (A–E) is highly varied, with notable differences in both disclosure and strategic prioritisation. When compared with De Funes et al. (2024) which frames PPPs as integral to multinational enterprise (MNE) environmental innovation

within broader stakeholder-driven ecosystems, the following similarities and differences emerge:

### **Limited Disclosure Trend vs. Central Role of PPPs**

The absence of PPP references in ESG reporting for Companies A, B, and D is at odds with De Funes et al. (2024) study, which underscores the indispensability of public partnership for enabling sector-wide innovation and adaptation to environmental challenges. This gap either reflects genuine non-engagement or divergent reporting practices where only exceptionally impactful collaborations are publicly recorded.

### **Proactive and Contextual Engagement**

Company C (Orange) exemplifies the operationalisation of PPPs as described by De Funes et al. (2024) embedding partnership in core risk management (water supply) and aligning with sectoral and community interests. This mirrors the multi-actor, ecosystemic approach detailed in De Funes et al. (2024) where PPPs serve as platforms for resilience and innovation.

### **Hybrid and Indirect PPPs**

The case of Company E (Yellow) highlights the subtler dimensions of PPP involvement, partnerships surfaced primarily through formal ESG documentation (multi-year regulatory negotiations and stakeholder-driven platforms such as the GNA agreement), with limited reflection in participant interviews. This indicates that PPPs may often be structured and impactful, yet not uniformly visible across internal and external communication channels. De Funes et al. (2024) also identifies PPPs in forms that range from highly public cooperative R&D and policy incentives to less visible, yet strategic, collaborative networks.

### **Interpretation and Visibility in Reporting**

Across the cases, PPPs appear in formal disclosures only when considered transformative or directly relevant to pressing business risks, such as regulatory requirements or critical resource supply. De Funes et al. (2024) argues for routine recognition of PPPs as essential for environmental progress, with government-led incentives and platforms facilitating multi-stakeholder engagement that transcends company boundaries.

#### *6.2.4.4 Conclusion of the discussion of findings for RQ1- Theme 4 Public Private Partnerships environmental initiatives*

The study's findings showed there were similarities in terms of outcomes of the study and literature on public private partnership initiatives.

The findings from the five-company analysis reveal selective and strategic engagement with public-private partnerships (PPPs), which only partially aligns with the comprehensive, ecosystem-driven perspective outlined by De Funes et al. (2024). PPP presence is highly variable, driven by specific operational demands and reporting practices, whereas the reviewed literature positions PPPs as foundational for environmental innovation within multinational enterprises (MNEs).

*Study's findings similarities to literature (De Funes et al., (2024))*

#### **Strategic and Contextual Engagement**

Companies such as Company C (Orange) and Company E (Yellow) demonstrate elements of PPP operationalization as described by De Funes et al. (2024). Their engagement is focused on addressing core risks (e.g., water management, regulatory compliance) using collaborative platforms and multi-year agreements, mirroring the multi-actor innovation ecosystems where governments, MNEs, and other stakeholders work together on tailored solutions.

#### **Stakeholder Platform Orientation**

Both sets of findings recognise the need for multi-stakeholder collaboration, particularly when navigating complex, localised environmental issues. De Funes et al. (2024) finds that government-led platforms and incentives (such as R&D grants, regulatory frameworks, and green funds) are crucial for these partnerships, a theme visible in the companies that engage in PPPs for regulatory or operational needs.

*Study's findings differences to literature (De Funes et al., (2024))*

#### **Disclosure and Visibility Variability:**

Companies A, B, and D show either an absence or limited disclosure of PPPs in their ESG reporting, which diverges from De Funes et al.'s assertion that PPPs are central and should be routinely acknowledged as drivers of environmental performance. This gap may indicate underreporting, stricter thresholds for disclosure, or a lack of transformative PPP activity.

## **Reporting Practices and Strategic Prioritisation**

In the corporate cases, PPPs are publicly disclosed only when they are considered transformative or essential to business operations. De Funes et al. (2024) advocates for routine, systemic recognition of all forms of PPPs, suggesting many actual partnerships and collaborative efforts may be omitted from formal disclosures.

## **Indirect and Fragmented Engagement**

Company E (Yellow) illustrates that PPPs may operate in less visible forms, such as through indirect agreements or regulatory processes that do not align with interview narratives. De Funes et al. (2024) identifies similar phenomena, where collaborative efforts—sometimes informal or embedded in routine operations—are pivotal but often underrepresented in public documentation.

## **Conclusion**

It is evident that PPPs play a significant role in enabling MNEs to confront environmental challenges, particularly when their engagement is directly tied to business resilience and stakeholder benefit. However, the visibility and acknowledgment of these partnerships in ESG disclosures remain inconsistent, suggesting a need for more transparent and systematic reporting approaches that better reflect the strategic, ecosystemic importance of PPPs advocated in the academic literature. This contrast highlights opportunities for improved communication of partnership activities and the broader institutional ecosystems that support MNE sustainability practices.

## **6.3 Research question 2: Environmental Performance**

### **6.3.1 RQ2: Theme 5- Carbon capture and carbon offset**

#### *6.3.1.1 Recap of findings on carbon capture and carbon offset*

The findings reveal a consistent absence of explicit carbon capture (CCS) initiatives across all cases. Neither the participants nor the ESG reports for Companies A (Green), B (Gold), C (Orange), D (Blue), and E (Yellow) mention active deployment or strategic plans related to carbon capture technologies. This indicates that carbon capture is either not pursued or not prioritised at present within these organisations stated environmental strategies.

Regarding carbon offsets, a differentiated pattern emerges. Companies D (Blue) and E (Yellow) demonstrate explicit commitments to carbon offsetting, embedding responsible offset strategies into their sustainability frameworks.

Company D (Blue) has developed a formal Carbon Offset Strategy guided by robust standards to ensure transparency, environmental integrity, and verifiable emissions abatement objectives across short, medium, and long-term horizons. Similarly, Company E (Yellow) commits to securing responsible carbon offsets specifically to neutralise remnant, hard-to-abate emissions, positioning offsets as a last-resort measure aligned with the Paris Agreement and latest climate science toward full carbon neutrality.

#### *6.3.1.2 Recap of literature on carbon capture and carbon offset*

Internal carbon pricing (ICP) has become an essential mechanism for advancing corporate environmental performance, particularly within multinational enterprises (MNEs) (Wang et al., 2022). ICP is typically implemented in three main forms: an internal carbon fee, in which a company levies a specific charge on each ton of greenhouse gas (GHG) emitted; a shadow price, which serves as an estimated cost for carbon in strategic decision-making and investment planning for low-carbon projects; and an implicit price, which reflects the cost incurred to reduce GHG emissions via targeted sustainability efforts (Wang et al., 2022).

Empirical evidence reveals that firms with higher emissions levels and greater exposure to climate-related risks are especially predisposed to adopt ICP practices (Ben-Amar et al., 2022). For these organizations, ICP not only encourages the alignment of investments and operations with net zero objectives but also serves as a response to stakeholder and regulatory expectations. This dual-purpose approach results in measurable improvements in environmental performance and confers tangible competitive advantages, such as enhanced access to export markets due to lower emission profiles (Wang et al., 2022).

#### *6.3.1.3 Discussion of findings with literature on carbon capture and carbon offset*

The study's findings reveal a notable absence of carbon capture and storage (CCS) initiatives across the examined multinational enterprises, aligning with the broader literature where internal carbon pricing (ICP) mechanisms rather than direct CCS technologies currently dominate corporate environmental strategies. Specifically, Wang et al. (2022) underscore ICP as a critical leverage tool employed by MNEs to internalize carbon costs and drive emissions reductions, which is further supported by empirical evidence revealing its adoption in high-emission firms facing climate risks (Ben-Amar et al., 2022). Conversely, the differentiated approach to carbon offsets observed in Companies D and E reflects an emerging strategy for managing residual emissions, with formal, transparent offset frameworks that adhere to climate science and international

agreements such as the Paris Agreement. This selective offset use complements ICP frameworks by mitigating hard-to-abate emissions when direct reductions are unfeasible.

#### *6.3.1.4 Conclusion of the discussion of findings for RQ2- Theme 5 Carbon Capture and Carbon Offset*

The study's findings showed that there were similarities between study's outcomes and literature on carbon capture and carbon offset initiatives.

This study's finding is similar with recent literature, which indicates that market-based instruments, specifically internal carbon pricing (ICP), have largely supplanted CCS initiatives as the primary mechanism for advancing corporate environmental performance in multinational contexts (Ben-Amar et al., 2022; Nippa et al., 2021; Wang et al., 2022). The adoption of ICP frameworks facilitates the internalisation of carbon costs, guides investment in low-carbon technologies, and aligns organisational policies with evolving regulatory and stakeholder expectations, thereby contributing to measurable improvements in environmental outcomes (Ben-Amar et al., 2022).

### *6.3.2 RQ2: Theme 6- Greenwashing*

#### *6.3.2.1 Recap of findings on greenwashing*

A comparative-case synthesis of Companies A–E indicates that while the mining firms exhibit collective recognition of transparency, data assurance, and compliance as integral to ESG credibility, their operationalisation of greenwashing management remains differentiated in both scope and explicitness. Convergence is evident in the institutional embedding of verification mechanisms and the adoption of international ESG frameworks, reflecting broader sectoral alignment with global sustainability norms and stakeholder expectations of reliability in environmental disclosure. Across all cases, the prioritisation of data accuracy through internal and third-party assurance represents a shared strategic response to the reputational and regulatory risks linked to greenwashing.

Despite this alignment, divergence emerges in how firms articulate and integrate anti-greenwashing principles. Blue: Company D demonstrates the most explicit engagement, directly framing transparent ESG reporting as a safeguard against greenwashing, a practice that signals a mature understanding of stakeholder accountability and reputational governance. In contrast, Companies A(Green), B(Gold), C(Orange), and E(Yellow) adopt implicit strategies that rely on procedural and technical credibility, such as alignment with GRI, SASB, ICMM, CDP, and GHG Protocol frameworks, rather than explicit narrative acknowledgment of greenwashing risk.

Yellow: Company E's integration of technology-enabled real-time monitoring and multi-dimensional disclosure (spanning climate, water, and nature domains) further illustrates an emerging trajectory within the sector, aligning digital verification and environmental analytics with ESG assurance innovation. Conversely, the more traditional assurance-driven strategies of Companies A–C, while robust, remain anchored in compliance rationales, suggesting an early-stage maturity relative to fully integrated, tech-enabled transparency systems.

#### *6.3.2.2 Recap of literature on greenwashing*

Greenwashing encompasses deliberately misleading communications that inflate perceptions of a company's environmental responsibility among stakeholders (Balluchi et al., 2020). Such practices can significantly distort stakeholder trust, damage corporate credibility, and intensify negative reactions during environmental scandals, particularly when gaps between public claims and actual conduct are exposed (Balluchi et al., 2020). Empirical studies by Cui et al. (2024) reveal that multinational corporations' environmental score ratings frequently serve as managerial tools to obscure inadequate carbon reduction efforts manifesting a “talk more, act less” pattern indicative of greenwashing. These behaviours are moderated by domestic cultural traits, such as individualism, masculinity, and uncertainty avoidance, which negatively affect firms' balance between environmental claims and substantive actions. After the Paris Agreement, greenwashing became more prevalent in societies characterized by greater power distance, with the treaty failing to curb these deceptive practices (Cui et al., 2024).

Research by Chen et al. (2025) further demonstrates that digitalisation heightens greenwashing risks, enabling impression management and information manipulation that complicate stakeholder evaluation of actual environmental performance. By contrast, Johan et al. (2024), using affordance theory, find that digital solutions, particularly financial technology, can counteract greenwashing by boosting transparency, managerial efficiencies, and green innovation.

Collectively, these studies underscore that greenwashing not only undermines genuine environmental progress through deceptive symbolic actions, but also reflects deeper vulnerabilities within corporate governance, digital strategy, and national cultural dynamics.

#### *6.3.2.3 Discussion of findings with literature on greenwashing*

A critical synthesis of the comparative-case findings (Companies A–E) reveals nuanced alignment and divergence in the operationalisation of greenwashing management within

the South African mining sector, congruent with evolving scholarly insights on the phenomenon. The collective recognition of transparency, verification, and compliance as pillars of ESG credibility among mining firms is notable, aligning closely with Balluchi et al. (2020), who argue that deliberate misrepresentation in sustainability communications significantly undermines stakeholder trust and corporate legitimacy. However, the findings illustrate that whilst all firms under the study institutionalise verification mechanisms and adhere to leading ESG frameworks (GRI, SASB, ICMM, CDP, GHG Protocol), explicit narrative engagement with greenwashing risks varies across cases.

The observed sectoral convergence towards adopting third-party assurance and global disclosure standards reflects a maturing response to reputational and regulatory pressures, mirroring literature that highlights the strategic importance of reliable ESG data in mitigating stakeholder scepticism. In particular, Company D's explicit positioning of transparent ESG reporting as a bulwark against greenwashing demonstrates an advanced stage in the operationalisation of stakeholder accountability, a recognition resonant with Balluchi et al. (2020), who emphasise the reputational toll of failed alignment between corporate claims and environmental conduct. Conversely, the implicit anti-greenwashing strategies of Companies A–C and E, which default to procedural rigor and technical credibility without overtly confronting greenwashing narratives, suggest a more cautious or compliance-driven maturity in aligning environmental communications with substantive action.

Emergent trends in digitalisation, as evidenced by Company E's adoption of real-time monitoring and multidimensional ESG analytics, further contextualise the relationship between technological innovation and greenwashing management. Chen et al. (2025) caution that digitalisation can exacerbate greenwashing by equipping firms with enhanced capabilities for impression management and selective disclosure, thus complicating external evaluations of true performance. This risk raises concerns about the veracity of digital ESG initiatives, underscoring the importance of embedding robust verification and transparency-by-design principles within digital sustainability platforms.

