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# Institutional, Cultural, And Resource Barriers To ESG Adoption In Duqm's Heavy-Industry Cluster

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***Abstract***
*This study investigates why Environmental, Social, and Governance (ESG) initiatives remain unevenly embedded across Duqm's heavy-industry cluster, a cornerstone of Oman's economic-diversification agenda. Adopting an interpretative phenomenological case-study design, the research draws on semi-structured interviews with senior managers and three focus-group discussions involving infrastructure, logistics, oil and gas, consulting, education, and local-government stakeholders. Thematic analysis reveals a multi-layered constellation of barriers. First, ESG literacy is shallow: employees and leaders like confuse ESG with corporate social responsibility or basic compliance, while training sessions are generic and disconnected from job roles. Second, regulatory expectations are opaque and dispersed across several authorities, leading firms to pursue symbolic compliance rather than strategic integration. Third, inside organizations, ESG tasks are bolted onto existing roles without clear ownership, and entrenched silo cultures frame ESG as an external imposition, fostering resistance and fatigue. These findings suggest that policy ambition alone is insufficient; effective ESG adoption hinges on coordinated governance, tailored capacity-building, and structural reforms that embed ESG into performance metrics and cross-functional workflows. By mapping where intentions stall, the study contributes a diagnostic lens for both scholars and practitioners and offers actionable recommendations to transform ESG rhetoric into operational reality.*

***Keywords:*** *institutional barriers, culture barriers, resource barriers, ESG adoption, Duqm special economic zone*

## 1. INTRODUCTION

The Duqm Special Economic Zone (SEZD) occupies a central position in Oman's Vision 2040, underpinning more than USD 20 billion in refinery, petrochemical, and maritime infrastructure investments intended to accelerate the Sultanate's economic diversification and job creation (Aggarwal et al., 2024). Constructed from scratch in a previously undeveloped desert area, Duqm presents a unique opportunity to embed Environmental, Social, and Governance (ESG) principles from the outset, rather than retrofitting sustainability into path-dependent, carbon-intensive systems (Tripathi, 2025). Policymakers have signaled that access to land, tax incentives, and sovereign financing will increasingly depend on demonstrable ESG progress aligned with both national and international standards (Rehman et al., 2024). Yet early insights from refinery and dry-dock managers suggest that ESG is often perceived as a bureaucratic obligation rather than a strategic value driver. This perception is at odds with a growing body of global evidence. Empirical studies across sectors, from aviation and manufacturing to agri-food supply chains, demonstrate strong positive correlations between high-quality ESG disclosure and improved profitability, lower financing costs, and enhanced firm value (Abdi et al., 2022; Akhtar et al., 2025; Camelo & Nogueira, 2024). Meta-analyses further highlight ESG integration as a resilience-enhancing strategy during economic shocks, as well as a magnet for responsible investors (Alhoussari, 2025; Astuti et al., 2024). These financial imperatives echo regional policy: Vision 2040 explicitly ties private-sector investment to sustainable development, aiming to avoid repeating the ecological costs of oil-led growth (Aggarwal et al., 2024). Yet despite awareness of ESG's potential, implementation gaps persist.

