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To cite this article: Eva M. Sánchez-Teba, Ana Isabel González-Fernández & Guillermo Bermúdez-González (12 Dec 2025): Business associations, access to finance, and institutional quality: Drivers of SMEs' circular economy transformation, *Journal of Small Business Management*, DOI: [10.1080/00472778.2025.2591696](https://doi.org/10.1080/00472778.2025.2591696)

To link to this article: <https://doi.org/10.1080/00472778.2025.2591696>



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Published online: 12 Dec 2025.



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Business associations, access to finance, and institutional quality: Drivers of SMEs' circular economy transformation

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ABSTRACT

This article examines how small and medium-sized enterprises (SMEs) engage in the circular economy (CE) through business association (BA) membership, perceptions of ease access to finance (AF), and institutional quality (IQ). Building on social capital theory, we argue that BA membership not only provides resources but also channels non-financial forms of public entrepreneurship and SME-supporting policies. Framed through a theory of change perspective, these soft interventions enhance social and human capital, enabling CE adoption. Using Eurobarometer 486 data from 7,680 SMEs in 39 countries, logit and OLS regressions show that BA membership fosters CE actions while increasing awareness of financial barriers, with AF partially mediating this link. IQ moderates these dynamics: in high-IQ contexts, non-financial support reduces the salience of financial barriers; in low-IQ contexts, AF perceptions remain decisive. We contribute by integrating SCT with public entrepreneurship to explain policy conditions shaping SME sustainability.

KEYWORDS

Circular economy; business association; access to finance; institutional quality; social capital theory; SME

Introduction

Sustainability has become a priority for businesses due to the imposition of more environmental regulations and institutional pressures. There is growing research interest in the analysis of the circular economy (CE) actions (hereinafter, CE) taken by small and medium-sized enterprises (SMEs) (Ferasso et al., 2023; Prieto-Sandoval et al., 2019). SMEs make up 90 percent of the world's business fabric (Sharma et al., 2024), generate approximately 70 percent of industrial pollution (Caldera et al., 2019), and consume 13 percent of energy resources (De et al., 2020). In the European Union (2019), SMEs employ 6.6 percent of the workforce, which underlines their importance in the

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transition to sustainable production models that maintain profitability and competitiveness (Malesios et al., 2021). Governments are introducing regulations (for example, an EU directive requiring smaller companies to produce sustainability reports; European Union, 2022) to minimize environmental impact. Beyond reporting, the EU's policy mix now couples market-shaping product rules and finance alignment, most notably the Circular Economy Action Plan (European Commission, 2020a) and the Ecodesign for Sustainable Products Regulation (European Union, 2024), which together aim to make circular design and transparency (for example, digital product passports) standard for firms operating in European value chains.

Alongside these financial and regulatory measures, governments increasingly deploy non-financial SME-supporting policies (such as mentoring, training, advisory services, and regulatory simplification) whose existence can be traced to the role of public entrepreneurs who design innovative responses to market failures (Organisation for Economic Cooperation and Development [OECD], 2023; Vivona et al., 2025). In parallel, the academic literature has increasingly located non-financial SME supports within ecosystem, institutional, and intermediary frameworks. Entrepreneurial ecosystem research conceptualizes these supports as interconnected pillars of actors, institutions, and policies that shape firm-level outcomes (Cavallo et al., 2019), while national systems of entrepreneurship view them as resource allocation mechanisms where institutional quality and entrepreneurial agency interact (Acs et al., 2018). Studies on incubators, accelerators, and intermediaries further demonstrate that advisory, training, and capability-building programs generate outcomes by mobilizing knowledge flows and strengthening absorptive capacity (Kramer & Kanbach, 2023; Sohail et al., 2023). Within this debate, business associations can be understood as institutional intermediaries that channel both financial and non-financial public entrepreneurship policies, thereby shaping SMEs' perceptions of access to finance and their capacity to engage in circular practices. By integrating these insights into a theory of change perspective, our model links business association (BA) membership, access to finance (AF) perceptions, and CE adoption in SMEs, highlighting the enabling role of non-financial interventions in sustainability transitions.

However, the transition of SMEs toward circularity remains uneven and poorly understood from a theoretical and empirical standpoint, particularly regarding the influence of business associations and institutional conditions in this process. Recent evidence has reinforced the timeliness of this research. Alcalde Calonge et al. (2024) demonstrated that social capital, together with adaptive capabilities and entrepreneurial orientation, is a critical driver of circular economy practices in SMEs. Their findings underline that, beyond financial constraints, relational resources and institutional linkages shape firms' ability to transition toward circular models, which aligns with the theoretical focus of the present study. Research on the implementation of

the circular economy in SMEs has established a consolidated body of knowledge that combines systematic reviews and empirical studies. Within this body of work, three main axes can be identified. First, the predominance of practices aimed at resource efficiency and waste management has been widely documented in the literature (Agyemang et al., 2019; Rizos et al., 2016). Second, the persistence of barriers related to financial constraints and knowledge deficits has been identified as a recurrent obstacle to the adoption of circular strategies (Mishra et al., 2025). Finally, empirical evidence highlights the crucial role of external support, such as customer demand, public policies, and inter-industrial cooperation, as decisive enablers of the transition toward circular models (Rizos et al., 2015; Segarra-Blasco et al., 2024).

SMEs are less able to influence their communities than are larger businesses. Their sustainability rests on relationships based on trust, legitimacy, and reciprocity and on their interactions with the public and private sectors (Spence & Schmidpeter, 2003). Individual actions taken by SMEs have been shown to have limited environmental impact, making business collaboration key for societal transformation (De Chiara, 2016). However, the implementation of circular models by SMEs is uneven and is characterized by informal processes and a lack of structure (Lawrence et al., 2006). In addition, the pace of CE adoption by SMEs varies significantly between sectors (Daddi et al., 2017), and SMEs' characteristics make it hard for them to replicate the successful strategies of larger companies (Johnson & Schaltegger, 2016). The research challenge is to identify the factors that can help SMEs achieve business circularity (Ferasso et al., 2024; Sohal & De Vass, 2022).

The literature has identified many barriers (Table 1) to the implementation of sustainable practices in SMEs (Calderá et al., 2019; Jesus et al.,

Table 1. Barriers to the implementation of sustainable practices in SMEs.