Yet, the literature also clarifies a countervailing potential: Johan et al. (2024) find that financial and digital affordances, when strategically integrated, can not only increase transparency but also improve managerial efficiencies and foster green innovation, thereby actively curbing greenwashing. The divergent articulation of anti-greenwashing commitments also highlights cultural and contextual influences discussed by Cui et al. (2024), who demonstrate that multinational enterprises' propensity to "talk more, act less"

in their environmental strategies is exacerbated in institutional contexts marked by high power distance and weak regulatory controls. The adoption of global ESG standards across the South African mining cases demonstrates both conformity to international norms and efforts to manage the legitimacy gap; however, notable differences in explicitness and integration of anti-greenwashing discourse suggest varying degrees of organisational reflexivity and adaptation to stakeholder pressures in different corporate cultures.

#### *6.3.2.4 Conclusion of the discussion of findings for RQ2- Theme 6 Greenwashing*

There were similarities between the study's findings and literature on greenwashing management initiatives.

Greenwashing remains a critical challenge in contemporary corporate environmental governance, particularly as firms increasingly seek to align with global sustainability norms in response to intensifying stakeholder scrutiny and evolving regulatory frameworks.

The examined cases demonstrate that while there is sector-wide convergence around the importance of transparency, data assurance, and adherence to international ESG standards, the operational maturity and explicitness of anti-greenwashing strategies are not uniform. This heterogeneity underscores the reality that, despite mounting reputational and regulatory pressures, many firms continue to rely on implicit, compliance-driven assurances rather than embracing proactive, narrative-based engagement with greenwashing risks, a finding echoed in the literature (Balluchi et al., 2020).

Moreover, digitalisation introduces a paradoxical dynamic: on one hand, it augments the risks of greenwashing through new channels for impression management and selective disclosure (Chen et al., 2025); on the other, it provides opportunities for greater transparency, real-time monitoring, and stakeholder accessibility, especially when digital affordances are strategically deployed to facilitate assurance and green innovation (Johan et al., 2024). The sector's progression towards technology-enabled ESG assurance, therefore, embodies both promise and peril, reinforcing the necessity for robust verification mechanisms and a culture of continuous, explicit stakeholder accountability.

Ultimately, as the literature further attests, cultural and institutional contexts, manifesting in managerial priorities, regulatory stringency, and national values, continue to shape

both the prevalence of greenwashing and the effectiveness of anti-greenwashing measures (Cui et al., 2024).

### 6.3.3 RQ1: Theme 7- Waste Elimination

#### *6.3.3.1 Recap of findings on waste elimination*

The comparative-case analysis reveals differentiated approaches to waste management and circular economy practices across the examined companies.

Company A (Green) demonstrates a proactive orientation toward circular innovation by repurposing slag, reflecting a direct operational commitment to waste reduction and resource efficiency.

Company B (Gold) integrates waste transformation within a collaborative supply chain framework, aligning environmental objectives with economic value creation and industry-wide synergies.

Company C (Orange) adopts an efficiency-driven strategy that extends beyond mineral waste to encompass broader forms of material recovery through strategic partnerships, signalling a systemic approach to resource stewardship.

In contrast, Companies D (Blue) and E (Yellow) place stronger emphasis on regulatory compliance, environmental licensing, and risk mitigation, with their waste management practices primarily serving to ensure legal conformity and operational continuity rather than fostering innovation-led circularity.

Collectively, these findings suggest a spectrum of engagement ranging from compliance-oriented to innovation-oriented approaches, reflecting varying levels of strategic maturity and integration of circular economy principles into organisational environmental management frameworks.

#### *6.3.3.2 Recap of literature on waste elimination*

Multinational enterprises (MNEs), due to their scale, global influence, and visibility, are poised as the first entities to move beyond the foundational targets of carbon neutrality and zero waste towards genuine ecosystem value creation (George & Schillebeeckx, 2022). Addressing the interlinked challenges of rapid economic decarbonisation, the marine plastic waste crisis, and biodiversity decline now increasingly coincides with tackling poverty and enhancing public health. While legacy sustainability and ESG frameworks have been grounded in process efficiency, lean operations, and waste minimisation, these cost-leadership approaches are proving inadequate for meaningful

firm-level differentiation and transformative environmental stewardship (George & Schillebeeckx, 2022).

As global market and regulatory contexts shift, stakeholder activism and demands for integrated governance are challenging firms to coordinate environmental and health strategies beyond the narrow confines of operational efficiency. The traditional sustainability paradigm, centered around minimising negative externalities like waste, pollution, and social injustice, remains vital but insufficient as a foundation for superior value creation and long-term appropriation (George & Schillebeeckx, 2022).

Against this backdrop, the role of green training is gaining prominence as a catalyst for reimagining waste management practices within MNEs. Green training fundamentally aims to increase employees' environmental commitment by enhancing their motivation and engagement with green concepts, leading directly to reductions in hazardous waste processes and resource overconsumption (Xie & Zhu, 2020). Such training and development initiatives are deliberately structured to heighten employee awareness of environmental issues and promote sustainable practices, such as recycling and proactive waste management, thereby contributing to measurable improvements in environmental performance (Alvarez-Gonzalez et al., 2023).

#### *6.3.3.3 Discussion of findings with literature on waste elimination*

The comparative analysis of waste management strategies among the studied multinational enterprises (MNEs) highlights both convergence with and divergence from contemporary academic perspectives on waste elimination and circular economy integration. The findings demonstrate a continuum, spanning from compliance-focused waste minimisation to innovation-driven circularity, that reflects different stages of strategic and organisational maturity in environmental stewardship.

The study reveals that Companies A (Green), B (Gold), and C (Orange) exhibit progressive engagement with circular economy principles, operationalising waste elimination not as a mere compliance exercise but as a channel for value creation and ecosystem stewardship. Company A's repurposing of slag to achieve resource efficiency and Company B's collaborative supply chain initiatives resonate strongly with scholarly assertions that leading MNEs should transcend conventional zero-waste goals to pursue genuine ecosystem value creation (George & Schillebeeckx, 2022). Company C's partnership-driven, systems-level approach similarly illustrates the movement toward integrated governance and coordinated solutions that address environmental and societal priorities.

In contrast, Companies D (Blue) and E (Yellow) exemplify the persistent relevance and limitations of traditional compliance-oriented frameworks. Their focus on regulatory adherence and operational continuity mirrors legacy ESG models anchored in process efficiency, which, while necessary, are increasingly critiqued for their inability to foster meaningful firm-level differentiation or transformative impacts (George & Schillebeeckx, 2022). This finding underlines ongoing challenges in shifting organisational mindsets from minimum compliance to proactive stewardship and innovation.

The literature identifies green training as a critical lever for catalysing deeper engagement with sustainable waste management. Empirical evidence suggests that structured training programmes increase employee environmental commitment and facilitate the adoption of recycling and proactive waste reduction practices, resulting in measurable environmental performance gains (Alvarez-Gonzalez et al., 2023; Xie & Zhu, 2020). While the case analysis foregrounds the structural and strategic dimensions of waste management, it also aligns with the recognition that individual and collective behavioural change, enabled by green skill development, is pivotal for embedding circular practices and achieving operational as well as strategic sustainability objectives.

Collectively, the comparative-case findings affirm the existence of a spectrum of waste management maturity among MNEs in this study, echoing recent scholarly critiques of one-dimensional, efficiency-centric approaches. The empirical differentiation between innovation-led and compliance-driven models substantiates the literature's call for integrated, governance-driven, and people-centred pathways toward environmental value creation (George & Schillebeeckx, 2022). Furthermore, the suggested importance of green training underscores the need to complement system-level reforms with targeted human capital investments cementing capacity for proactive, organisation-wide adoption of circular and sustainable waste management solutions (Alvarez-Gonzalez et al., 2023; Xie & Zhu, 2020).

#### *6.3.3.4 Conclusion of the discussion of findings for RQ7- Theme 7 Waste Elimination*

The study's findings showed that there were similarities between the study's outcome and literature on waste elimination initiatives.

Across the cases examined, waste management emerges as a domain marked by heterogeneity in both practice and strategic orientation, reflecting wider sectoral and institutional dynamics that shape environmental performance among multinational enterprises (MNEs). The study's synthesis demonstrates that while legacy compliance-based frameworks remain prevalent, particularly within companies whose primary

orientation is regulatory risk mitigation, there is clear evidence of an evolutionary shift among industry leaders towards innovation-driven circularity and ecosystem value creation (George & Schillebeeckx, 2022). This spectrum, ranging from operational conformity to transformative stewardship, illustrates the ongoing transition from efficiency-focused paradigms to more integrated, governance-led models of waste elimination.

Moreover, the literature underscores the insufficiency of process-centric, cost-leadership approaches for achieving substantive and enduring sustainability outcomes in the contemporary regulatory and stakeholder landscape (George & Schillebeeckx, 2022). Instead, firms that embed circular economy and resource stewardship principles within their core strategies and invest in enabling mechanisms such as green training are positioned to deliver not only compliance but also competitive differentiation and long-term environmental value (Alvarez-Gonzalez et al., 2023; Xie & Zhu, 2020). Therefore, advancing waste management practices among MNEs requires an integrated focus on organisational innovation, collaborative governance, and workforce engagement, ensuring that systemic and behavioural levers collectively support the transition towards sustainable, circular operations.

#### 6.3.4 RQ2: Theme 8- Nature-based solution environmental initiatives

##### *6.3.4.1 Recap of findings on nature-based solution environmental initiatives*

The comparative-case analysis reveals that all five companies are implementing nature-based solutions (NbS) as part of their environmental stewardship, but their approaches differ in scope, integration, and emphasis.

Each company recognises the operational and strategic importance of addressing nature-related impacts. Whilst some companies, such as Green: Company A (targeting air emissions, dust, biodiversity, waste, greenhouse gases, and climate issues, and implementing: avoid, minimize, restore, and offset) and Orange: Company C (conserving wetlands, indigenous zones, heritage sites, and species), differ in approach and have detailed, multi-dimensional frameworks and robust biodiversity action plans, others, like Gold: Company B and Blue: Company D (engages with Traditional Owners, pastoralists, specialists, and regulators to enable wildlife conservation alongside mining), focus on integrating nature-related considerations via ESG frameworks and stakeholder-driven initiatives adapted to their unique geographic contexts. Whilst Yellow: Company E focuses on nature loss in a biodiversity hotspot

A common trend across the cases is the emphasis on active stakeholder engagement. Companies illustrate collaboration with local communities, Traditional Owners, ecological experts, and regulatory bodies, underpinning the necessity of inclusive, context-sensitive NbS strategies.

There is a strong focus on tailoring nature-based interventions to local contexts, such as working within biosphere reserves or adjacent to protected natural habitats, demonstrating that spatial and ecological realities shape both the risks and opportunities for NbS.

#### 6.3.4.2 Recap of literature on nature-based solution environmental performance

The theme nature-based solution was not part of the theme that was identified as a theme in Chapter 2 of the literature review.

Given that this theme was not part of the literature review in Chapter 2 and the theme being considered a new theme, a three-step approach as outlined in 6.1 of this chapter was followed. In the first steps step, Step 1, the following articles as outlined in the table below were selected for the search of the words “nature-based solution”, “air”, “water”, “biodiversity”, “wetlands” or “heritage sites”.

Author(s)	Article title	Returned positive result of search
Lei et al., 2025	Common institutional ownership and carbon emissions	No
Budhwar et al., 2025	Linking HRM with sustainability performance through sustainability practices: Unlocking the black box	No
De Funes et al., 2024	The determinants of multinational enterprises' sustainable innovations	Yes

The study by De Funes et al., (2024) indicated that MNEs develop sustainable innovations aimed at reducing water wastage and ensuring efficient water use in production processes, such as implementing industrial waste repurposing and water conservation technologies at both the firm and value chain level. Local adaptation projects may include schemes addressing water scarcity, such as targeted solutions by subsidiaries operating in water-stressed regions, which draw upon both corporate capacity and local stakeholder input. These water-focused innovations often require

cross-sectoral collaboration with local communities and NGOs to effectively address unique water challenges.

MNEs invest in renewable energy and low-emission technologies as proactive responses to carbon emission regulations, which directly tackle air pollution and climate mitigation goals (De Funes et al., 2024). Innovations such as clean energy products, air pollution control technologies, and collaborative efforts for global CO<sub>2</sub> emission reduction are developed through partnerships across the value chain, including global suppliers and customers. These contribute to SDG 13 (climate action) and are shared across subsidiaries for broader impact.

The restoration and conservation of natural habitats and biodiversity is highlighted as part of the broader ecosystem innovation initiatives pursued by many MNEs. These involve leveraging stakeholder knowledge and partnerships with civil society, governmental bodies, and research institutions to tackle local biodiversity loss, deforestation, and ecological degradation (De Funes et al., 2024).

Collaborative innovation ecosystems are positioned as critical for developing nature-based solutions that address both climate adaptation and mitigation needs. MNEs' local subsidiaries can spearhead place-based projects such as flood management, regenerative farming, or urban greening to enhance climate resilience (De Funes et al., 2024).

#### *6.3.4.3 Discussion of findings with literature on nature-based solution environmental initiatives*

Both the five-company analysis and the De Funes et al. (2024) study highlight the centrality of nature-based solutions (NbS) for environmental sustainability, but they differ in their scope, integration, and priorities.

##### *Similarities*

All companies and the De Funes et al. (2024) study emphasise the operational and strategic need to address nature-related impacts, using NbS to tackle issues such as water scarcity, air pollution, and biodiversity loss.

