



Exploring the drivers of green SMEs: A multidimensional qualitative study

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ABSTRACT

Despite growing global attention to sustainable entrepreneurship, limited understanding persists regarding how financial, institutional, and leadership dynamics jointly shape the green transition of small and medium-sized enterprises (SMEs). Responding to this gap, the present study offers a novel, ecosystem-based perspective that examines how multiple drivers and barriers co-evolve to influence SME sustainability transitions. Drawing from institutional theory and the resource-based view, and using the United Arab Emirates as a representative context, the paper presents qualitative evidence from 96 stakeholders—including government officials, SME leaders, academics, consultants, and finance professionals. Findings include evidence of the complex interplay between internal capabilities and external institutional structures that determine the pace and depth of green transformation. The findings reveal that financial challenges—particularly high borrowing costs, investor risk aversion, and the absence of specialized green finance instruments—constitute the most significant barriers to sustainability adoption. Conversely, government support mechanisms, technological advancement, and leadership commitment act as powerful enablers, promoting innovation and resilience. The study further demonstrates that SMEs' ability to signal environmental and social value to investors depends on coherent policy frameworks and integrated public-private financing mechanisms. By integrating insights informed by theory and empirical data, this research proposes a multidimensional framework linking green finance accessibility, institutional readiness, and organizational capability development, advancing theoretical understanding of SME sustainability transitions. The findings provide actionable guidance for policymakers, financial institutions, and ecosystem stakeholders seeking to strengthen national green SME ecosystems and offer comparative insights for other economies pursuing sustainable and inclusive growth.

1. Introduction

The accelerating global transition toward sustainability has brought unprecedented urgency to the transformation of small and medium enterprises (SMEs). As engines of employment, innovation, and supply chain dynamism, SMEs are indispensable for achieving climate objectives and advancing the United Nations' Sustainable Development Goals (UN, 2015). No longer peripheral actors, they are increasingly recognized as key agents in driving circular economies, green innovation, and inclusive growth (Demirel and Danisman, 2019; Galloway et al., 2023).

According to Albloushi et al. (2022), the adoption of eco-friendly technologies and sustainable business practices enables green SMEs to

reduce carbon emissions and conserve resources, advancing the global climate-support agenda. Alongside this, the United Nations Environment Programme (UNEP, 2017) notes that adopting green practices enhances operational efficiency, competitiveness, and job creation, thereby fostering social and economic development. The transformation to green practices requires a fundamental reconfiguration of how SMEs finance, govern, and innovate for environmental performance though, and accordingly, green SMEs—those aligning business practices with environmental conservation—have attracted growing research attention.

In this paper, we explore green business adoption in the context of the United Arab Emirates (UAE). Like most countries, the SME sector in

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the UAE comprises over 90 percent of the business stock, contributing 64 percent of (non-oil) GDP (UAE Government, 2025). While the country has made notable progress in advancing its green agenda, significant challenges persist, particularly in financing and regulatory readiness (Al-Roubaie and Amra, 2020b). Existing research highlights that green SMEs play a central role in promoting sustainability and entrepreneurship (Alraja et al., 2022), yet high transition costs and limited access to investment remain major obstacles (Caldera et al., 2019; Garcés-Ayerbe et al., 2019). Despite this growing body of evidence, there is little research that has explored the integrated effects of the financial, regulatory, and organizational dimensions that jointly shape SME transitions toward sustainability (Hou, 2023; Mahesh et al., 2022; Tian et al., 2023). The current paper addresses this by reporting an ecosystem-based, qualitative study that explores how multiple drivers and barriers co-evolve to influence SME sustainability transitions. The originality of this paper lies in empirically examining how multidimensional factors co-evolve within a single ecosystem, offering a holistic and integrated understanding of SME sustainability transitions that has been largely overlooked in prior work.

From a theoretical perspective, the research is underpinned by both institutional theory and the resource-based view (RBV). Institutional theory proposes that firms are influenced by external pressures from the regularity (or formal institutional) environment and the normative (often informal socio-cultural) environment (Scott, 2001). Alongside this, the resource-based view (RBV) proposes that resources available to organisations are idiosyncratic, including a heterogeneous mix of financial, process, human and relational assets (Barney, 1991). Underpinned by both institutional theory and the RBV, a firm's absorptive capacity refers to its ability respond to institutional pressures, including new knowledge (Gibbons et al., 2012). Given the research explores the operating environment and green practices adoption amongst SMEs, this theoretical underpinning affords a lens through which to consider the resources and capabilities of firms to respond to both formal and informal institutions (including regulations and markets), both of which are influenced by the developing priority of the green agenda. Accordingly, both institutional theory and the RBV guide the interpretation of the empirical findings by explaining how regulatory pressures, financing structures, and internal capabilities jointly influence SME sustainability adoption.

This theoretical context is not without precedent in the green business literature; there is much reference to institutions and RBV throughout. However, much of the literature remains conceptually fragmented or contextually narrow, focusing on isolated drivers such as technological adoption (De Steur et al., 2020; Song et al., 2022) or environmental regulation (Siegel et al., 2022), while underexploring how institutional readiness, access to finance, and leadership dynamics interact to influence green business outcomes. Recent contributions by Silva et al. (2024) and Green and Erasmus (2024) reinforce this observation, calling for holistic approaches to sustainability measurement and strategy in SMEs, while Khamisu and Paluri (2024) underline the role of Environmental, Social and Governance (ESG) disclosure frameworks in linking finance and governance to sustainable performance. Together, these debates point to a persistent theoretical gap: the need for an ecosystem-based understanding of how financial, regulatory, and organizational factors co-evolve to shape SME sustainability transitions, particularly in fast-developing contexts such as the UAE. This study addresses this gap by advancing an empirically grounded, ecosystem-based examination of green SMEs in the UAE, contributing novel evidence on how policy frameworks, financial mechanisms, and internal organisational capabilities converge in practice.

The research employed a qualitative design grounded in non-participant observation and semi-structured interviews with 96 stakeholders, including SME leaders, government officials, finance professionals, academics, and consultants. This facilitated a rich understanding of how policy frameworks, leadership commitment, and access to green finance interact to shape SME sustainability pathways

(De Steur et al., 2020; Siegel et al., 2022; Silva et al., 2024). By integrating stakeholder perspectives at scale and mapping these interdependencies through analysis, the study offers original empirical evidence on the structural and relational dynamics that shape SME green transitions—dimensions that have rarely been examined together. The study contributes knowledge directly relevant to the UAE's vision of a resilient, inclusive, and innovation-driven green economy, reinforcing the pivotal role that SMEs play in this transformation (El Ghak and Zarrouk, 2022; MOCCAE, 2024). Furthermore, the novelty of the contribution extends beyond the UAE context by providing an analytically transferable framework for understanding green SME ecosystems internationally.

The next section reviews the relevant literature on drivers, barriers, and investment appeal of green SMEs. This is followed by a narrative about the research design, presentation of results, discussion of key findings, and concluding recommendations aimed at strengthening green SME ecosystems.

2. The green business agenda: drivers and barriers of green business adoption in SMEs

Green business, also termed sustainable or circular-economy business, describes practices that have a positive, or at least lowest possible negative, impact on the environment (Demirel and Danisman, 2019). More comprehensively, according to Potkány et al. (2018) green business practices include following the principles of sustainability in decisions-making; supplying environmentally eco-friendly products to reduce or replace demand for non-green products and services; having a more environmentally positive impact than competitors; improving efficiency; creating healthier workplaces; reducing reliance on natural resources or non-renewable sources of energy; engaging in recycling, repurposing and reusing; investing in sustainable packing; and complying with international and local guidelines and legislation on environmental matters. Recent studies also conceptualise green business as a strategic orientation shaped by firms' capabilities, ESG-related commitments, and long-term competitiveness goals (Green and Erasmus, 2024; Hossain et al., 2025). Adoption, however, varies widely among SMEs, as individual firms evaluate context-specific opportunities and constraints (Koirala, 2019).

The adoption of green practices amongst SMEs are affected by both internal and external factors. Externally, firms must consider the business environment and market demands. Critically, consumers increasingly expect eco-friendly items and evaluate businesses on their environmental impact (Parry, 2012; Darko et al., 2018; Trianni, 2020). Beyond market expectations, Badghish and Soomro (2024) shows that green initiatives can stimulate innovation in new products and production processes. Ahmed et al. (2025), Albloushi et al. (2022) and Almamari et al. (2021) further report that reuse and recycling practices reduce production and operational costs for SMEs. Prasanta Kumar Dey (2022) also argues that achieving sustainability objectives can unlock new business opportunities. As such, there is evidence that green business is good business.

More pragmatically, Luken and Van Rompaey (2008) and Mittal and Sangwan (2014) observe that environmental regulations exert a strong influence on SME motivation to adopt green practices. Integral to this are government policies and frameworks. Transparent and coherent regulations, spanning local, national, and international jurisdictions, are instrumental in facilitating the transition toward a green economy (Siegel et al., 2022). Moreover, governments play a vital role in supporting green SMEs through various means, including offering financial incentives, facilitating access to capacity-building programs, and providing funding opportunities (Aboelmaged and Hashem, 2019; Cassells and Lewis, 2019; Zarrouk et al., 2021). Emerging ESG disclosure frameworks further reshape external pressures by creating new expectations for accountability, transparency, and risk management among SMEs (Khamisu and Paluri, 2024).