Recent studies identify multiple bottlenecks: limited ESG literacy, especially among SMEs; training programs that are generic and disconnected from day-to-day responsibilities; regulatory fragmentation and audit fatigue; and organizational cultures that frame ESG as an external constraint rather than a source of innovation (Bui et al., 2024; Bebic et al., 2025; Parameswar et al., 2024). Structural issues such as underfunded sustainability units, siloed reporting lines, and opaque data-governance systems compound these barriers (Bezerra et al., 2024; Rehman et al., 2024). These dynamics create what Loko and Schiehll (2025) describe as "policy–practice decoupling", a phenomenon especially pronounced in emerging markets grappling with capacity shortfalls and volatile capital flows. Within the Gulf Cooperation Council (GCC), Duqm stands out as both a high-profile development zone and a case of limited ESG readiness. While sovereign wealth funds promote energy transition and circular-economy principles (Kandpal et al., 2024), many Duqm-based firms lack internal audit capacity, clear metrics, or unified oversight frameworks (Sadriwala et al., 2024; Rehman et al., 2024). Governance challenges, particularly the absence of board-level ESG integration, further weaken strategic alignment (Kouam, 2024; Yao et al., 2025). Existing ESG literature tends to focus either on aggregate disclosure indices or on mature logistics hubs in developed economies, leaving a gap in our understanding of how nascent, high-growth industrial zones like Duqm grapple with ESG imperatives. This study addresses that gap by asking: What institutional, cultural, and resource barriers inhibit effective ESG adoption in Duqm's refinery and dry-dock cluster? Drawing on an interpretive phenomenological case-study approach, and triangulating interviews, focus-group dialogues, and policy-document analysis, this research maps the specific frictions stalling ESG progress. In doing so, it extends ESG-capability theory to Gulf contexts and offers actionable recommendations for translating ESG from a compliance exercise into a strategic enabler of industrial transformation.

## 2. LITERATURE REVIEW

The scholarly discourse on Environmental, Social, and Governance (ESG) integration has expanded rapidly since 2020, drawing from a range of conceptual frameworks including neo-institutionalism, the resource-based view (RBV), stakeholder theory, and more recently, digital-culture perspectives (Daugaard & Ding, 2022; Matos, 2020). Neo-institutional approaches emphasize coercive and mimetic pressures, such as tightening disclosure regulations and investor demands, that often lead to symbolic adoption, particularly in contexts with weak enforcement or fragmented oversight (Loko & Schiehll, 2025). In contrast, RBV-oriented research positions ESG as a set of firm-specific capabilities that generate competitive advantage if they are rare, valuable, and difficult to replicate (Alhoussari, 2025). Recent work across both traditions converges on the insight that external mandates are insufficient without internal absorptive capacity: the organizational systems, digital infrastructure, and cultural alignment required to translate ESG norms into practice (Akhtar et al., 2025).

Empirical studies increasingly confirm that high-quality ESG integration correlates with stronger financial outcomes. Abdi et al. (2022) find that among global airlines, ESG performance moderates the negative effects of firm size and age on profitability. Malaysian SME research highlights how digitally enabled cultures enhance the ESG–performance nexus, suggesting that digital platforms can reduce compliance costs while unlocking innovation opportunities (Akhtar et al., 2025). Meta-analyses likewise identify ESG alignment as a source of resilience during market shocks and a magnet for responsible capital (Astuti et al., 2024). Region-specific studies note that early ESG adopters in the Gulf benefit from preferential financing, and that Oman's Vision 2040 explicitly ties ESG to long-term diversification and socio-economic sustainability (Aggarwal et al., 2024; Alhoussari, 2025). Despite these incentives, consistent implementation remains elusive. A global pattern of knowledge and training deficits has emerged as a primary bottleneck. Many SME managers conflate ESG with corporate social responsibility (CSR) or ISO-based compliance frameworks, resulting in fragmented efforts and duplicated reporting (Bui et al., 2024; Knihová & Jílková, 2023). Hotkova and Belas (2025) add that ESG workshops are often perceived as abstract and irrelevant to operational roles, thereby lowering behavioral intention to implement. These findings support UTAUT2-based research, which identifies facilitating conditions, such as IT support, peer learning, and role-specific tools, as decisive in converting intention into adoption (Hrnjica et al., 2024).