Stakeholder engagement is a universal trend, with firms collaborating closely with local communities, Traditional Owners, experts, regulators, and NGOs to tailor NbS initiatives.

Both sources underscore the importance of context-sensitive and place-based actions: NbS are adapted to local environmental realities such as biosphere reserves and

biodiversity hotspots, meaning that interventions are not generic in nature but customised to specific contexts, of the firm-level and subsidiary.

### *Differences*

The company cases show significant variation in NbS frameworks. Some (e.g., Green: Company A) adopt highly structured, multidimensional frameworks and formal biodiversity action plans, while others (e.g., Gold: Company B, Blue: Company D) integrate NbS more flexibly through ESG mechanisms or stakeholder-led initiatives.

Certain companies (Orange: Company C) focus on specific habitat or species restoration (e.g., wetlands, indigenous zones, heritage areas), whereas the De Funes et al., (2024) study provides a broader view of sustainable innovation, especially regarding water efficiency and industrial waste repurposing across entire value chains, not just site-level adaptations.

The De Funes et al. (2024) study particularly highlights cross-sectoral collaboration for water resource management (involving NGOs, communities, and firm subsidiaries) and positions innovations in water conservation as critical for both firm and local adaptation, a nuance not equally prominent in the company cases, where biodiversity and land management are more deeply foregrounded.

Yellow: Company E's focus on nature loss in biodiversity hotspots, and Blue: Company D's engagement with traditional landholders for wildlife conservation, suggest more specialized, context-driven approaches, compared to the wider technological and value-chain emphasis of De Funes et al. (2024).

De Funes et al. (2024) positions collaborative innovation ecosystems as the cornerstone for developing NbS that address both climate mitigation and adaptation, emphasising the role of subsidiaries in spearheading locally relevant projects such as flood management and regenerative agriculture, which go beyond typical restoration practices mentioned in the case companies.

#### *6.3.4.4 Conclusion of the discussion of findings for RQ2- Theme 8 Nature-based solution environmental initiatives*

The primary similarities between the five-company case analysis and the De Funes et al. (2024) study are their shared commitment to addressing environmental risks through nature-based solutions (NbS), active stakeholder engagement, and local adaptation. However, important differences emerge in how each approaches these solutions, their integration strategies, and their emphasis on technological versus ecological priorities.

### *Similarities*

Both the companies and De Funes et al. (2024) treat NbS as central to environmental stewardship, implementing interventions targeting water scarcity, air pollution, and biodiversity conservation.

Stakeholder engagement is a foundational element in findings and literature. Collaboration with local communities, Traditional Owners, experts, regulatory bodies, and NGOs is seen as necessary to effectively design and implement NbS initiatives.

Stakeholder engagement is a foundational element in terms of the findings and literature. Collaboration with local communities, Traditional Owners, experts, regulatory bodies, and NGOs is seen as necessary to effectively design and implement NbS initiatives.

### *Differences*

The five companies display significant variation in how NbS are structured and integrated. Some, like Green: Company A, employ formal, multidimensional biodiversity action plans; others (Gold: Company B, Blue: Company D) favour flexible, ESG-driven or stakeholder-led mechanisms.

Company-specific approaches may target particular habitats or species, with Orange: Company C, for example, focusing on indigenous zones and heritage sites. By contrast, the De Funes et al. (2024) study focuses more broadly on sustainable innovation, particularly water and waste management, and on cross-sectoral collaboration that enables integrated value-chain-level environmental solutions, even when not specific to individual locations.

De Funes et al. (2024) positions collaborative innovation ecosystems, linking subsidiaries, NGOs, and local stakeholders as key to addressing water challenges and advancing climate adaptation and mitigation through projects such as flood management or regenerative agriculture. The five-company cases, meanwhile, tend to foreground biodiversity restoration and stakeholder engagement, rather than system-wide technological shifts.

The De Funes et al. (2024) study is more explicit about using technical and cross-sectoral partnerships to innovate in water use efficiency, industrial waste repurposing, and clean energy, while the company cases show more specialization according to local environmental priorities, such as controlling nature loss in biodiversity hotspots or engaging Traditional Owners for wildlife conservation.

## 6.4 Research question 3: Organisational performance

### 6.4.4 RQ3: Theme 9- Access to credit/funding

#### *6.4.4.1 Recap of findings on access to credit/funding*

The comparative-case analysis indicates a limited and uneven integration of access to credit or financing within the sustainability and ESG discourse across the five companies examined. Company B (Gold) stands out as the sole case where participant perspectives directly connect the demonstration of climate impact and project-level sustainability performance to enhanced opportunities for financing. This linkage highlights the emerging strategic relevance of environmental accountability as a determinant of capital access. Notably, however, this relationship is not reflected in Company B's formal ESG reporting, pointing to a potential disconnect between operational practice and public disclosure. In contrast, Companies A (Green), C (Orange), D (Blue), and E (Yellow) exhibit no discernible reference, either in ESG documentation or in participant narratives to the interplay between sustainability performance and financing mechanisms. This absence suggests that the financial implications of ESG performance remain largely underdeveloped or unarticulated within their sustainability frameworks. Collectively, these findings reveal that while the alignment between environmental responsibility and financial capital is beginning to emerge within select contexts, it remains inconsistently embedded across firms, indicating an opportunity for deeper integration of sustainability–finance linkages in corporate strategy and reporting practices.

#### *6.4.4.2 Recap of literature on access to credit/funding*

Recent empirical research underscores the critical nexus between environmental performance and organizational access to credit, revealing a complex interplay between proactive sustainability practices, financial disclosures, and the impact of external regulatory pressures. Boateng et al. (2024) demonstrate that firms exhibiting strong environmental performance, anchored in information transparency and a robust internal sustainability culture, enjoy enhanced credit accessibility. This positive relationship is attributed to the reduction of informational asymmetries and environmental risks, which, in turn, strengthens firm credibility in the eyes of financial institutions. The internal motivation to pursue eco-friendly initiatives thus yields not only ecological benefits but also facilitates organizational growth, highlighting the financial and strategic merits of a proactive sustainability orientation (Boateng et al., 2024).

In contrast, Dang et al. (2025) provide evidence that the imposition of external climate regulations can generate adverse consequences for credit access, particularly concerning the availability of long-term financing. Increased compliance obligations inflate operating costs and raise the perceived financial risk among lenders, especially for carbon-intensive and publicly listed enterprises. As a result, financial institutions respond with heightened lending standards, raising collateral requirements, tightening eligibility thresholds, and elevating interest rates, thereby constraining firms' ability to secure the patient capital necessary for substantive energy efficiency and sustainability investments. These restrictions on long-term financing ultimately limit a firm's capacity to pursue value-enhancing environmental projects, elevate operational leverage, and diminish overall firm value (Dang et al., 2025).

#### *6.4.4.3 Discussion of findings with literature access to credit/funding*

The findings from the multi-case analysis reveal a discernible gap and variable integration of access to credit or financing within the environmental sustainability strategies of studied multinational enterprises in South Africa's mining sector.

Only Company B (Gold) demonstrates a clear, albeit informal, recognition of the direct link between environmental accountability and potential financing benefits, as perceived by interview participants. This connection, however, remains absent in Company B's formal ESG disclosures. For the remaining cases; Companies A (Green), C (Orange), D (Blue), and E (Yellow), there is no evident reference to the interface between sustainability performance and access to financial resources, either in participant accounts or in public ESG reporting.

Empirical literature affirms the pivotal role of environmental performance in shaping organisational access to credit, chiefly through the mechanisms of improved informational transparency and reduced environmental risk. As demonstrated by Boateng et al. (2024), firms with strong environmental track records and robust internal sustainability cultures tend to experience enhanced credit accessibility due to reduced information asymmetries and elevated trust among financial institutions. These studies also highlight the dual benefits, ecological and financial of proactive sustainability engagement, as firms are positioned to leverage both improved environmental outcomes and access to growth-enabling capital (Boateng et al., 2024).

Conversely, Dang et al. (2025) bring attention to the unintended negative ramifications of external climate regulation on long-term financing. Stricter compliance demands raise operational costs and heighten risk perceptions among lenders, leading financial

institutions to pursue more risk-averse approaches when it comes to credit terms, including higher collateral requirements and elevated interest rates. These changes disproportionately affect carbon-intensive and publicly listed firms, constraining their access to patient capital needed for transformative sustainability projects (Dang et al., 2025).

#### *6.4.4.4 Conclusion of the discussion of findings for RQ3- Theme 9 Access to Credit/funding*

There were similarities between the study's outcomes and literature on access to credit/funding of organisational performance.

In conclusion, the analysis of access to credit and funding within the examined multinational enterprises reveals an emergent yet inconsistently integrated relationship between environmental sustainability performance and financial capital accessibility. While participant perspectives in Company B (Gold) indicate a growing operational awareness of environmental accountability as a determinant of financing opportunities, this strategic link remains largely underarticulated in formal ESG disclosures and absent in the cases of Companies A (Green), C (Orange), D (Blue), and E (Yellow).

The academic literature substantiates the significance of environmental performance in facilitating access to credit, particularly through enhanced transparency and reduced risk, as outlined by Boateng et al. (2024). Firms managing to cultivate robust sustainability cultures and comprehensive disclosure practices can lower informational asymmetries, thereby improving their attractiveness to financial institutions and unlocking growth-oriented capital. However, as Dang et al. (2025) highlight, external regulatory pressures and elevated compliance costs can have countervailing effects, tightening credit conditions and potentially restricting long-term, transformative investment in sustainability for carbon-intensive enterprises.

Consequently, these findings point to a critical need for more unified and strategic integration of sustainability–finance linkages in both corporate practice and reporting. Systematic enhancement of transparency regarding environmental initiatives and their capital implications may foster better alignment between sustainability objectives and financial resource mobilization, thereby supporting organisational resilience and long-term value creation in increasingly capital-constrained contexts (Boateng et al., 2024; Dang et al., 2025).

#### 6.4.5 RQ3: Theme 10- Reduce costs/increase value

##### *6.4.5.1 Recap of findings on reduce costs/increase value*

The comparative-case analysis of Companies A(Green) to E (Yellow) reveals both commonalities and distinguishing features in the financial and operational impacts of environmental performance initiatives.

Green: Company A's evolution towards policy-driven water efficiency is undermined by recurring financial exposure tied to water-related fines, illustrating that governance gaps can offset operational improvements.

By contrast, Gold: Company B's large-scale integration of renewable energy and structured power purchase agreements has delivered clear environmental and financial gains, positioning hybrid energy investment as a resilient business strategy.

Orange: Company C's substantial upfront investment in electrified assets and solar facilities underscores the anticipated long-term savings and risk reduction central to contemporary decarbonisation strategies.

Blue: Company D demonstrates quantifiable cost savings and regulatory compliance, showing that resource stewardship can yield measurable financial returns.

Finally, Yellow: Company E's comprehensive decarbonisation efforts have produced both significant energy savings and operational cost reductions, affirming the organisational benefits of embedding sustainability within strategic planning.

Together, these cases substantiate the argument that environmental performance, when systematically and strategically managed, consistently drives positive organisational outcomes, albeit with varying degrees of immediate financial risk and long-term benefit.

##### *6.4.5.2 Recap of literature on reduced costs/increase value*

Firms face substantial costs and risks associated with the management of toxic novel entities, encompassing monitoring, control, and compliance expenditures alongside legal and reputational hazards arising from toxic releases (Hagendorff et al., 2025). These economic burdens create strong incentives for organizations, particularly multinational enterprises (MNEs), to invest in reducing harmful chemical emissions. Such investments serve not only to mitigate direct risks to employees and local communities but also to avoid costly litigation and sanctions. Consequently, a growing demand for green skills within MNEs is evident, especially aimed at minimizing the use and release of chemicals recognised as detrimental to human health (Hagendorff et al., 2025).

At the same time, digitisation emerges as a pivotal enabler in reducing these costs and accelerating sustainability transitions (George & Schillebeeckx, 2022). Innovations such as cloud computing have lowered the barriers to digital infrastructure, thereby democratising access and reducing monitoring costs for diverse environmental data. Real-time emission detection via remote sensing and Internet of Things (IoT) devices, alongside distributed ledger technologies, facilitate precise and transparent tracking across global cold chains and supply networks. These digital advances decrease coordination costs and enable MNEs to organise more complex and specialised global value chains, elevating the strategic importance of collective action across ecosystem boundaries as a new competitive advantage (George & Schillebeeckx, 2022).

Moreover, the implementation of both internal and external green supply chain management practices, such as green purchasing, collaborative engagement with customers and suppliers, and eco-design, can substantially reduce inventory and resource consumption, enhance asset recovery, improve cost control, and strengthen corporate reputation (Alvarez-Gonzalez et al., 2023). Yet, failure to engage with sustainability challenges in global supply chains presents severe risks, ranging from reputational damage, consumer boycotts, and legal sanctions to disruptions in raw material availability, cost escalations, profit erosion, and diminished investor confidence (Beugelsdijk et al., 2024).

Implementing such green practices is inherently complex, involving substantial upfront costs and continuous organisational learning to achieve breakthroughs in sustainable manufacturing operations (Xie & Zhu, 2020). While traditional sustainability efforts and ESG initiatives have largely targeted process efficiencies and waste minimisation, these cost leadership strategies fall short in delivering meaningful differentiation or competitive advantage in evolving market contexts (George & Schillebeeckx, 2022).

#### *6.4.5.3 Discussion of findings with literature on reduced costs/increase value*

The study identifies that the operational and financial impacts of sustainability initiatives vary yet generally confer measurable benefits when strategically integrated.