Despite these drivers, the costs of green transition are a consistent issue though. [Bıçakcıoğlu-Peynirci et al. \(2019\)](#) for example, found that developing green management systems can involve the costs of training for employees. Similarly, [Ghenta and Matei \(2018\)](#) and [Kang et al. \(2025\)](#) highlight the costs of implementing green accounting practices – the tracking and analysis of materials and cost information that complies with legislative and/or organisational rules on safety, emissions and energy. These all require investment, and so for companies focused on cost-cutting and profit maximization, the net-zero transition can present significant challenge. [Galloway et al. \(2023\)](#) observe that many SMEs have concerns about the potential adverse effects of implementing green practices on profit margins. Additionally, while [Hou \(2023\)](#) finds that China's SMEs transition to a greener economy is largely driven by its SMEs, empowered by green financing, and [Aboelmaged and Hashem \(2019\)](#) find in an Egyptian study that there is growing interest among private investors to support green endeavours, SMEs in most countries face hurdles in securing funds for green innovation initiatives ([Chien et al., 2021](#)).

Despite this, there is evidence that requisite investment can provide advantages. In the finance sector, for example, [Burki and Ersoy \(2022\)](#) demonstrate that integrating environmental considerations into accounting practices can contribute to financial management and support strategic decision making in SMEs. Similarly, by providing a framework for SMEs to measure and manage their environmental performance, green accounting has been found to lead to improved decision-making and increased competitiveness ([Gündüz and Gündüz, 2025](#)), and [Song et al. \(2022\)](#) also observed a positive impact on profitability. More generally, several studies have highlighted the potential financial benefits of implementing other green business practices for SMEs. Power, waste and paper usage reduction for example have been identified as practices that yield internal financial benefits ([Baah et al., 2022](#)). Thus, as [Čekanavičius et al. \(2014\)](#) demonstrate, although adopting green practices may initially require additional costs, they can ultimately lead to lower materials costs and increased profits. As such, there is a clear incentive for investors interested in both financial return and environmental business ([Bıçakcıoğlu-Peynirci et al., 2019](#)).

Notwithstanding the challenges of funding and investment, increasingly research is identifying that there are high levels of motivation to adopt green practices throughout SMEs globally ([Caldera et al., 2019](#); [Galloway et al., 2023](#); [Samal et al., 2025](#)). Internally, motivations originate from personal values, awareness, and a commitment to social and environmental responsibility ([Alraja et al., 2022](#); [De Steur et al., 2020](#); [Rahbauer et al., 2016](#)). Additionally, [Parry \(2012\)](#) found that the development of green practices in micro-businesses linked closely with the ethical principles held by business leaders, and often in turn these influenced the ethical behavior of employees. [García-Zamora et al. \(2013\)](#) support this in their study of organizational culture within SMEs finding that leaders have a profound influence on the promotion of green practices and [Kusumasari and Kusumaningrum \(2018\)](#) note that this has a stimulating effect on ongoing green business development. More recent work demonstrates that these internal drivers are closely tied to firm-level innovation capacity, operational learning, and the ability to integrate sustainability into business models ([Fülöp and Cifuentes-Faura, 2025](#); [Sanz-Torres et al., 2025](#)).

Broadly, therefore, the convergence of business owners' personal values, regulatory mandates, and market expectations serve as pivotal forces propelling the embrace of environmentally friendly initiatives. Implementation requires coordination and integration though ([Burki and Ersoy, 2022](#)). It also requires investment, and this is most marked in the manufacturing sector, where the costs of adopting green manufacturing practices can include those for research and development, policy formulation and framework development ([Karuppiyah et al., 2020](#); [Xu, 2022](#)). Linked to this, evidence from emerging economies highlights that the lack of dedicated green finance instruments, weak regulatory incentives, and gaps in sustainability governance frameworks remain persistent barriers ([Khamisu and Paluri, 2024](#)). To summarise

these key drivers and barriers, [Table 1](#) provides an integrated classification accompanied by concise explanations and supporting citations.

Despite progress in understanding, the existing literature remains theoretically fragmented. Many studies analyse isolated determinants—such as leadership values, technology adoption, or regulatory compliance—without explaining how these factors interact to shape SMEs' sustainability trajectories ([Silva et al., 2024](#)). Similarly, these tensions between financial constraints, market incentives, and regulatory expectations underscore a broader theoretical gap: the absence of an integrative framework that explains how these multi-dimensional drivers interact to shape SME green transition pathways. Addressing this gap requires a more integrated analytical approach capable of linking internal capabilities, financing conditions, and regulatory pressures within a coherent framework. The present study contributes to resolving this fragmentation by examining how these domains intersect in practice and by offering an ecosystem-based understanding of green SME development in the rapidly evolving context of the UAE. It is to this that we now turn.

3. The green agenda in the UAE

Driven by robust government initiatives, rising market demand for sustainable products, and heightened awareness of environmental issues amongst entrepreneurs, green practices in SMEs are gaining traction across the UAE ([Dagher, 2019](#)). The country's abundant renewable energy resources and its position as a global trade hub enhance the expansion opportunities for green SMEs both domestically and internationally. The UAE's strategic initiatives—such as the [UAE Vision, 2021](#), the [National Climate Change Plan, 2017-2050](#), and the [Dubai Clean Energy Strategy 2050 \(UAE Government, n.d.\)](#)—provide fertile ground for the development of green SMEs by promoting innovation, increasing the share of clean energy, and fostering green entrepreneurship ([UAE Ministry of Energy and Industry, 2015](#); [UAE Ministry of Climate Change and Environment, 2017](#); [Imran et al., 2020](#)). These national sustainability initiatives influence investor behaviour and financial market dynamics in the UAE, underscoring the interconnectedness between environmental policy and broader economic transitions ([Zarrouk and Ouafi, 2025](#)).

Despite these favourable conditions, significant challenges persist though. While technological advancements and innovation ecosystems have gone some way to address traditional barriers associated with adopting green practices, including high operational costs and technological accessibility ([Alraja et al., 2022](#); [Tian et al., 2023](#)), in the UAE there remains limited access to tailored financing instruments, high perceived investment risks, substantial upfront costs of sustainable technologies, and gaps in regulatory frameworks ([Chien et al., 2021](#); [Al-Roubaie and Amra, 2020a](#)). Although initiatives such as the UAE's Green Agenda Programs (2015–2030) aim to mitigate financial barriers through bank guarantees and low-interest financing schemes ([El Ghak and Zarrouk, 2022](#)), the financing landscape remains fragmented, and green SMEs often face considerable hurdles in accessing traditional funding avenues ([Alnaqbi and Alami, 2023](#)). Nonetheless, recent empirical studies suggest that with continued regulatory support, market dynamism, and advances in green technologies, the prospects for green SMEs in the UAE are good ([Al-Qudah et al., 2023](#); [Faccia et al., 2023](#)). According to [Tirupathi et al. \(2020\)](#), unlocking their full potential will require fostering a supportive ecosystem where stakeholders, including government bodies, financial institutions, academia, and SMEs, all have a part to play in addressing financial, technological, and regulatory challenges systematically. The present study explicitly responds to the absence of a holistic, integrated understanding of green adoption determinants and influences for SMEs. It reports an empirical study of how drivers, barriers, and investment mechanisms interact within the UAE's evolving green economy to address two main objectives:

Table 1
Summary of drivers and barriers to the ecological transition of SMEs.

Category	Drivers/Barriers	Short explanation	Key citations
Internal drivers	Leadership commitment	Strong environmental vision motivates employees and embeds sustainability into culture.	Parry (2012); García-Zamora et al. (2013); Kusumasari and Kusumaningrum (2018)
	Employee engagement & organizational culture	Employees adopt sustainability practices when supported by internal culture and managerial communication.	De Steur et al. (2020); Alraja et al. (2022)
	Operational efficiency & cost savings	Resource efficiency, energy savings, and waste reduction lower costs and incentivize green adoption.	Ahmed et al. (2025); Baah et al. (2022)
External drivers	Government policy & regulatory frameworks	Clear sustainability regulations and incentives motivate SMEs to adopt greener practices.	Siegel et al. (2022); Moktadir et al. (2018)
	Market & consumer demand	Growing demand for eco-friendly products stimulates SMEs to innovate sustainably.	Parry (2012); Darko et al. (2018); Trianni (2020)
	Technology availability & innovation ecosystems	Access to green technologies and research collaboration supports sustainability adoption.	Alraja et al. (2022); Song et al. (2022)
Financial drivers	Access to green finance	Availability of loans, grants, and incentives encourages investment in sustainability initiatives.	Hou (2023); Chien et al. (2021); Aboelmaged and Hashem (2019)
Internal barriers	Limited managerial awareness	Lack of knowledge or fragmented communication reduces motivation for sustainability implementation.	García-Zamora et al. (2013); Ghentjā & Matei (2018)
	Cost constraints & resource shortages	Financial pressure, limited staff time, and operational cost concerns impede green adoption.	Galloway et al. (2023); Mittal and Sangwan (2014)
External barriers	Regulatory complexity or uncertainty	SMEs struggle with unclear or fragmented regulations, certifications, and compliance processes.	Siegel et al. (2022); Luken and Van Rompaey (2008)
	Supply chain pressure	Requirements from multinational partners may create compliance burdens for SMEs with limited capacity.	Darko et al. (2018); Liao and Shi (2018)
Financial barriers	Lack of green financing options	Most persistent barrier: SMEs face high borrowing costs, low investor appetite, and limited green funding instruments.	Chien et al. (2021); Hou (2023)
	Investor hesitation & high perceived risk	Investors perceive green investments in SMEs as risky,	Chien et al. (2021); Hou (2023)

Table 1 (continued)

Category	Drivers/Barriers	Short explanation	Key citations
	Weak public-private financing mechanisms	reducing capital availability. Fragmented policies fail to link financial incentives with sustainability outcomes.	El Ghak and Zarrouk (2022); Khamisu and Paluri (2024)

- To explore the experiences and challenges of green business adoption amongst SMEs;
- To explore key stakeholders' opinions on how green business might be developed effectively with a view to informing those engaged in its practice and support.