A second cluster of barriers stems from regulatory ambiguity and fragmented oversight. In the Iberian agri-food sector, overlapping certification schemes overwhelm firms and create "audit fatigue," pushing them toward disclosure minimalism or strategic silence (Camelo & Nogueira, 2024). A modified TISM study in India finds that inconsistent mandates between ministries and stock exchanges erode managerial commitment (Parameswar et al., 2024). At the macro level, Tarczynska-Luniewska et al. (2024) document how emerging-market regulators oscillate between soft guidance and hard compliance, fostering uncertainty that weakens implementation. Studies in Taiwan and other emerging markets suggest that board-level ESG expertise can offset this ambiguity, but such governance capacity remains uneven (Yao et al., 2025; Kouam, 2024). The third domain involves cultural resistance and competing logics within firms. In German Mittelstand manufacturers, engineers often see ESG as a threat to efficiency or profitability (Bebic et al., 2025). Brazilian construction firms report that sustainability clauses inflate costs and reduce bid competitiveness (Bezerra et al., 2024). In the Gulf, ESG is sometimes perceived as externally imposed "Western" rhetoric, sidelined in favour of expansion targets aligned with national development agendas (Sadriwala et al., 2024). However, when firms reframe ESG as a form of national pride, linking it to energy transition leadership, they observe higher workforce engagement (Tripathi, 2025).

Finally, resource and structural barriers continue to obstruct implementation in asset-heavy sectors. Italian fieldwork finds that ESG integration into risk dashboards requires both high-cost data infrastructure and cross-functional governance, resources many mid-cap firms lack (Leto et al., 2024). In emerging economies, credit access remains constrained: banks remain sceptical about green investment returns, forcing firms to self-finance sustainability upgrades (Bezerra et al., 2024). Even large port operators struggle with fragmented legacy systems; ESG scoring gains traction only when safety, energy, and financial databases are unified (Dos Santos & Pereira, 2022). Rehman et al. (2024) further show that ESG credibility is undermined when audit teams are understaffed and unable to verify social-impact claims. Synthesizing these strands reveals two critical research gaps. First, most empirical studies isolate single barrier categories, yet few examine how institutional, cultural, and resource frictions interact in real-world decision-making. Second, the ESG literature remains skewed toward mature economies and large logistics hubs. Heavy-industry clusters in frontier contexts, such as Duqm, with their rapid buildouts, international joint ventures, and evolving policy frameworks, are significantly under-represented. Without deeper insight into these environments, policymakers risk issuing one-size-fits-all mandates that fuel symbolic compliance, while firms miss opportunities to develop context-appropriate ESG capabilities. This study addresses these gaps by mapping how global ESG norms collide with local organizational realities in Duqm's refinery and dry-dock ecosystem, thereby extending ESG-capability theory into a high-growth, resource-constrained, and policy-salient setting.

## 3. METHODOLOGY

This study is situated within an interpretivist paradigm, which views ESG adoption not as a fixed technical process but as a socially constructed phenomenon shaped by institutional, cultural, and economic contexts (Tarczynska-Luniewska et al., 2024). Interpretivism is particularly appropriate for examining emerging-market zones like Duqm, where formal policy frameworks intersect with legacy industrial logics and evolving governance structures. Rather than testing pre-defined hypotheses, the interpretivist approach seeks to surface participants' meaning-making and lived experiences in relation to ESG implementation (Matos, 2020; Daugaard & Ding, 2022). To operationalize this philosophical stance, the research employed an Interpretative Phenomenological Case Study (IPCS) design. This hybrid methodology combines the deep, idiographic orientation of phenomenology with the contextual reach of qualitative case research, making it well-suited for exploring complex organizational dynamics (Bebic et al., 2025; Tripathi, 2025). The IPCS approach has gained traction in ESG scholarship, particularly in studies that seek to bridge micro-level managerial experience with macro-level governance and policy systems (Perez Baez & Remond, 2022; Loko & Schiehll, 2025).

Data were collected through a maximum-variation purposive sample of 20 participants from Duqm's refinery, dry-dock, and maritime logistics ecosystem. Participants included senior executives, engineers, compliance officers, procurement managers, and sustainability staff, selected to reflect a range of roles and responsibilities across the ESG implementation spectrum (Hrnjica et al., 2024). Primary data sources consisted of three semi-structured focus-group discussions (12 participants in total) and twenty follow-up, one-on-one interviews lasting between 45 and 60 minutes. Interviews were conducted in English or Arabic (with interpreter assistance where necessary), audio-recorded, transcribed, and anonymized. Interview protocols explored participant understanding of ESG, the practical challenges of implementation, and organizational responses to evolving policy mandates. In parallel, documentary sources, including internal ESG training materials, compliance manuals, audit reports, and circulars from the Special Economic Zone Authority (SEZAD), were gathered to triangulate and contextualize participant testimony (Rehman et al., 2024).