Green: Company A demonstrates that while policy-driven operational improvements (e.g., water efficiency) are possible, persistent governance gaps can expose firms to ongoing financial penalties, an outcome reflective of literature asserting that incomplete compliance with toxic entity regulations results in significant monitoring and legal costs, alongside reputational hazards (Hagendorff et al., 2025). Conversely, Gold: Company B's successful transition to hybrid renewable energy systems through structured power

purchase agreements validates literature emphasising the economic and risk mitigation rationale for investments aimed at reducing chemical emissions and pollution, serving both legal compliance and the direct protection of employees and communities.

Orange: Company C's upfront investment in electrified assets and solar infrastructure highlights the actualisation of long-term cost savings and risk reduction, exemplifying the complexities cited in the literature where the implementation of green supply chain management (GSCM) and sustainable operations involves considerable initial outlay but positions firms for future competitive advantage and resilience (Alvarez-Gonzalez et al., 2023; Xie & Zhu, 2020). Blue: Company D's resource stewardship and regulatory compliance return quantifiable financial benefits, mirroring literature that underscores the necessity of continuous learning and adaptability for achieving cost reductions and environmental compliance in globalised operations. Finally, Yellow: Company E's comprehensive approach to decarbonisation, reflected in both measurable energy savings and operational cost reductions, demonstrates the organisational advantages of embedding sustainability within strategic decision-making, consistent with arguments that holistic investment in green skills and eco-design underpins both compliance and value creation (George & Schillebeeckx, 2022).

A comparative-cases, digitisation is shown to be a transformative enabler, reducing costs and supporting environmental performance through innovations in monitoring, detection, and supply chain traceability. This is in line with the literature, which points to cloud computing, IoT devices, and distributed ledgers as mechanisms that diminish barriers to real-time environmental data coordination, lower operational costs, and foster ecosystems of specialised collaboration, ultimately establishing new forms of competitive advantage in global value networks (George & Schillebeeckx, 2022).

The findings also reinforce the broader literature's caution that failure to engage with sustainability challenges, particularly in global supply chains, incurs severe operational and financial risks, including reputational damage, market disruptions, profit erosion, and loss of investor confidence (Beugelsdijk et al., 2024). Nevertheless, the cases demonstrate that the adoption of internal and external GSCM practices facilitates resource efficiency, asset recovery, and cost control, even if substantial upfront investments and organisational change are needed to realise these benefits over time (Xie & Zhu, 2020).

Critically, the study's findings substantiate the literature's argument that traditional cost leadership strategies and process optimisations associated with sustainability, while necessary, are insufficient for sustained differentiation. It is the strategic, digitally

enabled, and collective organisational engagement with environmental challenges, spanning green partnerships, advanced monitoring technologies, and ecosystem-wide collaborations, that underpins the transition from compliance and efficiency toward new market opportunities and a defensible competitive advantage (George & Schillebeeckx, 2022).

#### *6.4.5.4 Conclusion of the discussion of findings for RQ3- Theme 10 Reduced Costs/increase value*

Regarding the theme reduce costs/increase value, the study's findings align with existing scholarship that links cost reduction and value creation to organisational performance.

The comparative-case analysis affirms that strategically managed environmental performance initiatives consistently contribute to cost reductions and enhanced organisational value for multinational enterprises, despite contextual differences in implementation and financial risk. When sustainability is embedded within core business operations and governance, including targeted decarbonisation, resource efficiency, and advanced digital monitoring, firms experience not only short-term savings but also improved resilience and risk mitigation. The cases substantiate that upfront investments in digital, renewable, and green supply chain solutions foster measurable operational benefits and long-term financial returns, demonstrating that sustainable business strategies have evolved from peripheral compliance activities into central sources of competitive advantage and value creation.

These empirical findings reinforce recent literature, which highlights that proactive environmental management mitigates both direct and indirect organisational risks, including regulatory penalties, reputational damage, and supply chain disruptions (Beugelsdijk et al., 2024; Hagendorff et al., 2025). Furthermore, technological advancements such as cloud computing, IoT, and distributed ledgers significantly reduce monitoring and coordination costs, enabling firms to pursue more ambitious and collaborative sustainability agendas that translate into differentiated market positioning (George & Schillebeeckx, 2022). Nonetheless, achieving these outcomes requires substantial upfront investment and a sustained organisational commitment to continuous improvement and collective action, echoing calls in the literature for integrated, ecosystem-oriented approaches to green supply chain management (Alvarez-Gonzalez et al., 2023; Xie & Zhu, 2020).

## 6.5 Conclusion

In summary, Table 27 synthesises the alignment between empirical findings and extant literature by systematically presenting the outcomes of the comparative analysis. The table organises the themes and subthemes by overarching construct, reflecting the categorisation established in prior analysis. For each subtheme identified in Chapter 5 (as detailed in Table 25), the table explicitly indicates whether the observed pattern is consistent (similar) with, divergent (different) from, or represents a nuanced difference relative to findings in the literature. Through this in-depth evaluation, further engagement with scholarly sources has prompted the refinement and, where applicable, the renaming of select subthemes to more accurately capture the dynamics observed. All subthemes that have been renamed as a result of this analytical process are clearly marked in blue, ensuring transparency and continuity as they are incorporated into the revised conceptual framework.

*Table 27: Summary of discussion of outcomes of discussion of findings with literature*

Constructs	Themes	Sub-themes	Similarity or nuance of difference	Outcome	Renamed subtheme
Environmental initiatives	Peer collaboration and stakeholder green value co-creation	National collaboration (MCSA/DMPR)	Similarity	Adds to existing body of knowledge	National government collaboration
		International industry body collaboration (ICMM)	Similarity	Adds to existing body of knowledge	International industry body collaboration
		Interorganisational collaborations	Similarity	Adds to existing body of knowledge	Interorganisational collaborations
		Inter-sectoral partnership models	Similarity	Adds to existing body of knowledge	Inter-sectoral partnership models
		Regional multi-infrastructure governance: water	Similarity	Potential refinement to existing literature	Regional multi-infrastructure governance
	Green investment	Organizational Renewable Energy Investments	Similarity	Adds to existing body of knowledge	Organizational Renewable Energy Investments
		Third-Party Renewable Energy Procurement	Similarity	Adds to existing body of knowledge	Third-Party Renewable Energy Procurement
		Operational Eco-Efficiency Initiatives	Similarity	Adds to existing body of knowledge	Operational Eco-Efficiency Initiatives
		Power Purchase Agreement (Renewable)	Similarity	Adds to existing body of knowledge	Power Purchase Agreement (Renewable)
		Integrated Water Resource Management Strategies	Similarity	Adds to existing body of knowledge	Integrated Water Resource Management Strategies
		Circular Process Engineering Innovations	Similarity	Adds to existing body of knowledge	Circular Process Engineering Innovations

Constructs	Themes	Sub-themes	Similarity or nuance of difference	Outcome	Renamed subtheme
		Transitional Low-Carbon Energy Generation	Similarity	Adds to existing body of knowledge	Transitional Low-Carbon Energy Generation
		Energy Demand Reduction Technologies	Similarity	Adds to existing body of knowledge	Energy Demand Reduction Technologies
		Adoption of Electrified Machinery	Similarity	Adds to existing body of knowledge	Adoption of Electrified Machinery
		Strategic Green Technology Investment	Similarity	Adds to existing body of knowledge	Strategic Green Technology Investment
		Air Quality and Particulate Matter Mitigation Strategies	Similarity	Adds to existing body of knowledge	Air Quality and Particulate Matter Mitigation Strategies
		Circular Economy Integration Models	Similarity	Adds to existing body of knowledge	Circular Economy Integration Models
		Extended Supply Chain Decarbonization Initiatives	Similarity	Adds to existing body of knowledge	Extended Supply Chain Decarbonization Initiatives
	Innovation and digital technology	Centralized Digital Governance Platforms (Headquarter platforms)	Similarity	Adds to existing body of knowledge	Centralized Digital Governance Platforms (Headquarter platforms)
		Digital Environmental Data Reporting Systems	Similarity	Adds to existing body of knowledge	Digital Environmental Data Reporting Systems
		Automation-Driven Environmental Monitoring	Similarity	Adds to existing body of knowledge	Automation-Driven Environmental Monitoring
		Advanced Engineering for Environmental Sustainability	Similarity	Adds to existing body of knowledge	Advanced Engineering for Environmental Sustainability
		Resource Optimization Technologies	Similarity	Adds to existing body of knowledge	Resource Optimization Technologies
		Bioremediation technologies	Similarity	Adds to existing body of knowledge	Bioremediation technologies
		Sulfur Emission Reduction Technologies	Similarity	Potential refinement to existing literature	Emission Reduction Technologies
		Digital Sustainability Analytics and Disclosure Practices	Similarity	Adds to existing body of knowledge	Digital Sustainability Analytics and Disclosure Practices
		Artificial Intelligence-Enabled Environmental Management	Similarity	Adds to existing body of knowledge	Artificial Intelligence-Enabled Environmental Management
		Extended Reality Applications in Sustainability	Similarity	Adds to existing body of knowledge	Extended Reality Applications in Sustainability

Constructs	Themes	Sub-themes	Similarity or nuance of difference	Outcome	Renamed subtheme	
		Digital Twin Modelling for Sustainability	Similarity	Adds to existing body of knowledge	Digital Twin Modelling for Sustainability	
	Public Private Partnerships	Regional Water Governance Partnerships	Similarity	Adds to existing body of knowledge	Regional Water Governance Partnerships	
		Municipal Water Efficiency Initiatives	Similarity	Adds to existing body of knowledge	Municipal Water Efficiency Initiatives	
		Local Government Sustainability Projects	Similarity	Potential refinement to existing literature	Local Government Sustainability Projects	
		Environmental Regulatory Compliance and Stakeholder Engagement	Similarity	Adds to existing body of knowledge	Natural Gas to Electricity Conversion Initiatives	
<b>Environmental Performance</b>	Carbon capture and carbon offset	Natural Gas to Electricity Conversion Initiatives	Similarity	Potential refinement to existing literature	Natural Gas to Electricity Conversion Initiatives	
		Carbon offset strategy embedded	Similarity	Adds to existing body of knowledge	Carbon offset strategy embedded	
		Corporate Carbon Offset Programs	Similarity	Adds to existing body of knowledge	Corporate Carbon Offset Programs	
	Waste management	Tailings Facility Risk Optimization Strategies	Similarity	Adds to existing body of knowledge	Tailings Facility Risk Optimization Strategies	
		Waste repurposing	Similarity		Waste repurposing	
		Integrated Waste Minimization Approaches	Similarity	Adds to existing body of knowledge	Integrated Waste Minimization Approaches	
		Sustainable Supplier Sourcing Policies	Similarity	Adds to existing body of knowledge	Sustainable Supplier Sourcing Policies	
		Regulatory Waste Management Compliance	Similarity	Adds to existing body of knowledge	Regulatory Waste Management Compliance	
		Greenwashing	Sector-Specific ESG Disclosure Frameworks	Similarity	Adds to existing body of knowledge	Sector-Specific ESG Disclosure Frameworks
			International ESG Reporting Standards Implementation	Similarity	Adds to existing body of knowledge	International ESG Reporting Standards Implementation
	IFRS Sustainability Standards Adoption		Similarity	Adds to existing body of knowledge	IFRS Sustainability Standards Adoption	
	United Nations Global Compact Affiliation		Similarity	Adds to existing body of knowledge	United Nations Global Compact Affiliation	
	Strategic Integration of UN SDGs		Similarity	Adds to existing body of knowledge	Strategic Integration of UN SDGs	
	Sectoral ESG Reporting Supplements (Mining/Metals)		Similarity	Adds to existing body of knowledge	Sectoral ESG Reporting Supplements (Mining/Metals)	