4. Research design

This study adopted a qualitative research design. Given the exploratory nature of the study and the diversity of stakeholders involved, qualitative inquiry was deemed most suitable for capturing the complex, context-specific, and experiential dimensions of this phenomenon (Stake, 2010). Semi-structured interviews and non-participant observation were employed as complementary methods, providing both depth and reliability through methodological triangulation (Cheffi and Abdennadher, 2019). The interviews generated rich narratives and stakeholder perspectives, while non-participant observation offered an independent lens to validate and contextualize these insights by capturing real-world interactions and practices in professional settings (Abdennadher et al., 2024).

The multi-source data collection strategy proved particularly valuable in ensuring the credibility and authenticity of findings. In particular, non-participant observation, carried out during major sustainability conferences and forums, including Abu Dhabi Sustainability Week, Sustainability LIVE Dubai, the Energy, Water and Sustainability Summit, the World Future Energy Summit, the Green Hydrogen Summit, and Abu Dhabi Finance Week, provided direct exposure to live policy debates, expert presentations, and stakeholder dialogues among policymakers, investors, and SME leaders, creating an opportunity to observe sustainability discourse and practice as they unfolded in real time. Listening to expert discussions and observing interactions within these professional environments offered valuable insights into how green transition goals are communicated, interpreted, and implemented across sectors. In addition, informal exchanges with 42 professionals in sustainable finance, green technology, and SME development enriched the contextual understanding of the UAE's sustainability ecosystem. Key reflections and observations were recorded immediately after each event as detailed field notes, which were subsequently coded and incorporated into the broader qualitative dataset. Observation thus functioned not merely as a supplementary data source but as a validation tool that strengthened thematic interpretation and analytical depth.

In parallel, semi-structured interviews were conducted with stakeholders directly involved in supporting or implementing sustainable SME initiatives. A purposive sampling strategy was applied to deliberately select participants based on their expertise, influence, and engagement in sustainability-related activities (Patton, 2015; Robinson, 2014). The interview sample comprised four key stakeholder groups: academics specializing in sustainable business and manufacturing, consultants and government officials working within sustainability-focused institutions, senior SME managers implementing green initiatives, and finance professionals providing sustainable or ESG-linked financial services. Inclusion criteria required direct involvement in SME sustainability—such as policy formulation, funding assessment, or operational implementation. The SME participants reflected a broad and heterogeneous cross-section of industries, consistent

with the study's non-restrictive sector approach and reliance on voluntary participation.

Government and finance participants were identified through event rosters, professional networks, and publicly available directories. Firms were included based on their substantive engagement with sustainability practices, resulting in natural variation across the sample. Participants operated in clean-energy and renewable energy services, environmental and circular-economy solutions, transport and logistics, construction and infrastructure, and consumer- or service-oriented enterprises incorporating sustainable materials and processes. This diversity enhanced the analytical depth of the study by illustrating how financial, regulatory, organizational, and market dynamics influence sustainability adoption across different operational contexts, thereby offering a comprehensive view of the UAE's evolving green SME landscape.

A total of 163 individuals were contacted by institutional email, and 54 agreed to participate in the research, representing a 33.1 percent response rate. The interviews followed the qualitative protocols outlined by Stake (2010) and adopted a conversational, semi-structured format to allow flexibility and elaboration on emerging themes. The interview guide, developed from the literature on green SMEs and sustainability drivers, was pilot-tested with three stakeholders and refined for clarity and flow. Each interview lasted approximately 45 min, was conducted in English, audio-recorded with participants' consent, and transcribed verbatim to ensure precision and depth (Bertaux, 1981).

In total, the dataset comprised 96 participants, integrating both Primary interview participants ($n = 54$) and Event-based observation participants ($n = 42$). These two data sources were treated as complementary and equally significant, allowing for triangulation between in-depth interviews and contextual observation. This methodological combination provided a holistic perspective on the UAE's green SME ecosystem by linking stakeholder views with the observed realities of sustainability practices and policy dialogues. Table 2 provides summary information.

Interview transcripts and observation notes were analyzed thematically to identify recurring patterns across financial, institutional, and organizational dimensions of green SME development (Braun and Clarke, 2006). A hybrid inductive–deductive coding process was applied, combining insights from the literature with themes emerging directly from the data. Codes were refined and organized into coherent themes, which were validated for internal consistency and relevance to the research objectives. To enhance reliability, a subset of transcripts was double-coded by two researchers, and discrepancies were resolved through discussion. NVivo software facilitated data management, coding, and visualization, enabling cross-comparison of themes across participant categories. Analytical tools such as word-frequency queries, matrix coding, cluster and network analyses were used to explore relationships between concepts, with illustrative quotations selected to support interpretation. A final cluster analysis integrated participants' recommendations, mapping the interconnections between financial, regulatory, and organizational factors.

This rigorous analytical process ensured transparency and interpretive depth, establishing a credible foundation for the findings that follow, where the main themes and their interconnections are examined in detail.

5. Findings

Initial analysis of the narrative data involved the generation of a wordcloud to identify recurring semantic themes about the experiences and challenges of green business for SMEs. Presented as Fig. 1, this provides a visual synthesis of the most frequently cited terms across participant responses, highlighting the dominant concepts shaping the discourse. Core terms such as *sustaining*, *greening*, *SMEs*, *business*, and *company* point to a strong focus on the continuity and transformation of SMEs through sustainable practices. The frequent appearance of

Table 2
Participant categories and characteristic.

Participant Category	Primary Interview Participants	Event-based Observation Participants	Total	Description
Academics and Researchers (PROF)	9	7	16	Researchers from diverse disciplines, including sustainability, environmental safety, computer and information science, logistics and supply chain, and finance.
Consultants and Government Officials (GOV)	11	3	14	Consultants and representatives of public institutions engaged in SME development, sustainability policy, or green-business initiatives.
SME Leaders (SME)	27	28	55	Founders or senior managers of SMEs across the UAE demonstrating explicit green orientation or implementing sustainability practices.
Finance Professionals (FIN)	7	4	11	Representatives from private and public financial institutions involved in ESG-linked or green-finance programs.
Total	54	42	96	–

financial, *government*, *initiatives*, *practices*, and *investments* suggests the centrality of financial mechanisms, institutional support, and policy frameworks in advancing green transitions. Recurring terms such as *technology*, *stakeholders*, *products*, *efficiency*, and *accounting* point to participants' focus on operational and systemic dimensions of green business, emphasizing innovation, resource efficiency, and transparency.

The integration of organizational language (e.g., *efficiency*, *accounting*) and policy-oriented terms (e.g., *government*, *initiatives*) within the wordcloud reflects a dual perspective and reinforces the systemic view of sustainable development advocated in prior studies as concerning both internal business functions and the external environment (De Steur et al., 2020; Siegel et al., 2022). Overall, the word cloud analysis suggests that finance, institutional collaboration, and sustainable operations are core pillars of the green SME agenda in the UAE.

The following sections relate further details and analyses as they engage with the key research objectives.

5.1. Research objective 1: the experiences and challenges of green business adoption

To explore in more detail the first objective of this research, an analysis involved generating a hierarchical cluster diagram in NVivo, building upon the thematic patterns identified in the wordcloud. Fig. 2 depicts the structural organization of key factors shaping green SME development, grouped into four primary thematic clusters: *Financial Challenges and Funding Barriers*, *External Factors*, *Internal Factors*, and *Contextual Influence*, each comprising multiple subthemes.

Financial Challenges and Funding Barriers emerges as the most dominant cluster, with subthemes such as *Lack of Green Financing Options*, *Investor Hesitation and Risk Perception*, and *Public-Private*

Table 3
Matrix coding query.

	1: Internal Factors	2: Ext'l Factors	3: Context'l Influence	4: Fin'l Barriers
A: 01.Internal Factors	260	45	21	53
B: 011.Leadership Commitment to Sustainability	63	7	7	8
C: 012.Employee Engagement & Internal Culture	79	2	1	4
D: 013.Market Competitiveness & Branding	42	11	5	3
E: 014.Financial Benefits-Operational Cost Savings & Efficiency	121	30	12	42
F: 02.External Factors	45	308	19	71
G: 021.Government Policy & Regulatory Compliance	4	101	7	10
H: 022.Green Certifications &Green Scoring & ESG Compliance	10	39	2	3
I: 023.Public & Gov Pressure	9	43	6	7
J: 024.Technological Advancements & Digitalization Barriers to green technology transfer and R&D support	15	65	3	29
K: 025.Gov Support & Initiatives 7 Awards	13	111	6	26
L: 026.University & Incubator Support for R&D & Entrepreneurship	2	31	0	12
M: 03.Contextual Influence	21	19	137	21
N: 031.Market & Consumer Demand	17	13	73	17
O: 032.Supply Chain Pressure	4	6	64	4
P: 04.Financial Challenges & Funding Barriers	53	71	21	407
Q: 041.Lack of Green Financing Options	15	21	6	233
R: 042.Investor Hesitation & Risk Perception	19	13	14	104
S: 043.Public-Private Sector Collaboration Gaps	10	43	0	79
T: Cost constraints	11	2	3	45
U: 051.Financial Support, guarantee schemes, Gov grant or Tax Incentives	11	34	1	134
V: 052.Government Initiatives & Policy Development	7	20	0	43
W: 0521.Sustainabilityregulationsandcompliancesupport	5	42	5	16
X: 0522.Green scoring frameworks to assess SME sustainability	9	26	0	7



Fig. 1. Word cloud of green drivers and themes for SMEs.