All transcripts were imported into NVivo and analyzed through a thematic-phenomenological coding cycle. Initial open coding surfaced key challenges around ESG literacy, regulatory ambiguity, cultural resistance, and resource constraints, barrier clusters that recur in ESG scholarship (Parameswar et al., 2024; Knihová & Jílková, 2023). Axial coding then linked these themes to organizational outcomes such as internal-audit effectiveness, incentive alignment, and performance-metric integration (Leto et al., 2024; Yao et al., 2025). Selective coding refined these relationships into conceptual categories, while memo-writing supported reflexivity and the identification of latent themes, including green-finance incentives and circular-economy discourse (Kandpal et al., 2024; Mukhtar et al., 2024). To ensure trustworthiness, the study employed several qualitative validation strategies. Member-checking workshops were conducted with a subset of participants to verify the accuracy and resonance of thematic findings. In addition, an external researcher conducted an independent audit of the NVivo codebook and coding procedures, consistent with best practices in responsible-investment research (Alhoussari, 2025). Ethical approval was secured through the host institution's IRB process, and informed consent was obtained from all participants. Data were anonymized using role-based identifiers (e.g., FG2-P1), and transcripts were stored securely in compliance with Omani and international data protection standards (Sadriwala et al., 2024). Although the IPCS design prioritizes depth over statistical generalizability, its use of thick contextual description enables readers to assess the transferability of findings to other industrial contexts. By linking participant narratives to broader theoretical constructs, the methodology enables analytic generalization, offering insights not only into ESG implementation in Duqm but also into broader patterns of ESG-capability development in emerging-market SEZs (Tarczynska-Luniewska et al., 2024; Loko & Schiehll, 2025).

## 4. FINDINGS

Thematic analysis of three focus-group discussions (12 participants) and 20 in-depth interviews revealed a recurring triad of barriers that obstruct ESG adoption in Duqm's heavy-industry cluster. Despite variation across firms and sectors, participants' accounts converged around three core themes: (1) limited ESG literacy and role-specific training, (2) regulatory ambiguity and fragmented oversight, and (3) siloed organizational structures coupled with cultural resistance. These findings echo patterns identified in ESG scholarship across emerging economies, where institutional, cultural, and capability deficits intersect to impede meaningful implementation (Bezerra et al., 2024; Bebic et al., 2025).

First, across all focus groups, managers and technical staff admitted to shallow ESG understanding. Many participants described ESG as interchangeable with older frameworks such as corporate social responsibility (CSR) or health, safety, and environment (HSE) compliance, creating confusion and overlap. As one participant stated, “We can spell E-S-G but not explain what the S actually measures” (FG2-P3). This conceptual blurring reflects challenges reported in prior studies, where newly introduced sustainability frameworks are layered onto legacy compliance systems without sufficient adaptation (Abdi et al., 2022). Training sessions were often described as superficial and disconnected from functional roles. One procurement officer recalled a two-hour webinar as “all buzzwords and zero guidance on how I change vendor selection” (FG3-P2), highlighting the disconnect between generic training and operational relevance (Astuti et al., 2024). In the absence of sustained, role-specific learning pathways, ESG responsibilities were described as being pursued via “Google searches and borrowed PowerPoints” (FG1-P5). This knowledge vacuum undermined accountability, as no clear ESG ownership was assigned. As one participant put it, “The topic stays rhetorical, nobody owns it” (FG2-P1), reinforcing prior calls for modular, embedded ESG curricula in industrial zones (Knihová & Jílková, 2023).