Barriers	Description	General references	SMEs references
Financial	Lack of financial resources and difficulties in accessing funding for investments in circular technologies.	Jesus et al. (2023)	Tang (2022); Kato (2024)
Political and regulatory	Lack of government incentives and unclear or non-existent regulations supporting the circular economy in SMEs.	De Jesus and Mendonça (2018)	Fontoura et al. (2024)
Technological	Difficulties in accessing advanced technologies.	Jabbour et al. (2020)	Molina-Morejón et al. (2024)
Cultural and social	Lack of awareness and resistance to change among employees and managers.	Bhandari et al. (2019)	Molina-Morejón et al. (2024)
Human resources and training	Shortage of personnel trained in circular business models and lack of training strategies.	Jabbour et al. (2020)	Palombi et al. (2024)
Infrastructure	Lack of adequate facilities for efficient waste management and recyclable materials.	Kapoor et al. (2020)	Arranz et al. (2024)
Market	Low demand for circular products and difficulties in competing with more established linear models.	Kumar et al. (2019)	Arranz et al. (2024)

Source: Own elaboration.

2023), including financial constraints, lack of institutional support, and cultural inertia. Caldera et al. (2019) emphasized that limited financial resources and low technological capability hinder CE innovation in SMEs, while Jesus et al. (2023) highlighted the absence of a supportive regulatory framework as a key bottleneck. Despite this, there is no consensus on the drivers of SME sustainability (Dey et al., 2022), nor have these barriers been analyzed in conjunction with institutional context or collaborative mechanisms. Non-financial interventions merit particular attention because, although the available evidence is more mixed than in the case of financial subsidies, these measures have the capacity to address root constraints that hinder circular adoption. They can reduce information asymmetries, strengthen managerial and employee skills, and lower regulatory burdens, thereby shaping the enabling conditions that allow SMEs to engage in circular transitions. Interpreting these interventions through a theory of change perspective makes it possible to clarify the causal pathways and the assumptions that determine when and how such policies are effective.

Social capital theory (SCT) holds that networks of relationships and cooperation between economic actors generate intangible resources that support business development and innovation (Putnam, 2015). In SMEs, social capital is key in the transition to the CE, the promotion of knowledge sharing, the development of inter-company trust, and access to the strategic resources that favor the adoption of circular practices (Perrini & Tencati, 2011).

SCT encompasses three main dimensions (bonding, bridging, and linking) that shape different levels of social connectivity, with the linking dimension being particularly relevant to understand how SMEs relate to institutional actors and access broader resources.

From the SCT perspective, membership of a business association/industrial cluster (hereinafter, BA) is vital because they facilitate inter-SME collaboration and encourage the dissemination of sustainable innovations and the generation of synergies that optimize resource use and waste reduction (Daddi & Iraldo, 2016). Nevertheless, most empirical studies remain descriptive and case-based, lacking generalizable evidence about how BA influence CE adoption in SMEs at scale (Ferasso et al., 2024).

Similarly, from the SCT perspective, SMEs' perceptions of ease of access to finance (hereinafter, AF) is another key factor in the study of the CE of SMEs, as they often face greater economic constraints in investing in clean technologies and designing sustainable processes (Kato, 2024; Tang, 2022).

It has been proposed that other variables, such as the institutional quality (hereinafter, IQ) of the country where the SME is based, help them toward achieving sustainability (Hondroyannis et al. (2024)). Nonetheless, as indicated by Vu and Le (2022), the moderating influence of IQ on the proposed antecedents of CE (BA and AF) has not been sufficiently analyzed.

This study, thus, addresses a gap in the literature by analyzing, from a SCT perspective, the determinants of CE in SMEs (Prieto-Sandoval et al., 2018), exploring the roles of BA and AF. In addition, evidence is sought on the moderating effect of IQ on CE, an impact scarcely studied. In doing so, the study links its model to the broader debate on public entrepreneurship and SME-supporting policies, offering a theory of change-based account of how both financial and non-financial interventions shape SME circularity.

In light of these gaps, this study poses the following research questions:

RQ1: In the SME context, what impact does BA have on AF and CE?

RQ2: In the SME context, what impact does AF have on CE?

RQ3: In the SME context, how does IQ moderate the relationships between the variables of the proposed model (BA, AF, and EC)?

By answering these questions, the study contributes to theory by applying and adapting extending SCT to the CE domain for SMEs, and to practice by offering recommendations for policymakers and associations to enhance SME sustainability through collaborative and institutional mechanisms.

The remainder of this article is structured in five main sections. Section “Literature review” provides a comprehensive literature review. Section “Methodology” details the methodology used. Section “Results” presents the results. In Section “Discussion and conclusions”, the study’s findings are critically discussed and placed in the context of the existing literature, practical and theoretical implications are explored, limitations are identified, and future lines of research that can enrich the field are proposed.

Literature review

Social capital theory and the circular economy in SMEs

SCT emphasizes the interrelationships within social networks and the trust and reciprocity that arise from these connections, which improve coordination and social efficiency (Putnam, 2015). Researchers from economics (Woolcock, 2021), sociology (Portes, 2024), political science (Rayamajhee & Bohara, 2021), and SME management disciplines (Hock-Doepgen et al., 2021; Shafique et al., 2021) have examined social capital because it connects diverse groups, promoting information exchange and fostering unity. Trust is essential for building social capital, shaping both individual and collective behaviors (Dasgupta et al., 2021).

While alternative theoretical lenses such as the resource-based view (Barney & Arikan, 2005), resource dependence theory (Pfeffer &

Salancik, 2015), or institutional theory (DiMaggio & Powell, 1983) offer valuable insights into SME, environment interactions, that is, SCT, provide a more relational explanation of how firms overcome structural disadvantages in sustainability transitions. From a network theory perspective, SCT comprises three dimensions (bonding, bridging, and linking) that shape SMEs' ability to adopt CE practices (Alcalde Calonge et al., 2024; Claridge, 2018). Bonding capital reflects horizontal ties among similar firms, which foster trust and collective action, such as sharing recycling infrastructure or pooling resources for waste management. Bridging connects heterogeneous firms across sectors and value chains, enabling knowledge diffusion and cross-industry collaboration in eco-design or industrial symbiosis (Daddi & Iraldo, 2016). Linking describes vertical ties with institutional actors, such as public agencies, regulators, and business associations, which provide access to financial and, importantly, non-financial forms of support as mentoring, training, policy advocacy, and regulatory simplification. These interventions are frequently the outcome of public entrepreneurship, as policy actors mobilize resources and legitimacy to introduce innovative responses to SME constraints (OECD, 2023; Vivona et al., 2025). Complementarily, Simmou et al. (2025) demonstrated that social capital and green entrepreneurial leadership jointly act as catalysts for sustainable innovation in SMEs, reinforcing the relational foundations of the circular economy. A theory of change perspective helps to clarify the assumptions and causal pathways through which these interventions contribute to CE adoption.