Collaboration Gaps suggesting the centrality of financial constraints within the sustainability discourse, a finding consistent with previous studies highlighting the critical role of green finance accessibility (Chien et al., 2021; Hou, 2023). Consistent with these findings, participants provided extensive examples illustrating how limited access to green finance constrains sustainability adoption. Several SME leaders, academics, and government representatives highlighted the combined impact of high upfront costs, limited investor appetite, and insufficient financial incentives. The following are illustrative of comments across the four sample groups:

"We struggle with balancing cost-effectiveness while adopting sustainability initiatives that increase operational costs." Interviewee SME Fu.

“Capital investment is a major challenge. Green businesses often require higher initial costs due to research and development. Many sustainable technologies are more expensive than traditional alternatives. Without

subsidies or financial support, it's difficult for SMEs to transition to sustainable practices." Interviewee Prof. Ha.

"For financing ..., if it is difficult for a normal SME company, it is forty times more difficult for a green businessI think a company's metabolism also has to be subsidized and supported by the government, not only green products. So it's two sides of the picture: final products, green industries, recycling, waste management, and the process of production."
Interviewee Gov. Ab.

“This relates directly to the primary financing challenges—challenges that require action. For the development of a robust green financial and equity system, we need to strengthen the learning curve and the logic behind SME green financing. Clear policy incentives must also be included.” Interviewee FIN. Mo.

External Factors form the second-largest cluster, emphasizing the influence of government support, regulatory frameworks, and

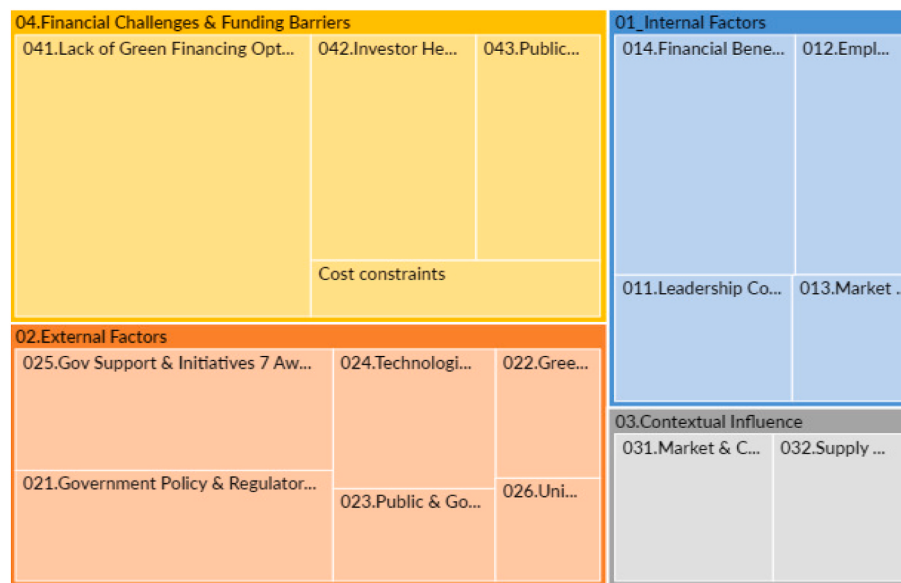


Fig. 2. Hierarchy diagram. showing clusters and subclusters

Note: This hierarchy diagram visually represents the thematic structure of stakeholder interviews, with clusters and subclusters organized by frequency and relevance as identified through the NVivo analysis. The four main thematic clusters are: (01) Internal Factors, (02) External Factors, (03) Contextual Influence, and (04) Financial Challenges and Funding Barriers. Full details of all themes and subthemes—including labels, descriptions, and co-occurrence patterns—are provided in [Table 3](#) (Matrix Coding Query) below.

technological infrastructure in shaping enabling environments, in line with research on policy-driven SME sustainability (Siegel et al., 2022; Moktadir et al., 2018).

Internal Factors, while slightly smaller, highlight the significance of leadership commitment, employee engagement, and operational efficiency within SMEs, reaffirming the critical role of internal capabilities in driving sustainable transformation (De Steur et al., 2020; Moktadir et al., 2018). Interview evidence strongly reinforces this pattern. Several SME leaders explained that sustainability adoption is deeply shaped by internal leadership vision and the degree to which sustainability is embedded into daily operations and organizational culture. Illustrative testimonies include:

“Sustainability comes from the top down, making it easier to engage employees” Interviewee SME_Gre.

“We incorporate a sustainability mindset into our daily work so that sustainability is not something extra but part of our process” Interviewee SME_Hy.

“... having our main scope totally focused on sustainability, of course, our workforce, employees, and colleagues must be very committed to sustainability. So we try to implement a sense of community ...” Interviewee SME. Da.

By contrast, *Contextual Influence*, comprising market and supply chain dynamics, registers the least emphasis. Although market demand and supply chain pressure have been recognized as important external triggers in other studies (Darko et al., 2018; Liao and Shi, 2018), their comparatively lower representation here suggests that in the UAE context, these forces act more as amplifiers rather than primary drivers of green SME transitions. To enrich this pattern, participants provided concrete examples of how contextual pressures—particularly supply chain requirements, regulatory anticipation, and shifting consumer expectations—act to reinforce sustainability adoption rather than independently initiate it. Illustrative testimonies include:

“Multinational companies are now requiring their suppliers to meet sustainability KPIs, which will push smaller businesses to comply in the future” Interviewee SME_Fu.

“Government policies are crucial for influencing sustainable practices. Market forces alone are not yet strong enough to drive sustainability” Interviewee SME_Hy.

“People are more eco-conscious these days, and that’s great news for green businesses. The more demand there is for sustainable products and services, the more these businesses can thrive. It’s all about meeting customer needs and making a positive impact on the world” Interviewee FIN_Sa.

Overall, the hierarchy illustrates a layered understanding of sustainability enablers, where financial access and institutional support constitute foundational conditions upon which internal organizational readiness and market responsiveness are built. These patterns reflect Institutional Theory, as SMEs appear strongly responsive to both coercive pressures (regulation, compliance requirements) and normative expectations (market demand, stakeholder norms). At the same time, the emphasis on leadership commitment, absorptive capacity, and operational efficiency illustrates core RBV principles, whereby firms’ internal capabilities determine their ability to convert external pressures into sustainability outcomes. This suggests that a systemic, ecosystem-based approach—integrating finance, regulation, innovation, and stakeholder engagement—is may be needed to unlock the full potential of Green SMEs (Alraja et al., 2022; Dhir et al., 2023).

A third thematic process was generated to provide further detail. This comprised the development of a matrix coding query in NVivo, designed to capture the frequency and co-occurrence of references across themes and subthemes. [Table 3](#) presents the results of this matrix analysis, offering empirical insight into the relative weight and interconnection of sustainability drivers as expressed by participants.

[Table 3](#) provides critical empirical insights into the co-occurrence intensity between major sustainability themes and subthemes, revealing how frequently specific topics were referenced together across the coded interview data. The most prominent pattern is the overwhelming emphasis on *Financial Challenges and Funding Barriers*, with the sub-theme *Lack of Green Financing Options* referenced 233 times and the broader financial theme appearing 407 times. This substantiates the argument that inadequate access to tailored financing instruments constitutes the most significant structural constraint to the adoption of

sustainability practices among SMEs according to our participating stakeholders. Further subthemes under the financial category, including *Investor Hesitation and Risk Perception* (104 references), *Public-Private Sector Collaboration Gaps* (79 references), and *Cost Constraints* (45 references), reinforce the multifaceted nature of financial inaccessibility. Collectively, these results point to a coherent pattern: financial barriers operate as the dominant structural constraint shaping SME sustainability across all thematic categories.

The theme of *Internal Factors* also demonstrates considerable engagement, with 260 references overall. Within this domain, *Financial Benefits through Operational Cost Savings and Efficiency* appears 121 times, indicating that SMEs are more inclined to adopt sustainable practices when such initiatives are associated with tangible cost reductions. Moreover, subthemes such as *Employee Engagement and Internal Culture* (79 references) and *Leadership Commitment to Sustainability* (63 references) emphasize the role of organizational dynamics in facilitating green transformations. These findings align with prior research asserting that internal capabilities, while crucial, are often dependent on enabling external conditions such as financial and regulatory support (Siegel et al., 2022; Moktadir et al., 2018). Taken together, the internal cluster highlights that organizational drivers can support sustainability adoption but require alignment with external financial and policy conditions to achieve meaningful impact.

External Factors are similarly prominent, with the main theme appearing 308 times. Within this category, *Government Policy and Regulatory Compliance* (101 references) and *Government Support and Initiatives* (111 references) dominate, illustrating the dual role of regulatory environments as both drivers and enablers of sustainability transitions. Nevertheless, relatively lower frequencies associated with *Green Certifications and ESG Compliance* (39 references) and *Technological Advancements and Barriers* (65 references) suggest either insufficient emphasis or gaps in practical implementation. This observation is consistent with findings by Liao and Shi (2018), who emphasize that policy support must be coupled with operational tools to ensure effective SME engagement in sustainability practices. Overall, the external cluster suggests a strong strategic policy direction but highlights inconsistencies in the availability of operational mechanisms that SMEs require for implementation.

By contrast, as per the cluster analysis, *Contextual Influence* themes register comparatively lower frequencies in the matrix coding. *Market and Consumer Demand* stands out with 137 references, indicating the relevance of evolving market expectations, while *Supply Chain Pressure* records a modest 64 references. This asymmetry may imply that, although external market pressures are recognized, their translation into internal strategic priorities may be weaker in the absence of structural financial and institutional supports. This pattern reinforces that contextual pressures tend to amplify rather than initiate sustainability adoption within SMEs.