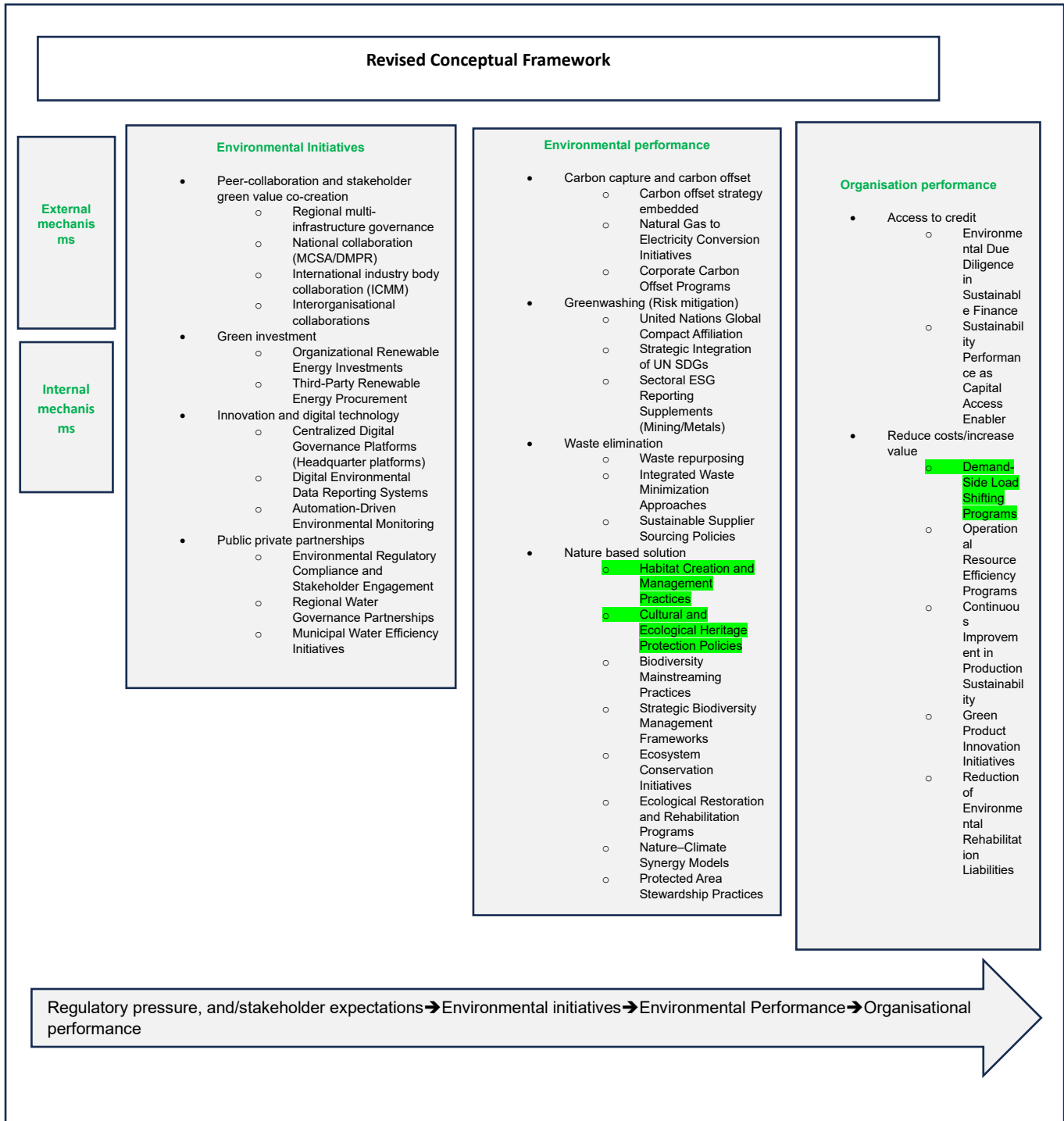
Constructs	Themes	Sub-themes	Similarity or nuance of difference	Outcome	Renamed subtheme
		GHG Emissions Protocols and Disclosure Instruments	Similarity	Adds to existing body of knowledge	GHG Emissions Protocols and Disclosure Instruments
	Nature-based solutions	Biodiversity Mainstreaming Practices	Similarity	Adds to existing body of knowledge	Biodiversity Mainstreaming Practices
		Strategic Biodiversity Management Frameworks	Similarity	Adds to existing body of knowledge	Strategic Biodiversity Management Frameworks
		Ecosystem Conservation Initiatives	Similarity	Adds to existing body of knowledge	Ecosystem Conservation Initiatives
		Ecological Restoration and Rehabilitation Programs	Similarity	Adds to existing body of knowledge	Ecological Restoration and Rehabilitation Programs
		Nature–Climate Synergy Models	Similarity	Adds to existing body of knowledge	Nature–Climate Synergy Models
		Protected Area Stewardship Practices	Similarity	Adds to existing body of knowledge	Protected Area Stewardship Practices
		Ecologically Responsible Tourism Support	Similarity	Adds to existing body of knowledge	Ecologically Responsible Tourism Support
		Corporate Wildlife Management Programs	Similarity	Adds to existing body of knowledge	Corporate Wildlife Management Programs
		Landscape-Scale Ecosystem Restoration	Similarity	Adds to existing body of knowledge	Landscape-Scale Ecosystem Restoration
		Habitat Creation and Management Practices	Nuance of difference	Potential refinement to existing literature	Habitat Creation and Management Practices
		Cultural and Ecological Heritage Protection Policies	Nuance of difference	Potential refinement to existing literature	Cultural and Ecological Heritage Protection Policies
		Water, land and air quality management	Similarity	Adds to existing body of knowledge	Water, land and air quality management
<b>Organisational performance</b>	Access to credit/funding	Environmental Due Diligence in Sustainable Finance	Similarity	Adds to existing body of knowledge	Environmental Due Diligence in Sustainable Finance
		Sustainability Performance as Capital Access Enabler	Similarity	Adds to existing body of knowledge	Sustainability Performance as Capital Access Enabler
	Reduce costs/increase value	Operational Resource Efficiency Programs	Similarity	Adds to existing body of knowledge	Operational Resource Efficiency Programs
		Continuous Improvement in Production Sustainability	Similarity	Adds to existing body of knowledge	Continuous Improvement in Production Sustainability
		Green Product Innovation Initiatives	Similarity	Adds to existing body of knowledge	Green Product Innovation Initiatives

Constructs	Themes	Sub-themes	Similarity or nuance of difference	Outcome	Renamed subtheme
		Reduction of Environmental Rehabilitation Liabilities	Similarity	Adds to existing body of knowledge	Reduction of Environmental Rehabilitation Liabilities
		Supplier Engagement for Low-Impact Product Sourcing	Similarity	Adds to existing body of knowledge	Supplier Engagement for Low-Impact Product Sourcing
		Cost effective and efficient technologies	Similarity	Adds to existing body of knowledge	Cost effective and efficient technologies
		Renewable energy (electricity cost reduction)	Similarity	Adds to existing body of knowledge	Renewable energy (electricity cost reduction)
		Access to funding	Similarity	Adds to existing body of knowledge	Access to funding
		Waste Monetization and Value Recovery Mechanisms	Similarity	Adds to existing body of knowledge	Waste Monetization and Value Recovery Mechanisms
		Demand-Side Load Shifting Programs	Nuance of difference	Potential refinement to existing literature	Demand-Side Load Shifting Programs

### 6.5.1 Revised Conceptual Framework

Figure 7 depicts the revised conceptual framework, developed following a comparative interrogation of the empirical findings and the extant literature. Within this framework, the themes of “public–private partnerships” and “nature-based solutions”, which were initially proposed as potential novel elements in the adapted conceptual framework in Chapter 5, were subsequently verified as already established in the existing scholarly discourse. From the empirical analysis, three subthemes emerged, representing nuanced distinctions between the study’s findings and extant scholarship. These subthemes are proposed as refinements that contribute to the advancement of existing theoretical understanding and are visually highlighted in green within the revised conceptual framework presented in Figure 7.

Figure 7: Revised conceptual framework



Source: Author's own

## 7. Chapter 7: Discussion of findings and literature

### 7.1 Introduction

This chapter offers a final integrative discussion of the study's outcomes in relation to each of the research questions. For every question, a comparative examination is undertaken between the empirical findings and the body of existing literature, as delineated in Chapter 6. The conclusions are framed within the context of the revised conceptual framework developed in Chapter 6, which was informed by both the empirical results and the literature synthesis. This framework delineates the environmental initiatives and organisational elements that facilitate environmental and overall organisational performance within the global value chains of multinational enterprises.

The study aimed to examine the role of multinational enterprises in advancing environmental sustainability and addressing climate change within South Africa's mining sector. This chapter further articulates the key contributions of the research, acknowledges its limitations, and offers recommendations for management and other relevant stakeholders. Finally, directions for future research are proposed to extend the understanding developed through this study.

**Main Research Question:** How do internal and external mechanisms translate environmental initiatives into environmental performance for organisational (firm) performance? (Asiaei et al., 2023)

**Sub-questions 1:** What are the external and internal mechanisms that are used for environmental initiatives? (Asiaei et al., 2023; De Funes et al., 2024).

**Sub-questions 2:** How do environmental initiatives improve environmental performance? (Asiaei et al., 2023; De Funes et al., 2024).

**Sub-questions 3:** How does environmental performance improve organisational performance? (Asiaei et al., 2023).

This chapter reports the empirical findings in relation to each of the research questions articulated at the outset of the study.

The outcomes are structured around the three research questions formulated in Chapter 1, and the theoretical conclusions for each are developed through a comparative analysis of the empirical findings and the extant literature, as elaborated in Chapter 6. These conclusions identify areas of alignment with previous studies, representing potential contributions to the existing knowledge base, as well as nuance of difference, which may offer potential refinements to current theoretical understanding. No significant variations

were observed across the principal thematic areas. Each subsection of the theoretical conclusions closes with a synthesis of the principal similarities and differences identified in relation to the extant literature. The chapter subsequently introduces the final conceptual framework derived from the empirical findings and proceeds to articulate the study's contributions and practice-oriented recommendations for management and other pertinent stakeholders. It then concludes by delineating the study's limitations and proposing avenues for future research.

## 7.2 Theoretical conclusions

### 7.2.1 Research Question 1: External and internal mechanisms that are used for environmental initiatives Introduction

This section is organised in accordance with the research questions, with the theoretical conclusions integrating the key findings of the study and situating them within the broader scholarly literature, highlighting points of convergence and divergence. Furthermore, the discussion seeks to uncover novel insights that advance and deepen the prevailing theoretical understanding.

#### *7.2.1.1 Similarities with extant literature for Research Question 1*

On the theme of peer collaboration and stakeholder green value co-creation, the outcomes of the study are aligning with the prior scholarship, highlighting that the firms that have internal and external alignment around sustainability are able to co-create green value (Annan et al., 2025). Additionally, as the outcome of the study pointed out that where stakeholders such as suppliers, collaborated with customers, such greening initiatives spilled over to other firms (Annan et al., 2025). Peer collaboration and stakeholder green value co-creation across the examined multinational enterprises is characterised by marked both its formal articulation and operational integration within organisational practice. This strong manifestation of alignment is observed in contexts where multi-stakeholder engagement is deeply embedded across strategic and operational domains, demonstrating the catalytic role of peer collaboration in resource stewardship (Annan et al., 2025; Cabigiosu et al., 2025) particularly in water governance (in areas of water scarcity), logistics, and infrastructure-sharing efforts.

On the theme of green investment initiatives, there were similarities between the study's outcomes and literature. The outcomes of the study revealed that companies in this study are actively integrating green investment as a core aspect of their sustainability and decarbonisation strategies, and these align with Almandoz et al. (2021), and Zaheer (2025) studies that highlighted that green investments are consistently driven by a

combination of strategic self-interest, legitimacy concerns, and external stakeholder pressures, paralleling the findings of Zaheer (2025) and Almandoz et al. (2021). Companies generally prioritise pollution prevention strategies (energy efficiency, renewables, process optimisation) over end-of-pipe abatement, reflecting the literature's consensus that prevention-oriented investments deliver greater environmental performance improvements (Li & Ramanathan, 2020). The outcomes of the study further demonstrated the importance of innovation and green intellectual capital in achieving sustainability goals, which aligns Asiaei et al. (2022) study which highlighted that innovation, leveraging digital tools, collaborative research, and employee-driven projects, are vital in enhancing overall environmental performance. The outcomes of the study also highlighted that context-specific environmental initiatives are important as part of the green investment initiatives, which aligns with study by matching Hagendorff et al. (2025) study which highlighted company level targeting operational sites for green investment has maximum impact.

On the theme of innovation and digital technologies initiatives, there were similarities between the study's outcomes and extant literature. The outcomes of the study highlighted that integration of innovation and digital technologies across the studied companies underscores a transformative (amplifies coordination, transparency and process efficiency) yet there was an observed uneven trajectory in corporate environmental sustainability implementation of technologies. The outcomes of the study pointed out to persistent gaps between strategic intent and operational realisation, particularly where digital tools are adopted symbolically rather than substantively to drive sustainability, and this aligns the literature concerns regarding technological complexity and the potential misuse of digitalisation for impression management and greenwashing (Chen et al., 2025; Nygaard & Silkoset, 2022). At the same time, evidence of transparency-enhancing applications and external validation, as seen in study's outcomes, illustrates how digital innovation can mitigate these risks through improved data integrity and accountability (Johan et al., 2024).

On the theme of private-public partnerships, there were similarities and differences between the study's outcomes and extant literature. The outcomes of the study revealed selective and strategic engagement with public-private partnerships (PPPs), and this aligns with the comprehensive, ecosystem-driven perspective outlined by De Funes et al. (2024), where PPP presence is highly variable, driven by specific operational demands and reporting practices. The outcomes of the study highlighted the focus on addressing core risks (e.g., water management, regulatory compliance) using collaborative platforms and multi-year agreements, mirroring the multi-actor innovation

ecosystems where governments, MNEs, and other stakeholders work together on tailored solutions, which are specific to MNEs operations in the South African context. These sets of outcomes recognise the need for multi-stakeholder collaboration, particularly when navigating complex, localised environmental issues. De Funes et al. (2024) finds that government-led platforms and incentives (such as R&D grants, regulatory frameworks, and green funds) are crucial for these partnerships, a theme visible in the companies that engage in PPPs for regulatory or operational needs.

Drawing on the outcomes of this study, the areas of similarities identified are consistent with extant scholarship and, as such, contribute to the existing body of knowledge.

### 7.2.1.2 Nuance of difference with extant literature for Research Question 1

On theme of peer collaboration and stakeholder green value co-creation, there was no difference to literature.

### 7.2.1.3 Summary of similarities and difference with extant literature for Research Question 1

Table 28 provides a consolidated overview of the similarities and differences examined in Sections 7.2.1.1 and 7.2.1.2, respectively.