This linking capital is crucial for SMEs, whose limited internal resources make them dependent on external support for implementing circular strategies. Recent policy frameworks (OECD, 2023) emphasize that such institutional linkages are essential for SME sustainability and constitute non-financial forms of public entrepreneurship that complement financial instruments. Empirical evidence further shows that when SMEs' network ties align with institutional support, the adoption of sustainable practices is significantly enhanced (Dvouletý et al., 2021). Taken together, these mechanisms (resource mobilization, knowledge diffusion, and legitimacy reinforcement) explain why SCT offers a superior lens for connecting CE business models with strategies for effective implementation (Hina et al., 2023).

Empirical studies suggest that SMEs frequently engage in collaborative strategies to sustain competitiveness, particularly when operating in regions where rivals also pursue collective initiatives. Such collaboration helps firms overcome scale limitations, share innovation costs, and access new markets (Saz-Gil et al., 2021).

In this sense, SCT not only explains how firms generate collective resources but also shows how institutional linkages become vehicles for SME-supporting

policies, both financial and non-financial, that enable circular business models.

SMEs must collaborate with other companies to maintain their competitiveness, as their territorial/regional competitors are also adopting collaborative strategies (Saz-Gil et al., 2021). Collaborative frameworks help SMEs address inefficiencies, expand product offerings, reduce response times, and overcome bureaucratic hurdles (Oldham & Spence, 2022). Strong partnerships with local institutions and supply chains increase the benefits of social capital, generating value for companies and communities.

Intangible elements such as trust, reputation, and legitimacy underpin social capital, and foster collective well-being and cooperation. These intangible resources are particularly crucial for SMEs, whose operations often depend on their integration with surrounding social and environmental ecosystems (Reisinger & Zabó, 2024). Institutions, such as these associations/clusters, play a complementary role in designing policies and services that strengthen networks, enhance regional capacities, and motivate SMEs to contribute to social welfare.

Effective collaboration between SMEs and institutions is essential for sustainable regional development. SMEs must develop networks based on local cultural and social contexts, while public institutions must ensure that the relationship between SME associations/clusters and financial institutions is balanced, that is, the SMEs are not subject to unfair contractual terms/excessive interest rates, and so on, such that they have easy access to the financial resources that will allow them to take sustainable actions. This interdependence highlights that financial resources are necessary but not sufficient, and that non-financial interventions and public entrepreneurship are equally important in shaping the enabling conditions for CE adoption and in ensuring that firms remain aligned with their broader environmental contexts, which is addressed in the model proposed in this research.

To address the multifaceted nature of SMEs' circular economy transformation, this study adopts an integrative conceptual framework linking BA membership, AF, and IQ. Drawing on social capital theory, BA membership is conceptualized as a bridging and linking mechanism that fosters information flows, trust-based relations, and institutional connectivity, which can directly enhance AF opportunities (Putnam, 2015). AF, in turn, provides the tangible resources necessary to overcome the financial barriers to implementing circular strategies. IQ is positioned as a contextual moderator that shapes the effectiveness of both BA and AF in driving CE adoption. In addition, the framework incorporates the role of non-financial SME-supporting policies and the entrepreneurial agency behind them, thereby aligning SCT with the broader debate on how public interventions foster circular transitions.

Influence of SME business association membership on the circular economy

The CE has been defined as “a model of production and consumption that involves sharing, renting, reusing, repairing, renewing and recycling existing materials and products as many times as possible to create added value. Thus, the life cycle of products is extended” (European Union, 2023). While policy-oriented definitions, such as those from the European Commission, have been instrumental in framing CE, the academic debate situates CE within broader theoretical contexts. Geissdoerfer et al. (2017) emphasized CE as a regenerative system aimed at minimizing resource input and waste through long-lasting design, maintenance, and closed-loop systems, which aligns with socio-technical transition theory. Kirchherr et al. (2017) and Murray et al. (2017) argued that CE requires systemic change, encompassing technological, cultural, and institutional dimensions, and cannot be reduced to recycling or resource efficiency alone. In the SME context, these transformations are shaped by dynamic capabilities (firms’ abilities to sense, seize, and reconfigure resources to address shifting sustainability demands) and by institutional pressures from regulatory frameworks and market expectations (Bocken & Short, 2021; De Jesus & Mendonça, 2018). Embedding CE within these theoretical debates enables a richer understanding of its drivers in SMEs, integrating innovation ecosystems, stakeholder networks, and institutional quality into the analysis.

The role of entrepreneurial ecosystems in facilitating CE transitions has gained considerable attention in recent literature. Ferreira et al. (2024) provided evidence that start-ups within entrepreneurial ecosystems face unique challenges and opportunities when transitioning toward CE models, requiring multi-level support spanning macro, meso, and micro levels.

SMEs, despite their inherent challenges, find many advantages in circularity, such as cost savings, reduced energy and raw material consumption, and increased prestige (Ormazabal et al., 2018).

Jesus et al. (2023) argued that association/cluster membership significantly increases CE by fostering collaboration, resource sharing, and innovation. Associations/clusters provide a platform for SMEs to overcome resource constraints, and foster sustainable practices, which are crucial for the transition to the CE. This collaborative approach boosts the visibility and competitiveness of SMEs and facilitates CE in various sectors (Jesus et al., 2023). Beyond network membership, business associations operationalize circularity through concrete initiatives. First, they provide capability-building and diffusion mechanisms (training, technical toolkits, and support for ISO 14001/EMAS adoption), which reduce uncertainty and align practices across SMEs (Daddi et al., 2017). Second, they coordinate and broker industrial symbiosis (mapping material and energy flows, orchestrating exchanges, and enabling shared infrastructure and reverse-logistics solutions), thereby unlocking resource efficiency at the cluster

level (Daddi et al., 2017). Third, they act as market and policy intermediaries, helping firms interpret standards and regulatory changes and mobilizing demand networks, which lowers search and transaction costs for circular business models (Rizos et al., 2016). These activities illustrate how associations serve not only as social capital platforms but also as institutional vehicles for soft policies designed by public entrepreneurs to reduce uncertainty and build trust in new sustainability practices. In the same line, Do et al. (2025) noted that business networks and social capital strengthen SMEs' sustainable innovation through knowledge combination and inter-organizational cooperation.