In sum, the matrix coding underscores the centrality of financial mechanisms in the broader sustainability ecosystem for SMEs in the UAE. Regardless of whether the coded subtheme relates to internal leadership, external regulation, technological advancement, or stakeholder engagement, the underlying dependency on financial enablement—whether through access to capital, blended finance, or risk mitigation—emerges as the primary determinant of successful sustainability transitions. Conversely, the relatively lower emphasis on elements such as *Green Scoring Frameworks* (7 references) and *Sustainability Regulation Support* (16 references) suggests there may be policy gaps or limited awareness of supports among SMEs, highlighting an important avenue for targeted policy intervention and capacity-building initiatives. Overall, these findings consolidate a clear insight: financial readiness consistently underpins progress across all other thematic domains and determines the extent to which SMEs can adopt and sustain green practices. These empirical patterns reinforce the case for embedding robust financial strategies and supportive regulatory frameworks at the core of any systemic effort to accelerate green SME participation in

sustainable economic development—a finding that resonates strongly with the broader literature on green entrepreneurship and sustainable innovation (Dhir et al., 2023; De Steur et al., 2020) and underscores the need for integrated, finance-led approaches capable of addressing structural constraints rather than isolated barriers.

An NVivo-generated three dimensional cluster analysis based on word similarity and semantic cohesion offers further conceptual mapping of sustainability themes relevant to green SME development. This multidimensional visualization illustrates how themes interrelate within the sustainability discourse, highlighting key latent structures and interdependencies. Presented as Fig. 3, the four major categories again emerge: *Internal Factors*, *External Factors*, *Contextual Influence*, and *Financial Challenges and Funding Barriers*. The spatial proximity of *Internal* and *External Factors* suggests a strong thematic affinity between organizational-level considerations—such as leadership commitment, employee culture, and branding—and external enablers like government policy, regulation, and certification frameworks. This alignment underscores findings elsewhere about the significant influence of institutional structures on internal sustainability strategies (Alraja et al., 2022; Moktadir et al., 2018). By contrast, *Contextual Influence*—comprising market and consumer demand, along with supply chain pressure—appears spatially distant from other clusters. This distance indicates that these market-related factors are acknowledged but are not positioned as central drivers of SMEs' sustainability narratives.

Financial Challenges and Funding Barriers are further isolated as a distinct domain. Subthemes such as lack of green financing, investor risk perception, and public-private collaboration gaps cluster separately, highlighting the unique semantic characteristics of financial discourse within sustainability discussions. This separation reflects how financial concerns are often treated as operational constraints rather than integrated components of policy or organizational strategy. At the same time, the adjacency between *Internal* and *External Factors* highlights their interconnectedness, while the intermediate position of *Contextual Influence* suggests a potential bridging role between market dynamics and institutional frameworks. These semantic relationships offer strategic insights: while financial challenges demand targeted interventions, greater integration across organizational, policy, and market dimensions seem to be understood as critical to fostering a cohesive green SME ecosystem.

Building on the cluster analysis, Fig. 4 presents a network graph that further elucidates the structural relationships among the themes. The network visualization reinforces the strong linkage between *Internal* and *External Factors*, demonstrating how regulatory frameworks and market expectations are reported as shaping organizational behaviour. *Financial Challenges and Funding Barriers* emerge as a dominant and central node, with strong connections to both *Internal Factors* and *Contextual Influence*, reinforcing the critical enabling role of finance in driving sustainable SME transitions. *Contextual Influence*, while moderately connected, seems to act as a bridge linking market forces to both regulatory structures and internal adaptation. The varying edge thicknesses in the network graph represent relationship strength, with the most pronounced connections highlighting financial viability as the cornerstone of green SME development. This structural centrality of finance aligns with previous findings that financial challenges, while distinct thematically, remain indispensable to advancing sustainable entrepreneurship (Hou, 2023; Dhir et al., 2023).

In a further analysis, a crosstab query offered a comparative perspective on how different stakeholder groups—SMEs, finance professionals, consultant and government officials, and academics—engage with key sustainability themes (Fig. 5). Consistent with the cluster and network analysis findings, financial challenges emerge as the most dominant concern across all categories, with *Financial Challenges and Funding Barriers* receiving the highest number of responses (92), closely followed by *Lack of Green Financing Options* (78). SMEs, comprising the largest respondent group, show strong engagement across all major themes, particularly in relation to financial constraints and regulatory

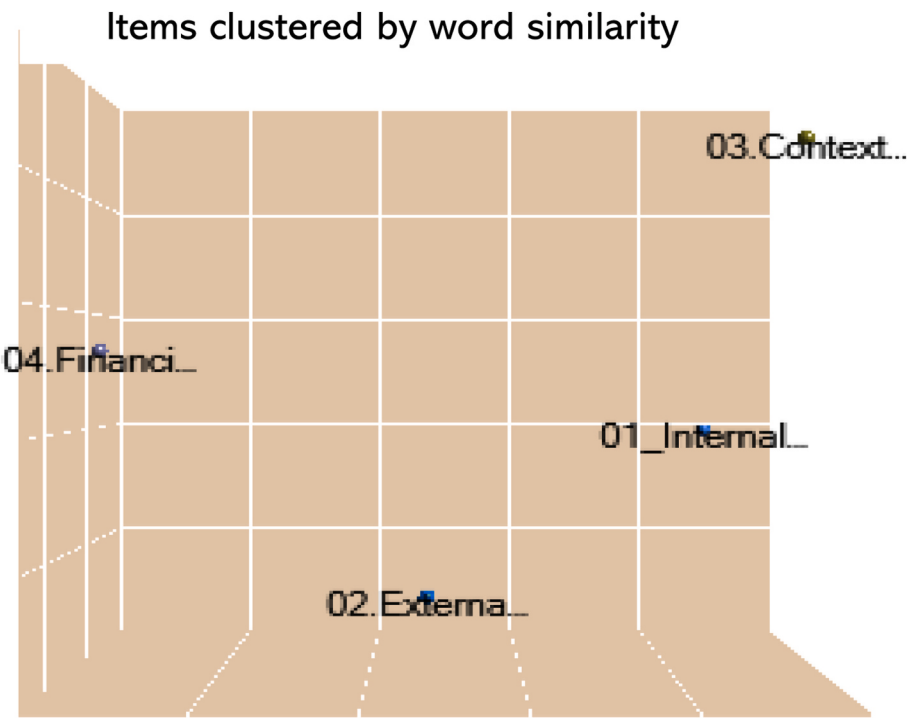


Fig. 3. Cluster analysis: Exploring theme similarities
Note. Cluster analysis illustrating the similarity relationships among the four main thematic clusters—(01) Internal Factors, (02) External Factors, (03) Contextual Influence, and (04) Financial Challenges and Funding Barriers—based on word co-occurrence patterns within NVivo.

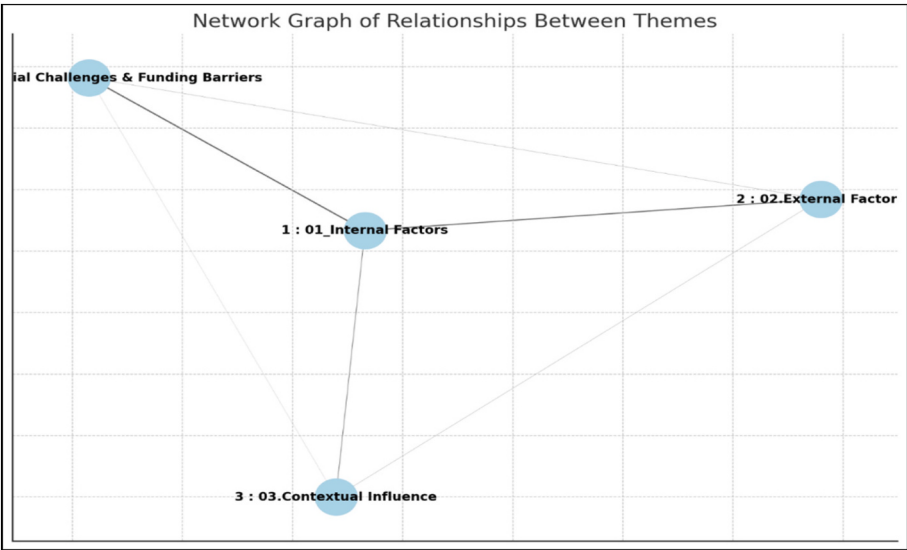


Fig. 4. Network graph of relationships between themes.

barriers, reflecting their direct exposure to operational and funding challenges. Consultant and government officials placed greater emphasis on regulatory compliance, certifications, and policy initiatives, reflecting their institutional role in sustainability governance. Finance professionals primarily focused on barriers to capital access and investment risk, aligning with recent calls for risk-sensitive green finance instruments (Dhir et al., 2023; Hou, 2023). Academics showed more balanced engagement across themes but emphasized leadership, internal culture, and capacity building, indicating a broader systemic orientation toward SME sustainability.

Overall, this cross-participant comparison highlights strong convergence around financial viability as the foundational enabler of SME

sustainability, while coordinated regulatory frameworks and institutional support are viewed as essential for connecting internal organizational readiness with market-driven adoption pathways.