*Table 28: Summary of similarities and differences, outcomes and literature*

Themes	Similarities	Differences
<b>Peer collaboration and stakeholder green value co-creation</b>	<ul style="list-style-type: none"> <li>National collaboration (MCSA/DMPR)</li> <li>International industry body collaboration (ICMM)</li> <li>Interorganisational collaborations</li> <li>Inter-sectoral partnership models</li> </ul>	No differences between the study's outcomes and literature
<b>Green investment</b>	<ul style="list-style-type: none"> <li>Organizational Renewable Energy Investments</li> <li>Third-Party Renewable Energy Procurement</li> <li>Operational Eco-Efficiency Initiatives</li> <li>Power Purchase Agreement (Renewable)</li> <li>Integrated Water Resource Management Strategies</li> <li>Circular Process Engineering Innovations</li> <li>Transitional Low-Carbon Energy Generation</li> <li>Energy Demand Reduction Technologies</li> <li>Adoption of Electrified Machinery</li> <li>Strategic Green Technology Investment</li> <li>Air Quality and Particulate Matter Mitigation Strategies</li> <li>Circular Economy Integration Models</li> <li>Extended Supply Chain Decarbonization Initiatives</li> </ul>	No differences between the study's outcomes and literature
<b>Innovation and digital technologies</b>	<ul style="list-style-type: none"> <li>Centralized Digital Governance Platforms (Headquarter platforms)</li> <li>Digital Environmental Data Reporting Systems</li> <li>Automation-Driven Environmental Monitoring</li> <li>Advanced Engineering for Environmental Sustainability</li> <li>Resource Optimization Technologies</li> </ul>	No differences between the study's outcomes and literature

Themes	Similarities	Differences
	<ul style="list-style-type: none"> <li>• Bioremediation technologies</li> <li>• Digital Sustainability Analytics and Disclosure Practices</li> <li>• Artificial Intelligence-Enabled Environmental Management</li> <li>• Extended Reality Applications in Sustainability</li> <li>• Digital Twin Modelling for Sustainability</li> </ul>	
<b>Public-private partnerships</b>	<ul style="list-style-type: none"> <li>• Regional Water Governance Partnerships</li> <li>• Municipal Water Efficiency Initiatives</li> <li>• Environmental Regulatory Compliance and Stakeholder Engagement</li> </ul>	No differences between the study's outcomes and literature

### *7.2.2 Summary of similarities and differences of study's outcomes with extant literature for Research Question 2*

The section is structured in direct accordance with the research question. The theoretical conclusions synthesise the key outcomes of the study and position them within the broader academic literature, underscoring both areas of consensus and points of departure. Moreover, the discussion seeks to elucidate novel theoretical insights that extend and deepen the prevailing scholarly understanding within the field.

#### *7.2.2.1 Similarities with extant literature for Research Question 2*

On the theme carbon capture and carbon offset as part of the environmental performance, there were similarities between the study's outcomes and literature. The outcomes of the study highlighted that internal carbon pricing mechanism has been used as part of the environmental performance, which is similar with recent literature, which indicates that market-based instruments, specifically internal carbon pricing, have largely supplanted carbon capture and carbon offset initiatives as the primary mechanism for advancing corporate environmental performance in multinational contexts (Ben-Amar et al., 2022; Nippa et al., 2021; Wang et al., 2022).

On the theme greenwashing as part of the environmental performance, there were similarities between the study's outcomes and literature. The outcome of the study demonstrates that there is sector-wide convergence around the importance of transparency, data assurance, and adherence to international ESG standards, an outcome that is echoed in the literature (Balluchi et al., 2020). The outcome of the study also highlighted the importance of using digitalisation as part of the greenwashing management, which aligns with literature (Chen et al., 2025), as the use of digital tools provides opportunities for greater transparency, real-time monitoring, and stakeholder accessibility, especially when digital tools are strategically deployed to facilitate assurance and green innovation (Johan et al., 2024). The outcome of the study further

highlighted the lack uniformity in technology tools adoption, which reflects that the firms under study are at different levels of adoption of digital technologies to management the risk of greenwashing, which align with Cui et al. (2024) attesting that cultural and institutional contexts, manifesting in managerial priorities, regulatory stringency, and national values, continue to shape both the prevalence of greenwashing and the effectiveness of anti-greenwashing measures.

On the theme waste elimination as part of the environmental performance, there were similarities between the study's outcomes and literature. The study's outcomes demonstrate waste management is managed from both operational and strategic orientation which aligns with literature, George and Schillebeeckx (2022) highlighted that there is clear evidence of an evolutionary shift among industry leaders towards innovation-driven circularity and ecosystem value creation, and this spectrum, range from operational conformity to transformative stewardship. Moreover, the study's outcome aligns with literature on process-centric, cost-leadership approaches for achieving substantive and enduring sustainability outcomes in the evolving regulatory and stakeholder landscape (Alvarez-Gonzalez et al., 2023; George & Schillebeeckx, 2022; Xie & Zhu, 2020).

On the theme nature-based solution as part of the environmental performance, there were similarities between the study's outcomes and literature. The outcome of the study highlighted the shared commitment to address environmental risks through nature-based solutions, which aligns literature (De Funes et al., 2024). The study's outcome and De Funes et al. (2024) treat nature-based solution as central to environmental stewardship, implementing interventions targeting water scarcity, air pollution, and biodiversity conservation.

Drawing on the outcomes of this study, the areas of similarities identified are consistent with extant scholarship and, as such, contribute to the existing body of knowledge.

#### *7.2.2.2 Nuance of difference with extant literature for Research Question 2*

On the nature-based solution theme, the study's outcome demonstrated that a targeted and context-specific approaches management of nature as part of environmental performance. In study, organisation contended with unique/context specific management of wildlife, heritage sites and ecological and cultural practices unique to the operational context. This differs to literature, De Funes et al. (2024), nature-based solution focuses more broadly on sustainable innovation, particularly water and waste management, a nuance of difference. The outcome of the study further highlighted that nature-based

solution, foreground biodiversity restoration and stakeholder engagement, showing a more specialisation according to local environmental priorities, such as controlling nature loss in biodiversity hotspots or engaging Traditional Owners for wildlife conservation, whilst the study by De Funes et al. (2024) is more about using technical and cross-sectoral partnerships to innovate in water use efficiency, industrial waste repurposing, and clean energy.

Drawing on the analyses undertaken in this study, the nuance of differences between the empirical findings and the extant literature yield fresh insights and enrich understanding of the focal themes, thereby constituting potential refinements to the existing body of knowledge.

*7.2.2.3 Summary of similarities and difference with extant literature for Research Question 2*

Table 29 provides a consolidated overview of the similarities and differences examined in Sections 7.2.2.1 and 7.2.2.2, respectively.

*Table 29: Summary of similarities and differences of study’s outcomes and literature*

<b>Themes</b>	<b>Similarities</b>	<b>Differences</b>
<b>Carbon capture and carbon offset</b>	<ul style="list-style-type: none"> <li>Natural Gas to Electricity Conversion Initiatives</li> <li>Corporate Carbon Offset Programs</li> </ul>	No differences between the study’s outcomes and literature
<b>Waste management</b>	<ul style="list-style-type: none"> <li>Tailings Facility Risk Optimization Strategies</li> <li>Waste repurposing</li> <li>Integrated Waste Minimization Approaches</li> <li>Sustainable Supplier Sourcing Policies</li> <li>Regulatory Waste Management Compliance</li> </ul>	No differences between the study’s outcomes and literature
<b>Greenwashing (risk mitigation)</b>	<ul style="list-style-type: none"> <li>Sector-Specific ESG Disclosure Frameworks</li> <li>International ESG Reporting Standards Implementation</li> <li>IFRS Sustainability Standards Adoption</li> <li>United Nations Global Compact Affiliation</li> <li>Strategic Integration of UN SDGs</li> <li>Sectoral ESG Reporting Supplements (Mining/Metals)</li> <li>GHG Emissions Protocols and Disclosure Instruments</li> </ul>	No differences between the study’s outcomes and literature
<b>Nature-based solutions</b>	<ul style="list-style-type: none"> <li>Biodiversity Mainstreaming Practices</li> <li>Strategic Biodiversity Management Frameworks</li> <li>Ecosystem Conservation Initiatives</li> <li>Ecological Restoration and Rehabilitation Programs</li> <li>Nature–Climate Synergy Models</li> <li>Protected Area Stewardship Practices</li> <li>Ecologically Responsible Tourism Support</li> <li>Corporate Wildlife Management Programs</li> <li>Landscape-Scale Ecosystem Restoration</li> <li>Water, land and air quality management</li> </ul>	<ul style="list-style-type: none"> <li>Habitat Creation and Management Practices</li> <li>Cultural and Ecological Heritage Protection Policies</li> </ul>

### *7.2.3 Summary of similarities and differences of study's outcomes with extant literature for Research Question 3*

The section is organised in correspondence with the research question. The theoretical conclusions integrate the principal outcomes of the study and situate them within the wider scholarly discourse, highlighting points of alignment and divergence. In addition, the discussion aims to reveal new perspectives that contribute to advancing and enriching existing theoretical understandings.

#### *7.2.3.1 Similarities with extant literature for Research Question 3*

Regarding the theme of access to credit and funding, the study's findings demonstrate similarities with existing scholarship that links credit and financial access to organisational performance.. The outcome of the study indicated that there is operational awareness of environmental accountability as a determinant of financing opportunities, and this aligns with literature. The academic literature substantiates the significance of environmental performance in facilitating access to credit, particularly through enhanced transparency and reduced risk, as outlined by Boateng et al. (2024). However, as Dang et al. (2025) highlighted, external regulatory pressures and elevated compliance costs have countervailing effects, tightening credit conditions and potentially restricting long-term, transformative investment in sustainability for carbon-intensive enterprises.

With respect to the theme of reducing costs and enhancing value, the study's findings exhibit convergence with existing literature that links cost reduction and value creation to improved organisational performance. The outcome of the study affirms that strategically managed environmental performance initiatives consistently contribute to cost reductions and enhanced organisational value for multinational enterprises, despite contextual differences in implementation and financial risk. When sustainability is embedded within core business operations and governance, including targeted decarbonisation, resource efficiency, and advanced digital monitoring, firms experience not only short-term savings but also improved resilience and risk mitigation. The cases substantiate that upfront investments in digital, renewable, and green supply chain solutions foster measurable operational benefits and long-term financial returns, demonstrating that sustainable business strategies have evolved from peripheral compliance activities into central sources of competitive advantage and value creation. These outcomes align with recent literature, which highlights that proactive environmental management mitigates both direct and indirect organisational risks, including regulatory penalties, reputational damage, and supply chain disruptions (Beugelsdijk et al., 2024; Hagendorff et al., 2025).

Furthermore, the literature highlights that technological advancements such as cloud computing, IoT, and distributed ledgers significantly reduce monitoring and coordination costs, enabling firms to pursue more ambitious and collaborative sustainability agendas that translate into differentiated market positioning (George & Schillebeeckx, 2022). The outcome of this study further highlighted that, achieving the outcomes costs reduction requires substantial upfront investment and a sustained organisational commitment to continuous improvement and collective action, echoing calls in the literature for integrated, ecosystem-oriented approaches to green supply chain management (Alvarez-Gonzalez et al., 2023; Xie & Zhu, 2020).

Drawing on the outcomes of this study, the areas of similarities identified are consistent with extant scholarship and, as such, contribute to the existing body of knowledge.

#### *7.2.3.2 Nuance of difference with extant literature for Research Question 3*

On the theme of cost reduction/value increase, the study's outcome revealed the unique context specific, wherein the organisations in the study, as part of their operational requirements are required to initiate, demand-side load shifting programs, and whilst these are initiatives that are assisting in emissions reductions, they are as result of unreliable power supply. Whilst the literature acknowledges that the adoption of internal practices, such as eco-design, can significantly lower inventory and resource use, improve asset recovery, and control costs (Alvarez-Gonzalez et al., 2023), the organisations in the study adopted the load shifting programs, not necessarily as part of the eco-related initiatives, but more a circumstance related operational initiative.

Grounded in the analyses undertaken in this study, the subtle divergences between the empirical findings and prior scholarship generate novel insights and enrich understanding of the focal themes, thereby constituting potential refinements to the existing body of knowledge.

#### *7.2.3.3 Summary of similarities and difference with extant literature for Research Question 3*

Table 30, is a summary of similarities and differences discussed in 7.2.3.1 and 7.2.3.2 respectively

*Table 30: Summary of similarities and differences of study's outcomes and literature*

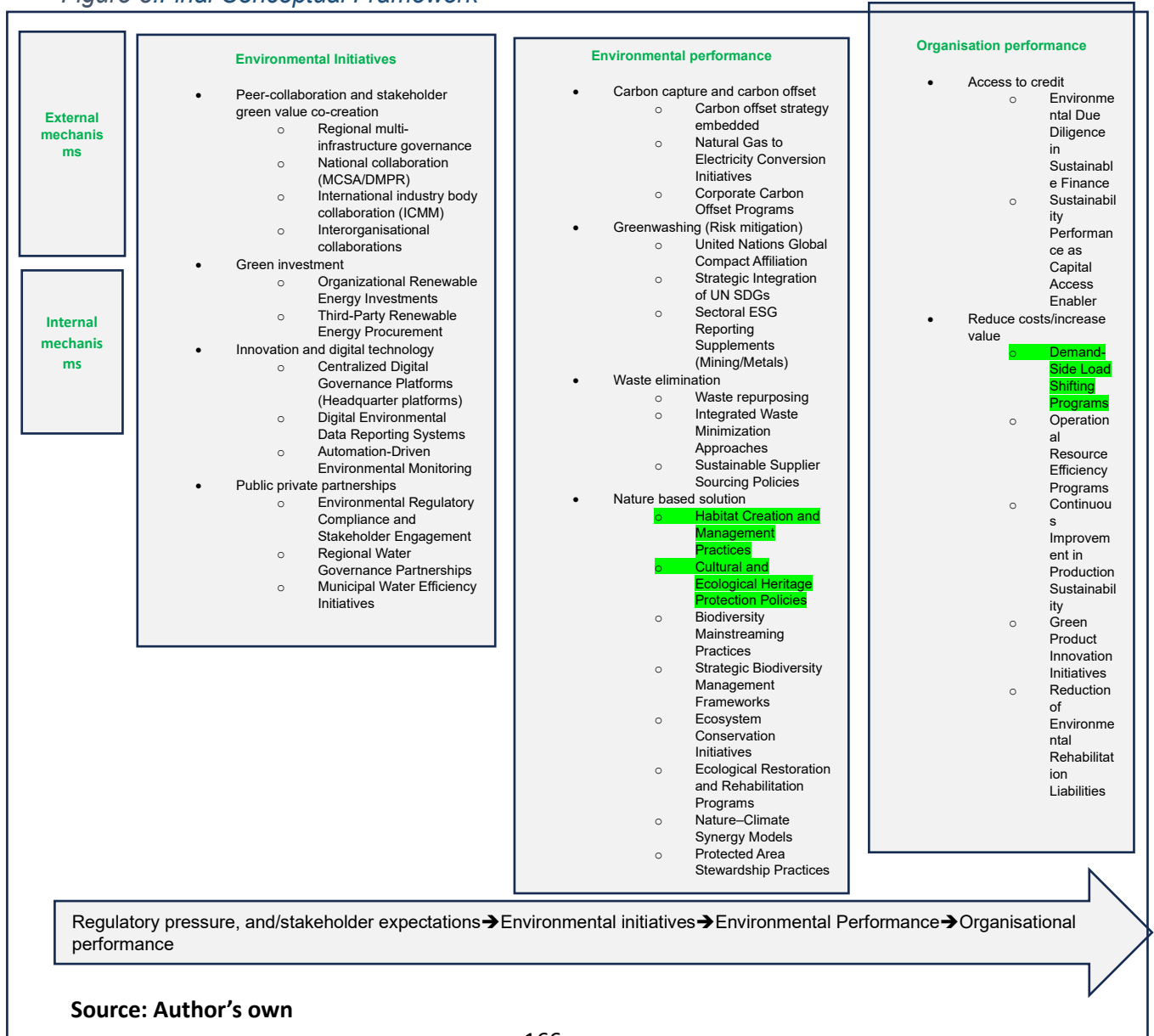
Themes	Similarities	Differences
Access to credit/funding	<ul style="list-style-type: none"> <li>Environmental Due Diligence in Sustainable Finance</li> <li>Sustainability Performance as Capital Access Enabler</li> </ul>	No differences between the study's outcomes and literature