The CE-SME relationship is still at an early stage of development (Ferasso et al., 2024). Ferasso et al. (2023) found, in their bibliometric study, that the connection between the CE and associations/clusters was weak. Liu (2014) argued that the CE should be integrated into industrial clusters, given its importance for the promotion of sustainable development. Baldassarre et al. (2019) investigated industrial symbiosis and its relationship with the CE in areas such as resource depletion, waste management, and pollution. The BA-CE relationship has been analyzed in research, such as Daddi et al. (2017), although no studies have quantitatively demonstrated the influence of SME associations/clusters on the implementation of circular strategies.

Beyond their direct influence on CE adoption, BAs act as gateways to financial opportunities by reducing information asymmetries and transaction costs between SMEs and financial providers. This role extends to both formal mechanisms, such as public subsidies, credit guarantees, and targeted investment programmes, and informal channels, including peer-to-peer lending and cooperative financing schemes. Empirical evidence from high-quality policy evaluations demonstrates that business networks often complement financial support programs, amplifying their impact on SMEs' investment capacity (Dvoulety et al., 2021; OECD, 2023). Equally important, BAs enable the deployment of non-financial policies such as mentoring, advisory services, and institutional coordination initiatives, which target root causes like information asymmetry, skills shortages, or regulatory burden. Situating these mechanisms within a theory of change framework explains under which assumptions they enhance SMEs' adoption of circular practices, thereby reinforcing the causal link between BA membership and CE.

In line with Dvoulety (2023), non-financial policy instruments generate multiple forms of capital (human, social, and symbolic) that enhance firms' ability to access and efficiently use financial resources. These complementarities between financial and non-financial capital reinforce the mechanisms through which public entrepreneurship policies and business associations jointly shape SME sustainability and circular engagement.

To bridge the gap in the literature, the following hypothesis is proposed:

Hypothesis 1: BA has a direct and positive impact on CE in SMEs.

Access to finance and the circular economy in SMEs

Access to finance is the availability of financial services to a company (Ganlin et al., 2021). SMEs face financial constraints, which are attracting growing interest in academic research. Limited financing has been identified as an important barrier to the long-term sustainability of SMEs. Access to capital markets and banking institutions, important for ensuring their growth, sustainability, and expansion, is often more complex for SMEs than for large corporations (Tang, 2022); thus, it is vital to analyze SMEs' perceptions of their ease of access to finance. From the SCT perspective, Patulny and Lind Haase Svendsen (2007) argued that access to finance is part of the connectivity of associations/clusters with other types of broader social/economic institutions. Kato (2024) showed that if SMEs have a positive perception of the quality of, and ease of access to, financing, they will be more open to CE. Jesus et al. (2023) argued that SMEs with a negative perception of access to finance are less open to CE, given that these require substantial investments in research and development that are not always beneficial in the short term.

However, access to finance should not be understood in isolation from the broader policy mix that supports SMEs. Recent studies have demonstrated that government support policies, including non-financial measures such as training, advisory services, and mentoring, can indirectly enhance SME performance by building entrepreneurial orientation and absorptive capacity (Prasannath et al., 2024). Evidence from enterprise training programs also shows that capability-building interventions improve SMEs' ability to translate financial resources into sustainable investments (Dammert & Nansamba, 2023). These findings indicate that non-financial forms of public entrepreneurship policies complement financial access by addressing structural barriers such as information asymmetry, skills shortages, and regulatory burdens, which financial capital alone cannot resolve. In line with this view, Romanello et al. (2024) showed that the effectiveness of public support depends on institutional quality and firms' absorptive capacity, which are decisive for effective financial access. From a theory of change perspective, financial and non-financial interventions operate jointly, since the latter create the preconditions under which financial resources can foster circular innovation and adoption.

Based on these arguments, the following is proposed:

Hypothesis 2: AF has a direct and positive impact on CE in SMEs.

The impact of business association and access to finance on SMEs' implementation of circular economy actions

Previous studies have suggested that social capital embedded in BAs can reduce financial barriers faced by firms. For example, L. Xiong and Talavera (2010) found that BA membership increased the probability of obtaining a loan, while Owolabi and Pal (2012) reported similar evidence. More recent research, however, has emphasized that BA influence goes beyond facilitating transactions, as they also shape SMEs' perceptions of their financial environment. De Chiara (2016) argued that associations affect how SMEs perceive their relationships with financial institutions, while Öztürk and Mrkaic (2014) highlighted that networks reduce information asymmetries that hinder access to finance. From a social capital perspective, BAs can generate resources, information, and legitimacy for their members (Bourdieu, 2011; OECD, 2023, 2024).

At the same time, empirical evidence also shows that associations may heighten awareness of financing barriers, as collective experiences expose structural constraints in SME financing (Dvouletý et al., 2021; Ghulam et al., 2025; International Monetary Fund [IMF], 2020). Thus, while associations often improve access to financial opportunities through information and advocacy (International Finance Corporation [IFC], 2022), they can simultaneously lead SMEs to recognize the limits of available funding. This dual role underlines that BA influence cannot be reduced to transactional outcomes but must be understood within a broader theory of change perspective. Associations provide not only financial linkages but also non-financial support such as mentoring, training, and policy intermediation, which create the enabling conditions for SMEs to transform resources into sustainable practices (Prasannath et al., 2024). From this viewpoint, public entrepreneurship manifests in the design of BA programs that combine financial facilitation with capability-building interventions, addressing root causes like skills shortages or information asymmetries that otherwise constrain CE adoption.

Taking these ambivalent effects into account, we argue that BA membership influences SMEs' financial access perceptions in ways that are context-dependent. In line with social capital theory, we expect a generally positive association, which leads us to propose:

Hypothesis 3. BA membership has a direct and positive impact on AF.

Moreover, perceptions of financial access do not automatically translate into CE adoption but influence firms' confidence and willingness to engage in

long-term, sustainability-oriented investments. Favorable perceptions reduce perceived risk and encourage resource allocation to CE practices (Jesus et al., 2023), whereas constrained perceptions often discourage such commitments, although in some contexts resource scarcity may also stimulate frugal innovation (Tang, 2022). Non-financial interventions are essential in this mediating role, since they strengthen SMEs' absorptive capacity and ensure that financial perceptions are effectively transformed into circular outcomes (Dammert & Nansamba, 2023).

Therefore, we consider access to finance perceptions as a plausible, though context-dependent, mediating mechanism in the BA–CE relationship.

Hypothesis 4: BA membership has an indirect and positive impact on CE through AF.