Finally, the bar chart presented in Fig. 6 compares engagement with key themes across participant groups and reinforces the centrality of financial issues within the sustainability discourse. The theme *Financial Challenges & Funding Barriers* received the highest number of responses across all participant groups, particularly among SMEs, reflecting their heightened exposure to funding constraints. *Lack of Green Financing Options* also drew substantial attention, especially from finance professionals and SMEs, indicating a shared concern over limited access to capital for green initiatives. Government participants, by contrast, were

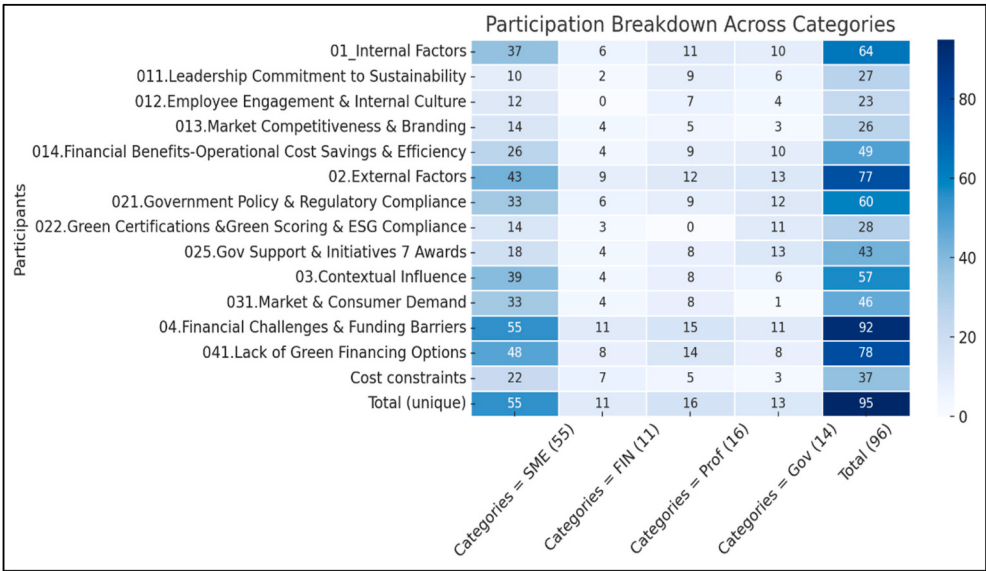


Fig. 5. Participation breakdown across categories.

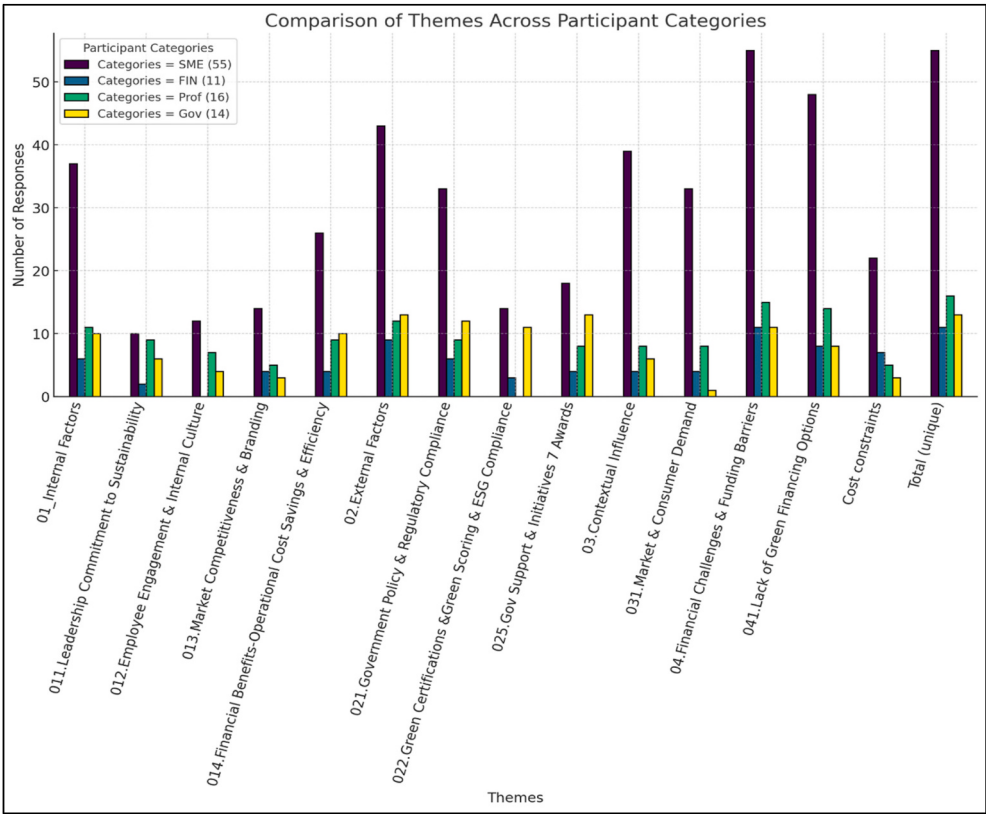


Fig. 6. Theme comparison across participant categories (Bar Chart).

most active in themes related to *Regulatory Compliance* and *Green Certifications*, consistent with their institutional role in policy development and enforcement. Academics exhibited a relatively even distribution of engagement across themes, suggesting a broader systems-level interpretation of SME sustainability. SMEs consistently showed the highest participation levels across nearly all themes, highlighting their central role in sustainability transitions and the need for interventions tailored to their operational realities. Taken together, these patterns illustrate a multi-stakeholder landscape in which financial viability, regulatory

structure, and internal organizational alignment operate as interlinked and mutually reinforcing conditions for sustainable SME development.

5.2. Objective 2: stakeholders' opinions on how green business may be developed effectively

In terms of the second objective of the research, Figs. 7 and 8 illustrate a correlation analysis of themes across participant categories and a cluster analysis respectively.

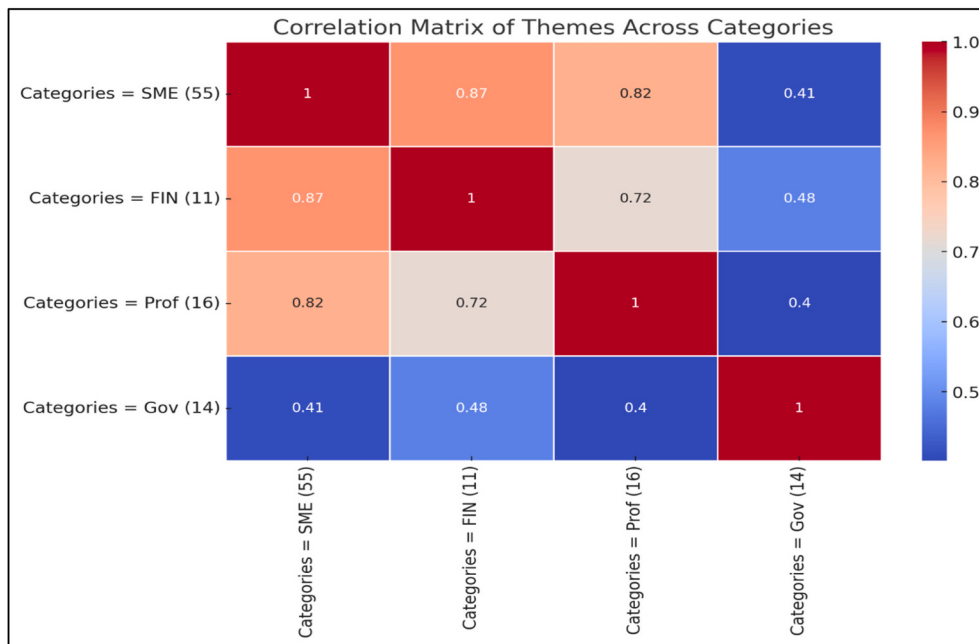


Fig. 7. Correlation matrix of themes across categories.

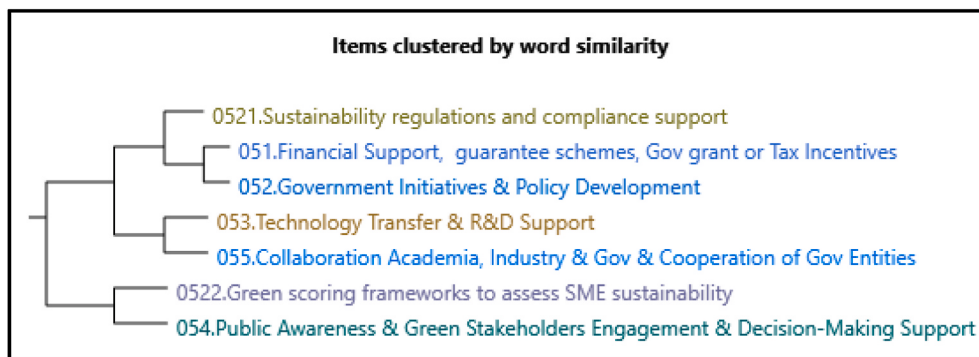


Fig. 8. Cluster analysis exploring theme similarities in Strategies and recommendations for green SMEs.

The correlation analysis (Fig. 7) quantifies the degree of alignment among stakeholder perspectives. A strong correlation between SMEs and finance professionals (0.87) indicates a shared focus on financial barriers, funding mechanisms, and the practical constraints of implementing sustainability. Similarly, the high correlation between SMEs and academics (0.82) suggests overlapping concerns in areas such as organizational leadership, employee engagement, and capacity building for sustainability. Finance professionals and academics also show notable alignment (0.72), reflecting a convergence of views on financial enablers and investment viability in the green transition. In interviews, there was articulation of this, as the comments below illustrate:

“Investment is a significant challenge because there is little impact investment available for sustainability” Interviewee SME_Gre.

“Government rules and incentives are a big deal for green businesses. They give us a roadmap to follow, like subsidies for renewable energy or environmental regulations. Having clear guidelines makes it easier for everyone to get on the same page” Interviewee FIN. Sa.