Themes	Similarities	Differences
Reduce costs/increase value	<ul style="list-style-type: none"> <li>Operational Resource Efficiency Programs</li> <li>Continuous Improvement in Production Sustainability</li> <li>Green Product Innovation Initiatives</li> <li>Reduction of Environmental Rehabilitation Liabilities</li> <li>Supplier Engagement for Low-Impact Product Sourcing</li> <li>Cost effective and efficient technologies</li> <li>Renewable energy (electricity cost reduction)</li> <li>Access to funding</li> <li>Waste Monetization and Value Recovery Mechanisms</li> </ul>	<ul style="list-style-type: none"> <li>Demand-Side Load Shifting Programs</li> </ul>

#### 7.2.4 Final Conceptual Framework

Figure 8 depicts the final conceptual framework, capturing the principal constructs together with the associated themes and sub-themes identified in this study. The sub-themes highlighted in green denote proposed refinements to the extant literature emerging from the empirical findings.

Figure 8: Final Conceptual Framework



### 7.3 Research Contribution

The study aimed to gain an understanding of how the multinational enterprises deploy environmental initiatives to improve environmental performance and organisational performance. The research contribution is at both theoretical and practical levels. First, it advances the integration of institutional theory, stakeholder theory, and the resource-based view in the context of emerging market multinational enterprises, specifically highlighting how internal governance mechanisms and external regulatory or stakeholder pressures jointly drive the adoption of environmental initiatives in the South African mining sector. This enriches the academic understanding of sustainability-oriented management by showing context-specific foundations and dynamic stakeholder interactions.

Second, the research provides empirical evidence on the pathways through which environmental initiatives such as green investment, innovation and digital technology, public-private partnerships, nature-based solutions, and circular waste practices can be operationalised to improve both environmental and organisational performance. Notable conceptual refinements include the identification of habitat creation and management, cultural and ecological heritage protection, and demand-side load-shifting programs as important, context-driven extensions to the body of knowledge on corporate environmental strategies in emerging markets.

#### 7.3.1 Potential additions to the existing body of knowledge

Based on the work conducted in this study, the areas of similarity presented in Table 31 are regarded as contributions that potentially extend the existing body of knowledge. Although the study differs from previous research in terms of setting, context, and scope, these similarities indicate that findings reported in earlier studies are also observable within the context of this research. Consequently, they are considered additions to the existing body of knowledge.

*Table 31: Potential additions to the existing body of knowledge*

Theoretical constructs	Themes	Sub-themes
Environmental initiatives	Peer collaboration and stakeholder green value co-creation	National collaboration
		International industry body collaboration
		Interorganisational collaborations
		Inter-sectoral partnership models
		Regional multi-infrastructure governance
	Green investment	Organizational Renewable Energy Investments
		Third-Party Renewable Energy Procurement
		Operational Eco-Efficiency Initiatives
		Power Purchase Agreement (Renewable)

Theoretical constructs	Themes	Sub-themes
		Integrated Water Resource Management Strategies
		Circular Process Engineering Innovations
		Transitional Low-Carbon Energy Generation
		Energy Demand Reduction Technologies
		Adoption of Electrified Machinery
		Strategic Green Technology Investment
		Air Quality and Particulate Matter Mitigation Strategies
		Circular Economy Integration Models
		Extended Supply Chain Decarbonization Initiatives
	Innovation and digital technology	Centralized Digital Governance Platforms (Headquarter platforms)
		Digital Environmental Data Reporting Systems
		Automation-Driven Environmental Monitoring
		Advanced Engineering for Environmental Sustainability
		Resource Optimization Technologies
		Bioremediation technologies
		Emission Reduction Technologies
		Digital Sustainability Analytics and Disclosure Practices
		Artificial Intelligence-Enabled Environmental Management
		Extended Reality Applications in Sustainability
	Digital Twin Modelling for Sustainability	
	Public Private Partnerships	Regional Water Governance Partnerships
Municipal Water Efficiency Initiatives		
Local Government Sustainability Projects		
Environmental Regulatory Compliance and Stakeholder Engagement		
<b>Environmental Performance</b>	Carbon capture and carbon offset	Natural Gas to Electricity Conversion Initiatives
		Carbon offset strategy embedded
		Corporate Carbon Offset Programs
	Waste management	Tailings Facility Risk Optimization Strategies
		Waste repurposing
		Integrated Waste Minimization Approaches
		Sustainable Supplier Sourcing Policies
		Regulatory Waste Management Compliance
	Greenwashing	Sector-Specific ESG Disclosure Frameworks
		International ESG Reporting Standards Implementation
		IFRS Sustainability Standards Adoption
		United Nations Global Compact Affiliation
		Strategic Integration of UN SDGs
		Sectoral ESG Reporting Supplements (Mining/Metals)
	Nature-based solutions	GHG Emissions Protocols and Disclosure Instruments
		Biodiversity Mainstreaming Practices
		Strategic Biodiversity Management Frameworks
		Ecosystem Conservation Initiatives
		Ecological Restoration and Rehabilitation Programs
		Nature–Climate Synergy Models
		Protected Area Stewardship Practices
Ecologically Responsible Tourism Support		
Corporate Wildlife Management Programs		
Landscape-Scale Ecosystem Restoration		
<b>Organisational performance</b>	Access to credit/funding	Water, land and air quality management
		Environmental Due Diligence in Sustainable Finance
	Reduce costs/increase value	Sustainability Performance as Capital Access Enabler
Operational Resource Efficiency Programs		
		Continuous Improvement in Production Sustainability

Theoretical constructs	Themes	Sub-themes
		Green Product Innovation Initiatives
		Reduction of Environmental Rehabilitation Liabilities
		Supplier Engagement for Low-Impact Product Sourcing
		Cost effective and efficient technologies
		Renewable energy (electricity cost reduction)
		Access to funding
		Waste Monetization and Value Recovery Mechanisms

### 7.3.2 Potential refinements to the existing body of knowledge

Drawing on the work undertaken in this study, the areas presented in Table 32 are understood to constitute nuanced differences from the extant literature. Crane et al. (2016) suggest that country-level studies may contribute to theory in three distinct ways: through its development, refinement, or theoretical testing. Theory testing, in particular, involves examining existing theoretical propositions within a “relatively new and still emerging empirical context” (Crane et al., 2016, p. 785). Accordingly, the areas outlined below are considered contributions that provide potential enhancements to the current body of knowledge within this emerging field of research.

*Table 32: Potential enhancements/refinements to the existing body of knowledge*

Theoretical constructs	Themes	Sub-themes
<b>Environmental performance</b>	Nature-based solution	Habitat Creation and Management Practices
		Cultural and Ecological Heritage Protection Policies
<b>Organisational performance</b>	Reduce costs/value increase	Demand-Side Load Shifting Programs

## 7.4 Recommendations for management and other stakeholders

### *Recommendations for Management*

Management in South African multinational mining enterprises should embed sustainability deeply into decision-making and core operational processes. This includes adopting renewable energy solutions, implementing innovative waste management and circular economy models, as well as integrating nature-based approaches to enhance environmental performance and community impact. Investment in digital technologies for environmental monitoring and supply chain transparency is essential to ensure ongoing emissions reduction, cost control, and resilience to regulatory and stakeholder scrutiny. To avoid greenwashing and build lasting credibility, managers should also foster a transparent reporting culture and continuous improvement in both product innovation and process efficiency

### *Recommendations for other stakeholders*

For broader stakeholder groups, such as regulators, investors, and local communities, multi-level collaboration is central to sustainable progress. Regulators should balance stringent climate and environmental policies with provisions that allow access to capital and credit for innovation and transition, ensuring that mandates support rather than stifle sectoral resilience. Investors and suppliers, in turn, should require robust ESG disclosures and proactively participate in public-private partnerships, collective action platforms, and sector initiatives that accelerate sustainable value chain transformation. Civil society and local communities must be meaningfully involved via ongoing dialogue, formal consultation mechanisms, and participatory benefit-sharing and monitoring practices, ensuring that social legitimacy and local development co-evolve with environmental gains.

Finally, management is advised to treat sustainability as a strategic opportunity for competitive differentiation and long-term value creation in the global minerals market. This entails future-proofing the business against carbon and water-related risks, aligning product portfolios with emerging green value chains, and investing in capacity-building for employees and partners to drive knowledge transfer, innovation, and ecosystem-wide spillovers. Such an integrated approach not only advances organisational performance and compliance but meaningfully contributes to the social and environmental resilience of mining regions and South Africa's just transition objectives.

### *7.5 Limitation of this research*

Whilst Chapter 4 addressed the limitations associated with the research design and methodological choices, this section focuses on outlining the limitations pertaining to the study as a whole.

- The scope of this study was limited to the South African context.
- The investigation focused exclusively on mining companies operating within South Africa and did not provide an in-depth exploration of the mining sector itself.
- The automotive sector, which was initially intended to be part of the study, was ultimately not included.
- The study did not examine the nuances of the observed differences in detail, as these emerged as outcomes rather than focal points of the research

### *7.6 Suggestion for future studies*

- Further research could be focused exclusively on mining companies operating within South Africa and provide an in-depth exploration of the mining sector itself,

in terms of the environmental initiatives being implemented to improve environmental performance and organisational performance.

- Future studies could explore the automotive sector, which was initially intended to be part of the study, but was ultimately not included.
- Future studies could be conducted in other developing nations to confirm and extend the present findings, which appear to be context-dependent and reflective of the unique characteristics of South Africa as a developing economy.
- Future studies could examine the nuances of the observed differences, to obtain in-depth insights on the work related to environmental initiatives that are context specific.

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## 9. APPENDENCIS

### 9.1 Appendix 1: Informed consent

Informed consent letter towards a qualitative study towards MPhil 2024/25

I am conducting research on “**Organisational performance through management initiatives that lead to firm environmental performance**”. Our interview is expected to last **60 minutes**, and will help us understand **how internal and external mechanisms translate initiatives into environmental performance for organisational (firm) performance?**

**Your participation is voluntary and you can withdraw at any time without penalty.** By signing this letter, you are indicating that you have given permission for:

- The interview to be recorded;
- The recording to be transcribed by a third-party transcriber, who will be subject to a standard non-disclosure agreement;
- Verbatim quotations from the interview may be used in the report, provided they are not identified with your name or that of your organisation;
- The data to be used as part of a report that will be publicly available once the examination process has been completed; and
- All data to be reported and stored without identifiers.

If you have any concerns, please contact my supervisor or me. Our details are provided below.

Researcher name: Griffiths Baloi

Research Supervisor name: Dr Jill Bogie

Email: 14304156@mygibs.co.za

Email: bogiej@gibs.co.za

Phone : 082 54 111 34

Signature of participant: \_\_\_\_\_

Date: \_\_\_\_\_

Signature of researcher: \_\_\_\_\_

Date: \_\_\_\_\_

## 9.2 Appendix 2: Interview protocol

<b>Interview guide</b>
<ol style="list-style-type: none"><li>1. Please tell me how you got involved in environmental matters in your organisation?</li><li>2. To the best of your knowledge, please tell me how does your organisation understand environmental performance?</li><li>3. As per your understanding, please tell me about your organisation's environmental initiatives?</li></ol>
<ol style="list-style-type: none"><li>4. <ol style="list-style-type: none"><li>a. May you please first tell me about the external mechanisms that influence environmental initiatives and their environmental performance, in your organisation?</li><li>b. Please, can you tell me about the internal mechanisms that are applied in the environmental initiatives to achieve the intended environmental performance?</li></ol></li></ol>
<ol style="list-style-type: none"><li>5. <ol style="list-style-type: none"><li>a). In your own experience, please tell me how your organisation's environmental performance led to your organisation's performance?</li><li>b) Please tell about the organisational performance that has been achieved as a result of the environmental initiatives.</li></ol></li></ol>
<ol style="list-style-type: none"><li>6. In closing, how do you see your organisation moving forward with its environmental initiatives?</li></ol>

Probing questions that will be used during the interview:

- a. I wonder if you could please give more examples?
- b. May you be kind and clarify or explain more?
- c. Please can you tell me more about that?