Institutional quality as a moderator of the circularity model in SMEs

Institutional quality refers to the extent to which a country's institutions, including its government and regulatory bodies, are effective, transparent, stable, and accountable in designing, implementing, and enforcing public policies (Sinha et al., 2019). Following Kaufmann et al. (2010), this study adopts the World Bank's six-dimensional framework, which includes voice and accountability, political stability, government effectiveness, regulatory quality, rule of law, and control of corruption. These dimensions are widely used to assess the quality and reliability of institutional environments at the country level.

Research interest in IQ's impact on CE has recently grown significantly. For example, Hondroyiannis et al. (2024) demonstrated that a direct, positive relationship exists between IQ and recycling rates. Sheraz et al. (2022) argued that poor IQ intensifies environmental deterioration, and others that components of IQ, such as democracy and anti-corruption measures, improve environmental quality (Sinha et al., 2019). Although these studies underline the importance of IQ in the analysis of CE, no research has examined the moderating influence of IQ on the interactions between BA, AF, and EC, which highlights the significance of RQ3. Only Vu and Le (2022), as a future line of research, recognized the importance of analyzing IQ as a possible moderating variable in the study of the interaction of variables such as BA and AF.

In this study, we conceptualize IQ as a contextual moderator rather than a direct determinant of CE adoption. The rationale is that while CE practices in SMEs are driven by firm-level capabilities and access to financial and network resources, the institutional environment conditions the reliability and efficiency of these channels. High-quality

institutions characterized by transparent regulations, predictable enforcement, and effective policy coordination reduce transaction costs and uncertainty, thereby amplifying the ability of BA to mobilize collective resources and of AF to support CE-oriented investments. Conversely, weak institutions may distort financial allocation, reduce trust in collective arrangements, and ultimately weaken SMEs' incentives to engage in CE strategies. This mechanism is consistent with evidence showing that institutional frameworks influence eco-innovation diffusion and shape the effectiveness of resource mobilization (De Jesus & Mendonça, 2018; OECD, 2023; Rodríguez-Pose & DiCataldo, 2015). In addition, IQ enhances the impact of non-financial public entrepreneurship policies, such as training, advisory programmes, and regulatory simplification, because these interventions depend on credible enforcement and trust-building to alter SMEs' behavior. From a theory of change perspective, this means that IQ is a precondition that allows soft policy tools to activate their intended causal pathways. We therefore argue that IQ plays a crucial role in strengthening, or weakening, the association-finance-circularity nexus, justifying its treatment as a moderator in our model.

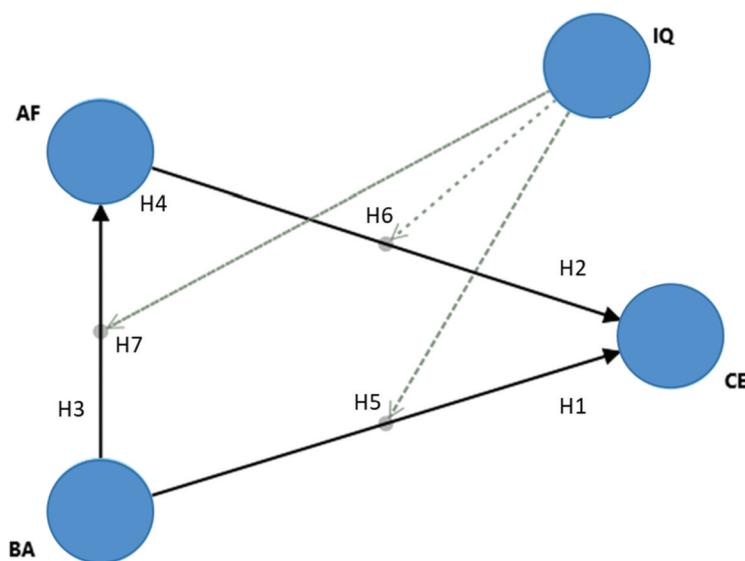
Theoretically, IQ can be expected to strengthen the relationship between BA, AF, and CE outcomes by reducing uncertainty, improving contract enforcement, and enhancing the efficiency of support systems. High IQ environments are associated with better financial development and more effective deployment of green finance, which in turn support CE initiatives (Antwi et al., 2024). Studies show that IQ moderates the relationship between financial mechanisms and sustainable transitions, ensuring that financing flows more effectively toward circular initiatives (Sun et al., 2024). Furthermore, countries with stronger institutions demonstrate a higher capacity to leverage alternative financing mechanisms, such as blended finance, to support SMEs in adopting circular practices (Austin & Rahman, 2022). This capacity extends beyond financial tools and underpins the success of non-financial interventions, reinforcing mentoring, capability-building, and cluster initiatives as legitimate and scalable solutions.

Building on these insights, we hypothesize that IQ positively moderates the effects of both BA and AF on the implementation of CE practices in SMEs:

Hypothesis 5: IQ moderates the relationship between BA and CE.

Hypothesis 6: IQ moderates the relationship between AF and CE.

Hypothesis 7: IQ moderates the relationship between BA and AF.



Note. CE = implementation of circular economy actions,
AF = perceptions of the ease of access to finance,
BA = membership of business associations/industrial clusters,
IQ = institutional quality

Figure 1. Proposed conceptual model. CE = implementation of circular economy actions.

Proposed conceptual model

Based on these arguments, we designed the following conceptual model, which includes the proposed hypotheses (Figure 1).

In summary, the literature indicates that while prior studies have examined SMEs' financial constraints and sustainability adoption, there is still limited understanding of how business associations influence access to finance perceptions and, in turn, CE implementation. Moreover, the role of IQ in conditioning these relationships remains underexplored, despite its centrality in shaping entrepreneurial ecosystems. Building on these gaps, and guided by social capital theory, this study formulates a set of hypotheses (H1–H7) that examine the direct, indirect, and moderated effects of BA, AF, and IQ on SMEs' adoption of CE practices.

Methodology

Data and sample

The analysis drew on data obtained from the Flash Eurobarometer 486 survey (European Commission, 2020b). This survey, conducted across the EU-27 and 12 non-EU countries/territories, focused on the challenges faced by SMEs in Europe in growing, transitioning to more sustainable business models, and

digitizing their operations. The non-EU countries and territories included in the survey were: Bosnia and Herzegovina, Brazil, Canada, Iceland, Japan, North Macedonia, Norway, Serbia, Kosovo, Turkey, the United Kingdom, and the United States. A total of 16,365 responses from micro, small, and medium-sized enterprises (MSMEs) were collected via personal communication between February 19 and May 5, 2020, using a multistage random sampling strategy to ensure cross-country representativeness.