In contrast, consultant and government officials exhibit weaker correlations with all other groups, ranging from 0.40 to 0.48. This may reflect the distinct roles and responsibilities of public sector stakeholders, whose contributions often emphasize strategic frameworks and institutional oversight.

Fig. 8 offers a granular perspective on strategic recommendations proposed by participants in terms of structural interrelationships. The cluster under the overarching category of *Strategies and Recommendations for Green SME Growth* reveals a highly interdependent structure of policy and support mechanisms, as perceived across the diverse stakeholder groups. Based on word similarity, the dendrogram organizes conceptually similar strategies into hierarchies that illuminate cognitive linkages in stakeholder perceptions of sustainability support. At the uppermost level, *Sustainability Regulations and Compliance Support* is closely aligned with *Financial Support* and *Government Initiatives and Policy Development*, reflecting participants' recognition that integrated financial-policy ecosystems form the foundation of effective SME sustainability pathways. Further downstream, the proximity between *Technology Transfer and R&D Support* and *Collaboration among Academia, Industry, and Government Entities* underscores the centrality of coordinated innovation ecosystems in facilitating green transformations, as one respondent put it, *“The UAE government has policies supporting sustainability, but businesses and universities must actively engage with them ...”* Interviewee SME_Sh. Meanwhile, *Green Scoring Frameworks to Assess SME Sustainability* and *Public Awareness and Green Stakeholder Engagement* coalesce into a distinct subcluster, indicating that accountability tools and public engagement strategies are viewed as complementary mechanisms for strengthening transparency and fostering

environmental literacy. Interview testimonies exemplify:

“Many SME owners are sceptical about sustainability due to high initial costs ..., businesses that invest in green strategies reap financial benefits in the long run. The problem is a lack of awareness—SMEs do not understand how sustainability can be cost-effective over time” Interviewee Prof. Ja.

“Strong government regulations and customer education helped drive this transition” Interviewee SME_Da.

These findings illustrate that, according to our stakeholders, advancing the green SME agenda requires not isolated interventions but a deeply integrated, multi-domain strategy that simultaneously addresses financial, regulatory, technological, and societal dimensions.

Taken together, the findings from this study imply the need to better support green business practices by enhancing coordination and dialogue across different ecosystem players to advance more integrated and responsive sustainability pathways. More broadly, while focused on the UAE context, the findings reveal that financial barriers are the most dominant constraint to sustainability adoption among SMEs. The theme of *Financial Challenges and Funding Barriers*, particularly the lack of green financing options, emerges as the most frequently mentioned issue, followed by items in the broader financial category. Other financial subthemes, such as investor hesitation, public-private collaboration gaps, and cost constraints, further highlight the systemic nature of financing inaccessibility. The theme of *Internal Factors* also shows significant relevance, especially when sustainability is tied to operational cost savings. Organizational culture, employee engagement, and leadership commitment play key roles, but appear to depend heavily on the availability of external financial and policy support. *External Factors*, particularly government policy and support, are prominently referenced, indicating that regulatory frameworks in the UAE are acting as both motivators and enablers of sustainability efforts. However, relatively limited references to green certifications, ESG compliance, and technological innovation suggest gaps in implementation tools and institutional backing. *Contextual Influences*, such as market demand and supply chain pressure, are acknowledged but seem to exert limited influence unless reinforced by financial and regulatory mechanisms.

Overall, the analysis underscores the centrality of financial mechanisms in driving sustainability transitions for SMEs. Regardless of whether the barrier is internal, external, or market-driven, broader access to finance, stronger risk-mitigation instruments, and clearer policy supports emerge as recurring prerequisites for sustainability adoption. The attention given to policy tools like green scoring frameworks and sustainability regulation support points to specific areas where targeted interventions and capacity-building are likely to have the greatest impact.

6. Discussion

The findings of this study reinforce and extend some of the extant knowledge on the drivers and barriers shaping the development of green SMEs. They corroborate the critical importance of financial access, regulatory clarity, and multi-stakeholder collaboration as foundational pillars for fostering sustainable SME growth (Dhir et al., 2023; De Steur et al., 2020). Consistent with prior research (Alraja et al., 2022; Aboelmaged and Hashem, 2019; Siegel et al., 2022), the analysis demonstrates that internal drivers—particularly leadership commitment, employee engagement, and operational efficiency—serve as essential catalysts for green transitions, yet their activation remains dependent on enabling financial and policy structures.

Building on this, the thematic analysis further reveal that leadership commitment is instrumental in embedding sustainability values into corporate culture and daily operations. In several cases, strong leadership vision translated into higher employee participation in energy-efficiency and waste-reduction initiatives. This pattern mirrors earlier

findings that leadership values and ethical orientation strongly influence employees' sustainability behaviour and supports evidence that leadership commitment is a key internal driver of SME green capability development (Parry, 2012; García-Zamora et al., 2013). These results also reinforce theoretical expectations that leadership shapes a firm's environmental orientation, promoting behavioural alignment with sustainability goals (Kusumasari and Kusumaningrum, 2018). Conversely, limited managerial awareness or fragmented communication channels constrained employee motivation and innovation, underscoring the importance of leadership-driven engagement mechanisms. These results reinforce earlier findings (e.g., García-Zamora et al., 2013) while adding evidence that the impact of leadership is moderated by financial accessibility and regulatory predictability. This suggests that leadership commitment, although necessary, cannot independently drive sustainability transitions without complementary institutional and financial support.

Financial Challenges and Funding Barriers emerged as the most salient and cross-cutting theme across all participant categories, mirroring well-documented empirical gaps regarding the persistent underdevelopment of green financing ecosystems (Chien et al., 2021; Hou, 2023). However, the integrated NVivo cluster and network analyses indicated that financial constraints are not isolated phenomena but interconnected inhibitors that reinforce weaknesses in internal capabilities and external regulatory systems. This interconnectedness supports recent arguments that green-finance gaps function as systemic rather than discrete barriers (Khamisu and Paluri, 2024), thereby limiting SME responsiveness to both regulatory and market pressures. Limited access to consistent financial incentives and sustainability-linked products—such as green loans, blended finance, or risk-mitigated investment structures—significantly restrict SMEs' ability to translate environmental intentions into concrete actions, a pattern that aligns with prior evidence that financial inaccessibility remains one of the most persistent structural barriers to green innovation among SMEs (Chien et al., 2021; Hou, 2023; Aboelmaged and Hashem, 2019). Consequently, while internal entrepreneurial motivations and policy-driven incentives appear robust, they are insufficient to catalyze the widespread adoption of sustainable models within SMEs.

Following this, the thematic hierarchy and participant cross-tabulations reveal a pronounced convergence between the perspectives of SME leaders and finance professionals regarding the urgent need for innovative, risk-sensitive financial products. This convergence is complemented by a similarly robust alignment between SMEs and academic stakeholders on the imperatives of capacity building, leadership development, and the establishment of robust innovation ecosystems, corroborating prior findings (Asad et al., 2023; Mahesh et al., 2022; Zarrouk et al., 2021). The triangulation of these perspectives empirically supports calls for ecosystem-based approaches to SME sustainability (Silva et al., 2024) and clarifies how formal institutional (financial, regulatory) and normative organizational capabilities interact in practice.

Interestingly though, contextual factors such as market demand and supply chain pressures—while frequently cited as enablers in existing literature (Darko et al., 2018; Muktadir et al., 2018)—were found in this study to function primarily as amplifiers rather than initiators of green behaviour, at least in the UAE context. This suggests that although external market forces hold relevance, their influence becomes significant only when accompanied by supportive financial and regulatory conditions. This observation refines market-centred explanations in prior research by showing that external pressures stimulate sustainability adoption only when SMEs possess sufficient financial and organizational readiness to respond—a pattern consistent with earlier findings that market and supply-chain forces act as secondary rather than primary drivers of green behaviour (Darko et al., 2018; Muktadir et al., 2018).

From a theoretical perspective, overall, the findings resonate with institutional and resource-based perspectives but advance both

frameworks by demonstrating that internal capabilities translate into sustainability outcomes only when situated within supportive financial and regulatory ecosystems—a nuance insufficiently articulated in earlier SME sustainability models (Silva et al., 2024; Green and Erasmus, 2024). In terms of practice, the research highlights the deep interdependence between financial, organizational, and contextual dynamics. Investment decisions are informed not only by capital availability but also by managerial capability, workforce readiness, and policy predictability. Supporting the green agenda therefore requires coordinated, multi-pronged action integrating financial, regulatory, and technological mechanisms, rather than isolated, unidimensional policies and initiatives.

Collectively, these findings challenge dominant arguments that internal culture or market incentives are primary triggers of SME sustainability adoption (Darko et al., 2018; Parry, 2012). Instead, the evidence indicates that financial architecture is the pivotal enabling condition, creating a hierarchy in which financial readiness shapes the effectiveness of both regulatory frameworks and organizational capabilities. Interpreted through institutional theory, the findings indicate that SME sustainability adoption is shaped by coercive pressures—such as government policy, regulatory compliance, and certification requirements (Siegel et al., 2022; Moktadir et al., 2018)—as well as normative pressures linked to stakeholder expectations and shifting market preferences (Parry, 2012; Darko et al., 2018). Additionally, competitive imitation dynamics appear to influence firms as they respond to emerging industry trends within an evolving sustainability landscape. The Resource-Based View further illustrates the uneven nature of this response: internal capabilities such as leadership commitment, absorptive capacity, and operational efficiency (De Steur et al., 2020; García-Zamora et al., 2013) determine whether SMEs can translate external pressures into tangible sustainability outcomes. Together, these perspectives clarify that the **interaction** of institutional forces and firm-specific capabilities provides the most coherent explanation for the drivers and barriers observed.