Second, participants consistently characterized Duqm’s policy environment as lacking coherence, often using terms such as “regulatory fog” or “three ministries asking for three different carbon numbers” (FG3-P3). Although Oman Vision 2040 outlines ambitious ESG targets, no single entity within the Special Economic Zone (SEZ) holds authority over standard-setting, auditing, or enforcement. This fragmented governance leads to symbolic compliance: “We file glossy sustainability pages because investors expect it, no one reads them afterward” (FG1-P2). The absence of clear mandates, penalties, or incentives discourages authentic engagement. One manager bluntly noted, “Until there’s a fine for greenwashing, ESG will stay paperwork” (FG2-P5). Participants overwhelmingly supported the idea of a zone-level lead authority empowered to issue harmonized scorecards and conduct on-site inspections, recommendations that align with international best practices in ESG coordination (Loko & Schiehll, 2025).

Third, the organizational culture and structure within firms exacerbated implementation challenges. ESG responsibilities were typically bolted onto HSE or administrative functions, often without budget, key performance indicators (KPIs), or decision-making authority. “Because project teams, HR, and finance work in silos, the ESG file just sits in SharePoint,” noted one operations head (FG3-P4). This structural fragmentation created fatigue and fostered skepticism. A senior engineer described ESG as “another Western buzzword, let’s get the job done first” (FG2-P2), illustrating cultural resistance and the perception that ESG is an external imposition rather than a strategic necessity (Hotkova & Belas, 2025). Notably, participants reported that cultural attitudes shifted only when ESG was tied to tangible incentives. One site linked 5% of management bonuses to verified emissions reductions, after which “everybody wanted the dashboard” (FG3-P5). This supports literature on incentive alignment as a catalyst for both behavioral change and ESG innovation (Saini & Kharb, 2025; Mukhtar et al., 2024). Taken together, these findings point to a capability–governance–culture nexus that keeps ESG at a superficial level. Inadequate skills limit meaningful engagement; ambiguous rules erode urgency; and siloed cultures dampen motivation and ownership. As one participant summarized, “ESG is a glossy heading on a dusty shelf, until we fix training, rules, and rewards at the same time” (FG2-P6). This triangulated evidence suggests that the challenges are not isolated but interdependent. Effective ESG adoption in Duqm requires simultaneous reform across training infrastructure, regulatory coordination, and organizational design.

## 5. DISCUSSION

The findings from Duqm's heavy-industry cluster reflect a broader pattern observed across emerging-market ESG research: technical capability, regulatory coherence, and organizational culture do not operate as isolated challenges but as mutually reinforcing bottlenecks (Bezerra et al., 2024; Bebic et al., 2025). Within the interpretivist–phenomenological frame of this study, participants' sense-making revealed how ESG remains trapped in legacy compliance structures due to systemic misalignments between policy ambition and operational reality. The metaphor of ESG as a "glossy heading on a dusty shelf" (FG2-P6) captures this disconnect, echoing what Loko and Schiehll (2025) call policy–practice decoupling. The issue of limited ESG literacy resonates strongly with global evidence that ad hoc workshops, often led by consultants, fail to foster job-relevant competencies (Astuti et al., 2024). Similar to the Malaysian SMEs examined by Akhtar et al. (2025), Duqm-based managers conflated ESG with CSR and HSE templates, undermining strategic integration. This points to a classic training–transfer gap, wherein knowledge is not embedded in workflows, incentives, or job design, and thus dissipates before crystallizing into routines (Knihová & Jílková, 2023). Firms with shallow ESG knowledge rarely convert disclosure into financial performance improvements, further weakening managerial buy-in (Abdi et al., 2022).