To ensure data quality, we applied a systematic cleaning process. First, we excluded firms with missing values in the variables of our model: CE (186 cases), AF (2,005 cases), BA (38 cases), AGE (390 cases), EMP (149 cases), and TUR (6,414 cases). Second, we removed 10 cases with implausible employee values (for example, 0.9, 1.7, 1.8, 1.9).

After these steps, the final analytical sample comprised 7,680 enterprises. Although the reduction represents a 53 percent retention rate, it results from ensuring completeness and internal consistency. Importantly, because the Flash Eurobarometer applies a multistage random sampling stratified at the country level, the exclusion of cases does not compromise representativeness.

The Flash Eurobarometer 486 database, although comprehensive and widely validated in recent research on SME sustainability, innovation, and digital transformation (for example, Austin & Rahman, 2022; Ardito, 2023; Ferreira et al., 2023; Segarra-Blasco et al., 2024; Suchek et al., 2024; Succurro & Donati, 2025), it presents several methodological limitations that should be acknowledged. Its cross-sectional design prevents the analysis of temporal or causal dynamics, and the number of items available for each construct is relatively limited. Moreover, most variables are perception-based and self-reported, which may introduce respondent bias and restrict analytical depth compared to firm-level administrative or panel data. The binary operationalization of key indicators, such as business association membership and perceived access to finance, also constrains the ability to capture nuances like engagement intensity or actual credit conditions. As with many secondary data sets, our analytical model is conditioned by the availability of survey items. However, the selected variables, BA membership, AF perceptions, CE practices, and IQ, align with prior studies and policy frameworks, ensuring the validity of the operationalization.

Variable measurement

Dependent variable

The dependent variable is circular economy (CE), constructed from four binary items in question Q24 of the Flash Eurobarometer survey (recycling, reducing materials, saving energy, and offering sustainable products/services). Previous studies have used Q24 to create, for example,

a binary variable indicating whether firms adopted at least one of the listed actions (see Austin & Rahman, 2022; Suchek et al., 2024). Other studies (for example, Ardito et al., 2021; Darmandieu et al., 2022; Suchek et al., 2024) have operationalized CE through additive indices (ranging from 0 to 4) that capture the intensity of practices. In line with these approaches, we employed a normalized version by computing the simple average of the four items (ranging from 0 to 1). This strategy, consistent with other sustainability indices such as the human development index (United Nations Development Programme [UNDP], 2009) and the environmental sustainability index (Esty et al., 2005), assumes equal importance of each action while enabling a straightforward interpretation as the proportion of CE practices adopted by each firm.

To assess the validity of this composite measure, we conducted internal consistency and factor analyses. The KR-20 reliability coefficient (equivalent to Cronbach's alpha for binary items) was 0.67, indicating an acceptable level of internal consistency. This value is considered adequate in short scales, as is the case with only four items related to circular practices (Tavakol & Dennick, 2011). Previous literature has noted that reliability coefficients between 0.60 and 0.70 are considered acceptable thresholds in the early stage (Lance et al., 2006). Exploratory factor analysis revealed a unidimensional structure, with a first eigenvalue of 2.03 explaining 51 percent of the variance and factor loadings above 0.62 for all items. Factor loadings above 0.60 are generally regarded as acceptable indicators of construct validity (Hair et al., 2019; Tabachnick & Fidell, 2019). The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was 0.72, which exceeds the minimum recommended value of 0.60 (Kaiser, 1974), confirming good suitability. Together, these results indicate that the four items capture a coherent construct and can be meaningfully aggregated into a single CE index.

Independent variable

The independent variable is business association membership (BA), obtained from question Q9-4 of the Flash Eurobarometer survey. It is constructed as a binary variable equal to 1 if the firm reports being a member of a business association, industry cluster, or other SME support organization in the region, and 0 otherwise.

This operationalization has been employed in previous studies using the same Eurobarometer data (Ardito et al., 2024; Succurro & Donati, 2025), where the variable serves as a proxy for access to collaborative structures and collective resources. While the binary coding does not reflect engagement intensity or association type, it captures the formal link to organizational networks relevant to the theoretical mechanisms of social capital theory.

Mediating variable

Perception of the ease of AF serves as the mediating variable, obtained from question Q17-5 of the survey. In the questionnaire, AF was originally framed as a problem (that is, difficulty accessing finance). However, we reverse-coded this to represent it as a facilitator (that is, ease of access) for consistency with the logic of our conceptual model. The variable equals 1 if the firm did not consider access to finance as one of its top three problems, and 0 otherwise.

Moderating variable

The moderating variable is institutional quality (IQ). To construct this variable, we followed the methodology proposed by Kaufmann et al. (2010), creating a simple aggregated index of national governance dimensions, including political stability, absence of violence, government effectiveness, regulatory quality, rule of law, voice and accountability, and control of corruption. Data were sourced from the World Bank's Worldwide Governance Indicators.

Control variables

We included SME-level controls for firm age (AGE), turnover (TUR), and number of employees (EMP). These variables are commonly accepted in the literature as significant predictors of CE engagement in SMEs (for example, Ferreira et al., 2023; Labella-Fernández et al., 2021).

At the country level, we controlled for macroeconomic and financial development variables such as real GDP per capita growth, inflation, and domestic credit to the private sector, all sourced from the World Bank's World Development Indicators. Additionally, a set of sectoral dummy variables was included to control for industry-specific effects.

Table 2. Descriptive sample variables.

	Values	Frequency	Percentage		Values	Frequency	Percentage			
					CE	AF	BA	IQ	RECYCLNG	Mean
	0	1,265	16.47%			0	1,653	21.52%		
	1	1,490	19.40%			1	6,027	78.48%		
	2	1,495	19.47%			0	6,265	81.58%		
	3	1,774	23.10%			1	1,415	18.42%		
	4	1,656	21.56%							
	0	2,713	35.33%			0	3,838	49.97%		
	1	4,967	64.67%			1	3,842	50.03%		
	REDUCING	0	3,400	44.27%		IQ	1.06	1.15		Máx.
		1	4,280	55.73%						
	SAVING ENERGY	0	3,332	43.39%						
		1	4,348	56.61%						
	SUST. PROD./SERV.	0	4,849	63.14%						
		1	2,831	36.86%						

CE = implementation of circular economy actions, AF = perceptions of the ease of access to finance, BA = membership of business associations/industrial clusters, IQ = institutional quality.

Source: Own elaboration.