### 9.3 Appendix 3: List of codes used

No	First order codes	Themes
1	Peer collaboration locally	Peer collaboration and stakeholder green value co-creation
2	Peer collaboration at multinational level	
3	Collaborating with industry peers	
4	Collaborate through MCSA forums	
5	Collaborate through DMPR forums	
6	Collaborate through Minerals Council South Africa	
7	ICMM membership collaboration	
8	VPSHR collaboration	
9	National chambers of commerce collaboration	
10	Industry bodies as collaboration platforms	
11	Joint problem-solving with other mines	
12	Neighbouring mines water management forum	
13	Regional multi-infrastructure governance (water)	
14	Interorganisational collaborations	
15	Inter-sectoral partnership models	
16	Community-level green value co-creation	
17	Co-creation with local communities on projects	
18	Engagement with Indigenous and traditional communities	
19	Engagement with heritage and cultural groups	
20	Engagement with environmental NGOs	
21	Cross-company collaboration on biodiversity projects	
22	Collaborative standard-setting in industry bodies	
23	Joint advocacy for environmental regulation	
24	Joint advocacy on heritage protection	
25	Sharing best practices on water management	
26	Sharing best practices on dust reduction	
27	Sharing best practices on tailings management	
28	Stakeholder dialogue platforms at regional level	
29	Stakeholder dialogue platforms at mine-site level	
30	Multi-stakeholder forums on just transition	
31	Joint training programmes with partners	
32	Partnering with suppliers on eco-design	
33	Partnering with suppliers on low-emission processes	
34	Partnering with logistics providers on emissions	

No	First order codes	Themes	
35	Supplier collaboration on waste reduction		
36	Supplier collaboration on circular economy		
37	Collaborative risk assessments with stakeholders		
38	Co-designed community development projects		
39	Co-designed water stewardship programmes		
40	Co-designed biodiversity action plans		
41	Multi-stakeholder grievance mechanisms		
42	Joint monitoring with regulators on permits		
43	Collaborative reporting with industry platforms		
44	Industry benchmarking on ESG performance		
45	Benchmarking of emissions with peers		
46	Benchmarking of water intensity with peers		
47	Benchmarking of rehabilitation practices		
48	Stakeholder engagement to validate ESG data		
49	Engagement with investors on ESG priorities		
50	Engagement with lenders on climate risk		
51	Engagement with rating agencies on ESG scores		
52	Participating in sector-specific reporting guidelines		
53	Participation in social dialogue on mine closure		
54	Participation in national climate forums		
55	Participation in regional development forums		
56	Alignment with community expectations for nature protection		
57	Alignment with municipal plans on infrastructure		
58	Stakeholder collaboration on air quality initiatives		
59	Stakeholder collaboration on land management		
60	Stakeholder collaboration on heritage site management		
61	Stakeholder collaboration on wildlife management		
62	Eco/environmentally friendly products		Green investment
63	Eco-design of mining products		
64	Eco-design of components in value chain		
65	Green product certification targeting markets		
66	Process optimisation for energy efficiency		
67	Process optimisation for water efficiency		
68	Process optimisation for waste reduction		

No	First order codes	Themes
69	Production process optimisation	
70	Operational eco-efficiency initiatives	
71	Operational efficiency in mineral processing	
72	Operational efficiency in smelting and refining	
73	Operational efficiency in logistics	
74	Renewable energy investment (solar)	
75	Renewable energy investment (wind)	
76	Renewable energy investment (bioenergy)	
77	Renewable energy investment at mine sites	
78	Renewable energy investment for smelters	
79	Renewable projects ~500 MW (flagship)	
80	Third-party renewable energy procurement	
81	Power Purchase Agreements (renewable)	
82	Long-term renewable PPAs with IPPs	
83	Embedded generation projects on-site	
84	Transitional low-carbon energy generation	
85	Replacing diesel with natural gas (transition)	
86	Replacing coal-based power with green electricity	
87	Green electricity sourcing via grid	
88	Energy demand reduction technologies	
89	Optimised ventilation control systems	
90	High-efficiency motors and drives	
91	Heat recovery and reuse in processing	
92	Adoption of electrified machinery	
93	Battery-electric vehicles underground	
94	Hybrid mine vehicle fleets	
95	Retrofits to reduce fuel use	
96	Integrated water resource management strategies	
97	Closed-loop water systems	
98	Water recycling in process plants	
99	Water reuse in tailings management	
100	Technology-driven loss minimisation	
101	Smart metering for water and power	
102	Circular process engineering innovations	
103	Waste circular projects (e.g. slag reuse)	
104	Co-processing waste in downstream industries	
105	By-product valorisation strategies	
106	Mineral residue monetisation projects	
107	Air quality and particulate matter mitigation strategies	

No	First order codes	Themes	
108	Dust management investments		
109	Stack emission abatement technologies		
110	Fume and gas capture systems		
111	Strategic green technology investment		
112	Portfolio of green R&D projects		
113	Piloting low-carbon technologies		
114	Scale-up of successful pilots		
115	Green skills development at site level		
116	Environmental skills training for operators		
117	Specialist green engineering capabilities		
118	Green intellectual capital building		
119	Capital allocation linked to environmental payback		
120	Environmental criteria in capex screening		
121	Long-term green capex planning horizons		
122	Environmental investments to reduce liabilities		
123	Investments in rehabilitation technologies		
124	Investments in tailings stability improvements		
125	Efficiency-related technologies		Innovation and information technology
126	Emissions mitigation technology		
127	AI for operational insights		
128	AI-driven business operations		
129	Artificial intelligence technology for planning		
130	AI for environmental anomaly detection		
131	GIS and digital tools		
132	GIS for environmental monitoring		
133	GIS for land-use planning		
134	Digital mapping of biodiversity areas		
135	Digital environmental data platforms		
136	Centralised ESG data warehouse		
137	Automated ESG data collection		
138	Real-time environmental dashboards		
139	IoT sensors for water monitoring		
140	IoT sensors for air quality monitoring		
141	IoT sensors for tailings monitoring		
142	IoT-based leak detection		
143	Advanced metering infrastructure (AMI)		
144	Digital twin modelling for energy scenarios		
145	Digital twin for mine design and closure		
146	Metaverse and extended reality training		
147	VR/AR for safety and environmental training		
148	Virtual walkthroughs of rehabilitation plans		

No	First order codes	Themes
149	Remote monitoring centres	
150	Control rooms integrating environmental KPIs	
151	Automation of high-risk operations	
152	Autonomous equipment reducing emissions	
153	Integrated reporting software	
154	Data assurance systems for ESG figures	
155	Systematic environmental reporting processes	
156	Technology for water management	
157	Technology for dust suppression	
158	Technology for air filtration	
159	Technology for resource optimisation	
160	Digital tools for rehabilitation planning	
161	Data analytics for resource efficiency	
162	Public-private partnership on water	
163	PPP for bulk water infrastructure	
164	PPP for wastewater treatment plants	
165	PPP for municipal water efficiency	
166	PPP for rural water access projects	
167	Public-private partnership for energy infrastructure	
168	PPP for renewable energy corridors	
169	PPP for transmission upgrades	
170	PPP for local grid stability	
171	PPP for road and rail upgrades	
172	PPP for port and logistics access	
173	Co-funding of municipal infrastructure	
174	Co-funding of community services	
175	Co-design of water governance structures	
176	Co-design of local sustainability projects	
177	Tripartite agreements (company-government-community)	
178	Mine-municipality strategic collaboration	
179	Alignment with municipal Integrated Development Plans	
180	Joint planning of land-use with municipalities	
181	Joint planning of disaster risk management	
182	Participation in regional PPP governance bodies	
183	PPPs for regional environmental monitoring	
184	PPPs for environmental education programmes	
185	Assurance providers to certify ESG	Greenwashing (its mitigation)
186	Internal and external ESG verification	

No	First order codes	Themes
187	Use of external assurance for ESG reports	
188	Data assurance for ESG indicators	
189	Accurate ESG reporting emphasis	
190	Transparent data reporting	
191	Transparent ESG frameworks adoption	
192	Systematic reporting processes	
193	Alignment with ICMM socio-economic framework	
194	Alignment with IFRS sustainability standards	
195	Alignment with GRI standards	
196	Alignment with SASB standards	
197	UNGC signatory commitments	
198	Integration of UN SDGs into strategy	
199	Reporting aligned with CDP requirements	
200	Reporting aligned with GHG Protocols	
201	Industry group participation to validate claims	
202	Avoiding impression management in ESG reports	
203	Use of comparable metrics across peers	
204	Disclosing limitations and uncertainties	
205	Disclosing challenges and trade-offs	
206	Positioning offsets as last resort	
207	Focusing on real emission reductions first	
208	Explicit commitment to avoid greenwashing	
209	Emphasis on substance over symbolic actions	
210	Waste optimisation	Waste Management
211	Waste minimisation	
212	Waste reduction	
213	Waste repurposing	
214	Waste reuse projects	
215	Waste-to-value initiatives	
216	Circular economy initiatives	
217	Prevention of environmental burden from waste	
218	Hazardous waste control	
219	Hazardous waste tracking systems	
220	Compliance-driven waste management	
221	Compliance with waste legislation	
222	Safe disposal of hazardous materials	
223	Tailings management improvements	
224	Tailings thickening to reduce footprint	
225	Tailings water recovery	
226	Slag reuse in construction	

No	First order codes	Themes	
227	Scrap metal recycling		
228	Oil and lubricant recycling		
229	Packaging waste reduction		
230	Plastics reduction initiatives		
231	On-site waste segregation		
232	Waste audits and material flow analysis		
233	Waste-related safety improvements		
234	Waste-related efficiency improvements		
235	Efficiency in resource utilisation (reduce water)		Cost reduction/financial benefit
236	Efficiency in resource utilisation (reduce energy)		
237	Efficient processes (general)		
238	Operational efficiency programmes		
239	Operational efficiency in mining		
240	Operational efficiency in processing		
241	Production process optimisation for cost		
242	Resource optimisation (materials)		
243	Resource optimisation (energy)		
244	Resource optimisation (water)		
245	Renewable energy as cost reduction		
246	Renewable energy to reduce power costs		
247	Renewable energy to hedge tariff risk		
248	Cost reduction via LED lighting		
249	Cost reduction via battery-electric vehicles		
250	Cost reduction via efficient motors		
251	Cost reduction via process automation		
252	Continuous process improvement culture		
253	Lean initiatives with environmental benefits		
254	Reduce long-term environmental liabilities		
255	Reduce rehabilitation liabilities		
256	Water reuse reducing long-term costs		
257	Recycling reducing raw material costs		
258	Emissions reduction reducing regulatory costs		
259	Adoption of cost-effective and efficient technology		
260	Influencing suppliers to adopt low-emission processes		
261	Supplier efficiency partnership models		
262	Monetisation of waste for revenue		
263	Access to funding through strong ESG performance		

No	First order codes	Themes
264	Improved investor perception reducing cost of capital	
265	Efficient processes increasing competitiveness	
266	Cost avoidance through regulatory compliance	
267	Cost avoidance through risk mitigation	
268	Environmental due diligence for funding	Access to credit/funding
269	Sustainability performance as enabler to funding	
270	ESG-linked loan arrangements	
271	Green bonds or sustainability-linked bonds (concept)	
272	Bank engagement on climate risk disclosures	
273	Meeting lenders' ESG covenants	
274	Using ESG ratings to access cheaper credit	
275	Addressing climate-related financial risk in disclosures	
276	Financing conditions tied to emission reduction	
277	Financing conditions tied to safety and environment	
278	Funding for renewable projects linked to ESG	
279	Funding for water projects linked to ESG	
280	Funding for rehabilitation programmes	
281	Investor scrutiny of environmental performance	
282	Rating agency assessment of ESG practices	
283	Improved access to export incentives via environmental performance	
284	Internal focus on carbon management	
285	Carbon capture and offset strategies	
286	Carbon capture feasibility assessments	
287	Use of offsets for hard-to-abate emissions	
288	Commitment to offsets as last resort	
289	Replacing natural gas boilers with green energy	
290	Replacing natural gas boilers with bioenergy	
291	Clear carbon offset management framework	
292	ESG report commitments to carbon neutrality	
293	Roadmap to full carbon neutrality	
294	Considering carbon cost in project economics	
295	Demand-side load shifting programmes	
296	Energy curtailment to reduce peak demand	
297	Participation in demand response programmes	
298	Electrification of high-carbon operations	
299	Carbon abatement through process redesign	

No	First order codes	Themes
300	Carbon abatement through renewable substitution	
301	Biodiversity initiatives	Nature-based solutions
302	Conservation initiatives on-site	
303	Conservation initiatives off-site	
304	Rehabilitation initiatives	
305	Post-mining land rehabilitation	
306	Ecosystem restoration projects	
307	Habitat creation projects	
308	Wildlife management programmes	
309	Establishment of nature reserves	
310	Buffer zones for biodiversity	
311	Protecting natural areas	
312	Protecting endangered species	
313	Protecting heritage sites	
314	Cultural and ecological heritage protection	
315	Balance between climate and nature	
316	Land and air management	
317	Dust and air quality management as nature-linked	
318	Water stewardship initiatives	
319	Catchment-level water stewardship	
320	Wetland restoration	
321	River health improvement projects	
322	Nature-based carbon sequestration (e.g. reforestation)	
323	Landscape-level rehabilitation planning	
324	Community co-management of conservation areas	
325	Integration of nature-based solutions in mine closure plans	