Regulatory ambiguity emerged as an equally salient friction. Despite Oman Vision 2040 articulating ambitious sustainability goals, participants described the regulatory environment in Duqm as fragmented and duplicative, "three ministries, three carbon numbers" (FG3-P3). This mirrors Diana's (2024) concept of ESG regulatory fog, a condition wherein overlapping authorities dilute accountability and stall implementation. Empirical work on European ports shows that codified scorecards and single-window audits significantly improve compliance depth and reduce reporting fatigue (Leto et al., 2024). Absent such clarity, firms in Duqm often defaulted to symbolic compliance, producing polished reports to satisfy investor expectations while internal operations remained largely unchanged, a pattern also noted in broader Gulf contexts (Daugaard & Ding, 2022). The role of culture and internal governance further complicated ESG uptake. ESG duties were typically appended to HSE or administrative functions without authority, KPIs, or resources. Employees perceived these responsibilities as additional, unrewarded tasks, "extra work with no reward" (FG2-P5), a sentiment widely documented in SME literature (Hotkova & Belas, 2025). However, the few cases where ESG was tied to performance-based incentives (e.g., linking bonuses to emissions reduction) saw greater engagement and innovation, supporting research by Mukhtar et al. (2024) and Saini and Kharb (2025) on the role of incentive alignment in overcoming cultural inertia.

Synthesizing these strands, this study proposes the concept of a capability–governance–culture nexus. Limited technical skills reduce firms' capacity to interpret and respond to policy mandates; regulatory ambiguity erodes the motivation to invest in ESG capabilities; and siloed organizational cultures prevent cross-functional learning and integration. These feedback loops explain why ESG initiatives stall even when individual constraints appear solvable in isolation. Comparable triadic dynamics have been observed in cross-country analyses of ESG disclosure drivers (Roy & Mukherjee, 2025) and in Gulf-specific case studies where successful ESG integration required simultaneous regulatory clarity, leadership commitment, and workforce skilling (Tripathi, 2025). Theoretical implications of this research are twofold. First, it extends ESG-capability theory into under-explored frontier zones, highlighting how institutional thinness and fragmented ownership structures complicate the ESG-performance relationship. Second, it deepens understanding of how ESG barriers interact, rather than accumulate, shaping decision-making in emergent sustainability regimes. This insight is especially critical for regions like the Gulf, where policy enthusiasm may outpace institutional capacity. For ESG adoption to move from rhetoric to operational reality, interventions must address the interdependence of technical literacy, regulatory architecture, and organizational culture, not treat them as separate silos.

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## 6. PRACTICAL IMPLICATIONS AND RECOMMENDATIONS

The findings underscore that ESG implementation in Duqm's heavy-industry cluster is hindered by a triad of capability, governance, and cultural frictions. To move beyond symbolic compliance and embed ESG meaningfully into organizational strategy, a set of coordinated, multi-level interventions is required. First, addressing the capacity gap demands a transition from generic, one-off training sessions to scaffolded, role-specific learning pathways. The data reveal that "all-slides, no tools" workshops have failed to equip staff with actionable knowledge (FG3-P2). International research shows that short, modular micro-credentials, integrated into job workflows and tied to performance reviews, significantly outperform traditional workshops in both knowledge retention and behavioral change (Knihová & Jílková, 2023). Malaysian SMEs that implemented such tiered ESG training reported measurable improvements in both compliance scores and profitability within 18 months (Akhtar et al., 2025). Duqm firms should adopt a similar approach, embedding ESG learning within corporate learning-management systems to create verifiable audit trails for regulators and investors (Mukhtar et al., 2024).

Second, the current landscape of regulatory ambiguity and institutional overlap must be resolved. Participants described an environment of "three ministries, three carbon numbers," which fosters confusion, duplicative reporting, and audit fatigue (FG3-P3). Establishing a dedicated ESG Coordination Unit under the Duqm Special Economic Zone Authority would address this fragmentation. The unit should be empowered to issue sector-specific scorecards, harmonize data templates, and mandate third-party verification. Similar single-window systems in Portugal's agri-food sector increased disclosure quality by 30% within two years (Camelo & Nogueira, 2024). For Duqm, unified ESG guidance would replace confusion with clarity and elevate ESG from a reporting chore to a performance domain (Daugaard & Ding, 2022). Third, to overcome cultural resistance, ESG must be integrated into both incentive structures and leadership narratives. Many participants perceived ESG as "extra work with no reward" (FG2-P5). However, the one site in the sample that tied 5–10% of management bonuses to emissions reduction and supplier audits saw significantly higher engagement (FG3-P5). This finding aligns with studies in Taiwan, where linking ESG to executive compensation accelerated project completion and improved employee morale (Yao et al., 2025). Firms should embed ESG targets into KPIs and performance reviews, while senior leaders publicly endorse ESG achievements during town halls, investor briefings, and board meetings. Framing ESG as a source of competitive advantage, rather than reputational liability, can realign organizational mindsets (Alhoussari, 2025).