Table 2 addresses the variables. Some 16.48 percent of the SMEs undertook no CE, 19.40 percent undertook only one, 19.47 percent undertook two, 23.10 percent undertook three, and 21.56 percent undertook four. The circular action most undertaken was recycling/reuse of materials (64.67 percent), while the least undertaken was the development of sustainable products and services (36.86 percent). Some 78.48 percent of the SMEs found no problem with access to finance, while 21.52 percent did; 18.42 percent belonged to an association/cluster, and 81.58 percent did not. The average value of the IQ index was 1.06, in a range from 0 to 1.75. Nearly half, 49.97 percent, reported low IQ values, the remainder, 50.03 percent, reported high values. These figures were derived by dividing the distribution of the IQ variable by the median value, 1.15.

Methods

As AF is a binary variable, we could analyze the influence of BA on AF using the econometric techniques logit or probit regressions (Hoetker, 2007). We chose logit regression because, in both the Akaike and Bayesian reporting criteria, it provides lower values than the probit regression criterion (Wooldridge, 2012). We used ordinary least squares (OLS) regression to estimate the effects of AF on CE, the mediating effects of AF, and the moderating effects of IQ on these relationships.

Although previous works (Preacher & Hayes, 2004; Zhao et al., 2010) simplified the mediation conditions (the independent variable has a significant effect before adding the mediating variable, but its effect is reduced after the mediating variable is introduced), we used Sobel–Goodman tests (Sobel, 1982) to check the robustness of the mediation. This has been done in previous works (Baron & Kenny, 1986; Erdiaw-Kwasie et al., 2024).

The following conditions must be met (Baron & Kenny, 1986) for AF to be considered a mediator of the BA–CE relationship: (i) the independent variable must significantly affect the mediator; (ii) in the absence of the mediator, the independent variable must significantly affect the dependent variable; (iii) the mediator must significantly affect the dependent variable; and (iv) when incorporating the mediator into the model, the effect of the independent variable on the dependent variable should decrease.

The mediation analysis first examined the effects of BA on AF and the effects of IQ and BA on AF. Thus, we estimated model (1) and extended model (1). In the estimation of model (1), we tested condition (i) of the AF mediation analysis. With the extended model (1), we tested a possible moderated mediation. We estimated model (2), which addresses condition (ii) of the mediating effect of AF. Subsequently, the substituted model (2) and the extended model (2) were estimated, which correspond respectively to conditions (iii) and (iv).

We estimated model (1) to test condition (i), where $AF_{(k,i,c)}$, is a binary variable that measures AF with the value 1 or zero, the dependent variable in model (1); k , i , and c refer to company, sector, and country, respectively. $BA_{(k,i,c)}$ is a binary variable that measures whether the company is a member of an association/cluster with the value 1, or zero otherwise. $AGE_{(k,i,c)}$, $EMP_{(k,i,c)}$ and $TUR_{(k,i,c)}$ are continuous control variables that measure company age, size, and turnover. $IQ_{(c)}$ is a continuous variable that measures a country's IQ. $GDP_{(c)}$ and $INF_{(c)}$ are continuous control variables that measure a country's macroeconomic circumstances. The continuous control variable $BD_{(c)}$ measures a country's financial development. $SEC_{(i)}$ are the binary variables by sector, and error $\varepsilon_{(k,i,c)}$ is the error term. In addition, to analyze the possible moderating mediation, the interaction $BA_{(k,i,c)} * IQ_{(c)}$ (extended model (1)) was added to the previous model). H3 was tested with coefficient 1, and H7 was tested with coefficient 9.

$$\begin{aligned} AF_{(k,i,c)} = & \beta_0 + \beta_1 BA_{(k,i,c)} + \beta_2 AGE_{(k,i,c)} + \beta_3 EMP_{(k,i,c)} + \beta_4 TUR_{(k,i,c)} \\ & + \beta_5 IQ_{(c)} + \beta_6 GDP_{(c)} + \beta_7 INF_{(c)} + \beta_8 BD_{(c)} + \beta_9 BA_{(k,i,c)} * IQ_{(c)} \\ & + SEC_{(i)} + \varepsilon_{(k,i,c)} \end{aligned} \quad (1)$$

To analyze mediation condition (ii), we estimated model (2), where CE is the dependent variable in model (2) of the circular economy actions index, $CE_{(k,i,c)}$; k , i , and c refer to company, sector, and country, respectively. H1 was tested with coefficient 1.

$$\begin{aligned} CE_{(k,i,c)} = & \beta_0 + \beta_1 BA_{(k,i,c)} + \beta_2 AGE_{(k,i,c)} + \beta_3 EMP_{(k,i,c)} + \beta_4 TUR_{(k,i,c)} \\ & + \beta_5 IQ_{(c)} + \beta_6 GDP_{(c)} + \beta_7 INF_{(c)} + \beta_8 BD_{(c)} + SEC_{(i)} + \varepsilon_{(k,i,c)} \end{aligned} \quad (2)$$

To test the effects of AF on the implementation of circular strategies, we estimated model (2) that corresponds to condition (iii), substituting the variable $BA_{(k,i,c)}$ for $AF_{(k,i,c)}$. H2 was tested with coefficient 1 for the substituted model (2).

Finally, to analyze condition (iv), we extended substituted model (2) by adding the variable $BA_{(k,i,c)}$. In this extended, substituted model, H4 (mediation) was tested with coefficient 9 ($\beta_9 BA_{(k,i,c)}$). In addition, we performed a Sobel test, Aroian test, and Goodman test (Aroian, 1947; Goodman, 1960; Sobel, 1982) to assess the presence of an indirect association through the mediator.

To analyze the moderating effects of IQ on the AF-CE and BA-CE relationships, we extended model (2) (model (2) substituted, extended) by including two interactions: $AF_{(k,i,c)} * IQ_{(c)}$ and $BA_{(k,i,c)} * IQ_{(c)}$. If there is moderation in the model, H5 and H6 would be accepted, that is, coefficients 10 and 11 would be significant.

$$\begin{aligned}
CE_{(k,i,c)} = & \beta_0 + \beta_1 AF_{(k,i,c)} + \beta_2 AGE_{(k,i,c)} + \beta_3 EMP_{(k,i,c)} + \beta_4 TUR_{(k,i,c)} \\
& + \beta_5 IQ_{(c)} + \beta_6 GDP_{(c)} + \beta_7 INF_{(c)} + \beta_8 BD_{(c)} + \beta_9 BA_{(k,i,c)} + \beta_{10} AF_{(k,i,c)} * IQ_{(c)} \\
& + \beta_{11} BA_{(k,i,c)} * IQ_{(c)} + SEC_{(i)} + \varepsilon_{(k,i,c)}
\end{aligned} \tag{3}$$

Results

Principal results

The results of the estimated logit models are in [Table 3](#), showing the coefficients, the robust standard errors in parentheses, the hypotheses, and the variance inflation factor (VIF) values of the key variables. The BA variable has a negative, significant coefficient in columns (1) and (2)

Table 3. Logit models with control variables.