6.1. A proposed multi-pillar approach

Building on the empirical insights reported in this research, a comprehensive, stakeholder-informed, and research-based multi-pillar strategy is proposed to foster the sustainable development of green SMEs. This contribution responds directly to theoretical and policy gaps identified in recent sustainability scholarship (Green and Erasmus, 2024; Silva et al., 2024) by translating empirical evidence into an integrated, context-sensitive framework for green SME development. Recognizing that successful sustainable entrepreneurship necessitates systemic interventions rather than fragmented efforts, the proposed strategy is structured around three interdependent pillars: (1) financial and policy support, (2) regulatory and compliance enhancement, and (3) innovation and public engagement ecosystems.

6.1.1. Financial and policy support

First, strengthening financial and policy support is paramount. Expanding access to green finance through public-private partnerships and sustainability-linked financial instruments is essential to address the prevailing funding gaps (Chien et al., 2021; Hou, 2023). Germany's KfW Bankengruppe provides a successful international model, offering low-interest loans and guarantees to SMEs investing in energy efficiency and renewable technologies. Adapting similar mechanisms through a country-specific Green SME Financing Program—coordinated by local banks, sovereign funds, and development agencies—could significantly enhance capital accessibility (Al-Qudah et al., 2023). Furthermore, the adoption of risk-sharing mechanisms—including guarantees, blended finance programs, and green bonds—would mitigate investment risks, aligning with emerging best practices such as the European Investment Bank's Green Loan Programme and Singapore's Green Finance Action Plan. Embedding regulatory compliance criteria directly into financial

incentive frameworks, as advocated by Bai et al. (2018) and Gandhi et al. (2018), would further strengthen the alignment between economic rewards and sustainable practices.

6.1.2. Regulation

Second, regulatory and compliance enhancement is pivotal. Developing green scoring frameworks and tailored SME sustainability certifications would reconceptualize compliance from a bureaucratic obligation into a strategic advantage, echoing the success of the European Union's Eco-Management and Audit Scheme (EMAS). South Korea's Environmental Technology Verification (ETV) programme offers a further benchmark for enhancing SME credibility and market access (He and Chen, 2024; Kang and Hew, 2024; Kang et al., 2025). Streamlining regulatory processes and integrating financial incentives within compliance structures would promote broader adoption of sustainable practices among SMEs. Moreover, regulatory frameworks must prioritize transparency, consistency, and predictability to foster investor confidence.

6.1.3. Ecosystem

Third, fostering innovation ecosystems and public engagement is indispensable for long-term green SME resilience. Strengthening university-industry-government collaboration platforms can accelerate technology transfer, research, and entrepreneurial capacity-building. Public awareness and consumer-driven sustainability campaigns can further generate demand-pull dynamics that incentivize eco-friendly product and service development. These actions align with broader evidence emphasizing the critical role of public pressure and end-user demand in mainstreaming sustainable practices (Moktadir et al., 2018; Liao and Shi, 2018).

Ultimately, these recommendations converge to propose that sustainable SME growth demands financial systems, regulatory frameworks, innovation infrastructures, and societal engagement. Critically though, while examples of good practice are noted above, these exemplars should form parts of an *integrated* strategy. Thus, rather than advocating isolated interventions, this study highlights the necessity of cultivating a synergistic ecosystem wherein finance, governance, innovation, and market dynamics coalesce around shared sustainability objectives.

7. Conclusion

This study provides a comprehensive, empirically grounded examination of the drivers, barriers, and investment signals influencing the development of green business practices in SMEs. By integrating insights from policy frameworks, technological advancements, social dynamics, and internal organizational capabilities in the context of the UAE, the research confirms that financial access, regulatory clarity, and innovation ecosystems are critical enablers of the green transition. The qualitative findings reinforce the theoretical frameworks outlined in the extant literature and further uncover unique systemic interdependencies between financial mechanisms, institutional readiness, and internal SME capabilities that shape the pace and direction of sustainability adoption. In doing so, the study advances current debates by demonstrating that these determinants operate not in isolation, but as mutually reinforcing components of a broader sustainability ecosystem—an interaction that previous research has acknowledged conceptually but has not substantiated empirically.

Drawing on extensive thematic, cluster, and network analyses, the study proposes a stakeholder-informed multi-pillar strategy encompassing financial and policy support, regulatory enhancement, and innovation-driven public engagement. This framework organizes the complex landscape of enablers and barriers and demonstrates how coordinated interventions can accelerate SME sustainability pathways in practice. Such an integrated model offers actionable pathways for policymakers, investors, financial institutions, and ecosystem developers,

aiming to dismantle barriers, mobilize resources, and foster coordinated action toward sustainable SME transformation. By linking these empirical insights to broader theoretical constructs, the study provides a conceptual scaffold that can inform future scholarly work on green entrepreneurship and sustainability transitions.

While this study provides valuable insights, several limitations must be acknowledged. First, the research is based on a qualitative methodology with purposive sampling, and while appropriate for exploratory inquiry, this limits the generalizability of findings across all SME sectors and regions. Second, the study captures a cross-sectional perspective at a particular moment in time in the UAE; evolving policy landscapes, market conditions, and technological advances may alter the dynamics of green SME development over time. Third, while the analysis incorporated diverse stakeholder perspectives—including SMEs, consultant and government officials, academics, and finance professionals—the relative representation of each group was uneven, which may introduce interpretative biases. Despite these limitations, the study makes several key contributions for research and theory and for policy and practice. By empirically validating and extending the theoretical foundations outlined in the extant literature, this research offers a structured, actionable blueprint for advancing green SMEs. Moving beyond the identification of isolated drivers, it maps systemic interactions among financial, regulatory, technological, and market forces, which are critical for impactful and enduring transformation. Furthermore, the study provides policymakers, financial institutions, and ecosystem builders with evidence that concrete, context-sensitive pathways to accelerate sustainable economic transitions are important.

7.1. Implications for policy and practice

In the UAE context specifically, the findings highlight that empowering green SMEs is an environmental and economic imperative and a strategic necessity for meeting the UAE's national sustainability goals and contributing meaningfully to the broader global green economy transition.

More generally, and regardless of national context, the results also indicate that this transition requires targeted interventions across financial, regulatory, technological, and organizational domains to address the systemic constraints that SMEs continue to face. Strengthening the financial architecture available to green-oriented enterprises—through dedicated sustainability-linked loans, credit-guarantee schemes, and blended-finance instruments—would help alleviate the persistent funding barriers identified by participants. Likewise, enhancing sector-specific regulatory clarity and streamlining compliance procedures would reduce administrative burdens and support SMEs in navigating increasingly complex sustainability requirements. The findings underscore the importance of internal capabilities by proposing that embedding leadership development and employee training initiatives within national sustainability strategies can reinforce managerial commitment and cultivate the organizational readiness necessary for meaningful green transformation. Complementary incentives for technology adoption, such as subsidies for renewable energy integration, efficiency-enhancing upgrades, and digital monitoring tools, may additionally ease operational constraints and accelerate sustainable practices.

7.2. Implications for theory and research

This study contributes to the theoretical literature in several ways. First, it identifies and empirically substantiates the interconnected nature of financial, regulatory, and organizational drivers, addressing the persistent gap concerning how these determinants jointly shape green transitions in SMEs. Second, the findings extend institutional and resource-based theories by demonstrating that internal capabilities (e.g., leadership commitment, employee engagement) achieve impact only when aligned with enabling financial and regulatory conditions, thereby

clarifying how context moderates sustainability adoption. Third, the multi-pillar framework proposed in this study offers a theoretically informed model that can inform future research on sustainability ecosystems, particularly within emerging-economy settings. Taken together, these contributions deepen conceptual understanding of SME sustainability pathways and open avenues for refining theoretical models that capture cross-domain interdependencies.

Future research might focus on several avenues. Quantitative studies could statistically validate and generalize the proposed multi-pillar strategy across different industries and regions, offering a broader empirical base. Additionally, future work could explore the evolving role of digital innovation, artificial intelligence, and blockchain technologies in accelerating sustainable entrepreneurship among SMEs. Comparative studies between the UAE and other economies could further enrich understanding of context-specific versus universal drivers of green SME transformation. Longitudinal studies examining how changes in policy frameworks, financial systems, and technology infrastructures influence SME sustainability trajectories over time might also yield valuable insights. Furthermore, mixed-methods designs could strengthen causal inference by triangulating qualitative narratives with objective performance indicators, enabling analysis of how internal capabilities, external pressures, and institutional conditions interact. By extending and deepening the research agenda, scholars and practitioners can contribute to nuanced, evidence-based policy frameworks and support mechanisms that not only empower green SMEs but also advance global sustainability imperatives. Such efforts would help build a cumulative body of knowledge capable of guiding policymakers and practitioners in designing adaptive, context-aware strategies for sustainable SME development.

CRedit authorship contribution statement

Hajer Zarrouk: Writing – review & editing, Writing – original draft, Supervision, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Sonia Abdennadher:** Writing – original draft, Formal analysis, Data curation, Conceptualization. **Laura Galloway:** Writing – review & editing, Writing – original draft, Validation, Formal analysis. **Jaber Jemai:** Formal analysis, Data curation. **Tayseer Mohammad Ismail:** Investigation, Data curation, Conceptualization. **Mourad Elhadef:** Writing – original draft, Investigation, Formal analysis. **Morad Benyoucef:** Writing – original draft, Methodology, Formal analysis.

Declaration of competing interest

I confirm there is no conflict of interest in this paper or its associated research.

Data availability

The data that has been used is confidential.

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