Fourth, resource pooling mechanisms are vital, especially for SMEs and subcontractors. Many smaller firms reported limited budgets to invest in sustainability technology or data infrastructure. A cross-firm ESG consortium, anchored by Duqm's anchor tenants such as the refinery and dry-dock, could support shared services like waste-heat recovery hubs, joint training centers, and ESG data platforms. German Mittelstand firms that adopted consortium-based ESG initiatives reduced compliance costs by up to 30% while accelerating organizational learning (Bebic et al., 2025). Shared platforms would also standardize methodologies, easing benchmarking and enabling peer learning. Finally, the adoption of digital technologies, including AI-driven dashboards and blockchain traceability, offers a pathway to reduce the data burdens associated with ESG reporting. Pilot projects in Southeast Asia demonstrate that ESG dashboards can cut reporting cycles by 40% and increase accuracy (Akhtar et al., 2025). Embedding such tools into SEZD's proposed ESG portal would streamline compliance and attract ESG-conscious investors. Aligning these digital solutions with Oman Vision 2040 would further signal national commitment and unlock public financing earmarked for sustainable development (Aggarwal et al., 2024). Collectively, these recommendations form a synchronized intervention agenda. Duqm must replace fragmented reporting and symbolic gestures with integrated governance, embedded capacity-building, performance-based incentives, and digital innovation. Branding Duqm as a pilot zone for rigorous, tech-enabled ESG governance could yield demonstration effects for other industrial hubs in the Gulf and position Oman as a regional ESG leader.

## 7. LIMITATIONS AND DIRECTIONS FOR FUTURE RESEARCH

While this study offers the first in-depth exploration of ESG implementation barriers in Duqm's heavy-industry cluster, several limitations constrain the generalizability and scope of its findings. First, Duqm represents a unique institutional environment within the Gulf, characterized by a hybrid governance model involving a single-window SEZ authority and multiple line ministries. This context differs substantially from other industrial zones such as Sohar or Jazan, which operate under different concession models, ownership structures, and regulatory regimes (Tarczynska-Luniewska et al., 2024). As such, findings should be interpreted as analytically generalizable rather than statistically representative. Comparative, multi-site studies are needed to test whether the knowledge gaps, coordination failures, and resistance patterns identified here represent broader regional trends or context-specific anomalies. Second, although the purposive sampling strategy yielded rich insights from senior and middle managers, the study underrepresents the perspectives of shop-floor technicians, subcontracted workers, and local community stakeholders. These groups often possess tacit operational knowledge that significantly shapes ESG outcomes in practice. Their absence risks what Bebic et al. (2025) describe as "elite bias", wherein implementation challenges are filtered through managerial lenses. Future research should incorporate participatory methods, such as worker diaries, photovoice, or mobile ethnography, to surface grounded perspectives that lie below the organizational surface (Bui et al., 2024).

Third, this research offers a cross-sectional snapshot of ESG dynamics during a period of rapid regulatory and organizational change. ESG integration is a path-dependent process, subject to shifts in leadership, market conditions, and policy reforms (Daugaard & Ding, 2022). Longitudinal designs that track firms over time would sharpen causal inferences about what accelerates or stalls ESG adoption. This is particularly important in emerging markets where policy signals may evolve rapidly or inconsistently. Fourth, as with many interview-based studies, findings may be affected by social desirability bias. Participants may have overstated their ESG engagement or downplayed organizational resistance to align with perceived normative expectations (Loko & Schiehll, 2025). Future work could triangulate self-reported narratives with unobtrusive indicators, such as energy meter logs, supplier audit records, or whistle-blower disclosures, to increase validity and reduce bias.

Finally, while investor pressure emerged as a recurring theme, this study did not examine how capital market instruments, such as green bonds, sustainability-linked loans, or ESG index inclusion, shape firm-level ESG incentives. Mixed-method research that combines ethnographic fieldwork with event-study econometrics could illuminate whether ESG disclosure shocks translate into measurable changes in credit risk, equity valuations, or access to capital (Akhtar et al., 2025). Based on these limitations, several future research directions emerge. First, experimental or quasi-experimental evaluations of a proposed ESG Coordination Unit in Duqm could test whether regulatory consolidation improves reporting quality and compliance efficiency. Second, pilot studies tracing the rollout of digital ESG tools, such as AI-powered dashboards or blockchain traceability, could help identify the cost–benefit tipping points of digital oversight mechanisms (Sadriwala et al., 2024). Third, action-research interventions that simultaneously realign incentives and reframe ESG as a source of national pride could measure whether cultural resistance declines when ESG is linked to identity and career value (Hrnjica et al., 2024; Tripathi, 2025). Finally, cross-sector benchmarking that compares ESG integration in Duqm's heavy-industry profile with low-carbon sectors such as wind energy could clarify whether the observed barriers are sector-specific or structural (Noronha, n.d.).

## 8. CONCLUSION

This study set out to examine why ESG adoption remains uneven across Duqm's heavy-industry cluster, despite strong national policy signals and institutional support under Oman Vision 2040. Drawing on an interpretative phenomenological case-study design, and triangulating executive interviews, focus-group discussions, and documentary analysis, the research identified three interlocking constraints: limited ESG literacy and role-specific training, fragmented regulatory oversight, and siloed organizational cultures coupled with resistance to change. These findings align with emerging ESG literature in emerging markets while offering a novel contribution: a capability–governance–culture nexus that explains why ESG efforts often stall at the level of symbolic compliance. Crucially, the study shows that these barriers are mutually reinforcing. Inadequate ESG skills reduce firms' ability to interpret evolving mandates; regulatory ambiguity weakens the incentive to build internal capacity; and siloed structures fragment responsibility, reducing accountability and buy-in. As such, ESG underperformance in Duqm is not the result of isolated knowledge gaps, misaligned incentives, or weak policy enforcement, but the product of systemic misalignment across these domains. This insight helps to explain why ESG initiatives often fail to move from rhetoric to operational reality, especially in fast-growing industrial hubs that lack mature governance ecosystems.

In practical terms, the findings suggest that one-off workshops and glossy reporting are insufficient to drive authentic ESG integration. Duqm's stakeholders, regulators, firm leaders, and sustainability practitioners, must priorities embedded learning pathways, establish a zone-level ESG coordination unit, align ESG performance with incentive structures, and leverage shared digital infrastructure to reduce compliance burdens. Branding Duqm as a national pilot zone for rigorous, tech-enabled ESG governance would not only fulfil Vision 2040 ambitions but also provide a scalable model for industrial zones across the Gulf and other emerging markets. From a scholarly perspective, this research extends ESG-capability theory to a frontier context characterized by institutional thinness, rapid industrial expansion, and mixed-ownership models. It also contributes a nuanced, empirically grounded framework for diagnosing where ESG intentions stall and what conditions enable progress. While the study's context-specific nature limits broad generalization, it opens several avenues for future inquiry, including cross-sector benchmarking, digital tool evaluation, and incentive-alignment interventions. Ultimately, the study reaffirms that policy ambition, while necessary, is insufficient. Accelerating ESG adoption in Duqm, and by extension, in similar emerging-economy zones, requires synchronizing institutional mandates with organizational learning and cultural transformation. Only by addressing the capability–governance–culture nexus can ESG evolve from a peripheral compliance exercise into a core driver of sustainable industrial development.

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