	(1) AF	(2) AF		
BA	-0.2387*** (0.0659) VIF: 1.07 <i>H3: Rejected</i>	-0.3729*** (0.1623) VIF: 8.06 <i>H3: Rejected</i>		
AGE	0.1582*** (0.0417)	0.1584*** (0.0416)		
EMP	0.0714*** (0.0202)	0.0711*** (0.0203)		
TUR	0.0521*** (0.0172)	0.0526*** (0.0174)		
GDP	0.0052 (0.0386)	0.0057 (0.0385)		
INF	0.0482** (0.0196)	0.0501** (0.0201)		
BD	-0.0012 (0.0025)	-0.0011 (0.0026)		
IQ	0.7011*** (0.1686)	0.6805*** (0.1814)		
IQ*BA		0.1183 (0.1492) VIF: 8.45 <i>H7: Rejected</i>		
Constant	-1.4436*** (0.3780)	-1.4379** (0.3765)		
SEC	Yes	Yes		
Observations	7680	7680		
Log-pseudolikelihood	-3848.1013	-3847.8061		
Wald chi(2)	1810.78***	1894.90***		
Hosmer–Lemeshow test	Pearson chi(2) 7647.60	p-value 0.5120	Pearson chi(2) 7647.32	p-value 0.5097
AUC	0.6376	0.6376		

* $p < .10$; ** $p < .05$; *** $p < .01$; robust s.e. clustered by country in parenthesis; CE = implementation of circular economy actions; AF = perceptions of the ease of access to finance; BA = membership of business associations/industrial clusters; AGE = company age; EMP = number of employees; TUR = turnover; GDP = gross domestic product; INF = infraction; BP = bank development; IQ = institutional quality; VIF = variance inflation factor; SEC = sector.

Source: Own elaboration.

Table 4. OLS models with control variables.

	(3) CE	(4) CE	(5) CE	(6) CE	(7) CE	(8) CE
AF		-0.0302** (0.0134)	-0.0264* (0.0137)	-0.0594** (0.0251)	-0.0262* (0.0136)	-0.0592** (0.0251)
		VIF: 1.04	VIF: 1.04	VIF: 4.61	VIF: 1.04	VIF: 4.61
		H2: Rejected				
BA	0.1157*** (0.0152)		0.1147*** (0.0153)	0.1147*** (0.0152)	0.1582*** (0.0439)	0.1583*** (0.0439)
		VIF: 1.07	VIF: 1.07	VIF: 1.07	VIF: 8.06	VIF: 8.06
		H1: Accepted	H4: Accepted	H4: Accepted	H4: Accepted	H4: Accepted
AGE	0.0176*** (0.0053)	0.0205*** (0.0050)	0.0183*** (0.0054)	0.0182*** (0.0054)	0.0182*** (0.0053)	0.0182*** (0.0053)
EMP	0.0279*** (0.0052)	0.0281*** (0.0052)	0.0281*** (0.0052)	0.0280*** (0.0052)	0.0282*** (0.0052)	0.0281*** (0.0051)
TUR	0.0029 (0.0040)	0.0046 (0.0040)	0.0032 (0.0040)	0.0032 (0.0040)	0.0030 (0.0040)	0.0031 (0.0040)
GDP	-0.0135 (0.0140)	-0.0148 (0.0146)	-0.0133 (0.0140)	-0.0126 (0.0140)	-0.0133 (0.0140)	-0.0126 (0.0140)
INF	0.0076 (0.0091)	0.0105 (0.0091)	0.0078 (0.0090)	0.0080 (0.0090)	0.0073 (0.0091)	0.0074 (0.0090)
BD	0.0007 (0.0008)	0.0008 (0.0008)	0.0007 (0.0008)	0.0007 (0.0008)	0.0007 (0.0008)	0.0007 (0.0008)
IQ	0.0999* (0.0578)	0.1107* (0.0578)	0.1030* (0.0568)	0.1112* (0.0556)	0.1087* (0.0567)	0.1170** (0.0567)
IQ*AF				0.0341* (0.0192)		0.0341* (0.0192)
				VIF: 4.63		VIF: 4.63
				H5: Accepted		H6: Rejected
IQ*BA					-0.0359 (0.0405)	-0.0359 (0.0404)
					VIF: 8.45	VIF: 8.45
constant	0.2330** (0.0850)	0.2115** (0.0881)	0.2407*** (0.0851)	0.2638*** (0.0905)	0.2380*** (0.0845)	0.2611*** (0.08974)
SEC	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7680	7680	7680	7680	7680	7680
VIF	4.17	4.17	4.04	4.22	4.51	4.67
R-squared	0.1235	0.1092	0.1244	0.1249	0.1248	0.1252
Ajusted R-squared	0.1209	0.1065	0.1218	0.1220	0.1219	0.1223
F statistics	74.38***	103.7000***	72.99***	82.29***	147.81***	167.08***

* $p < .10$; ** $p < .05$; *** $p < .01$; robust s.e. clustered by country in parenthesis; CE = implementation of circular economy actions; AF = perceptions of the ease of access to finance; BA = membership of business associations/industrial clusters; IQ = institutional quality; AGE = company age; EMP = number of employees; TUR = turnover; GDP = gross domestic product; INF = infraction; BP = bank development; IQ = institutional quality; SEC = sector; VIF = variance inflation factor.

Source: Own elaboration.

(Model 1: $= -0.238$, $p < .01$; Model 2: $= -0.373$, $p < .01$). H3 is, therefore, rejected, as SMEs in associations/clusters perceive more access problems to finance than do nonmembers. In addition, IQ*BA is not shown to be significant in AF. Therefore, we reject H7, the moderation effect of IQ in the BA-AF relationship.

Table 4 presents the results of the effects of BA in column (3), the effects of AF in column (4), and the mediating effect of AF in column (5), on CE. The results of the moderating effects of IQ are shown in columns (6), (7), and (8). This table shows the coefficients, the robust standard

errors in parentheses, the hypotheses tested, and the VIF values of the key variables.

As to our key variables, AF is negative and significant in all estimated models (4)-(8) ((4): = -0.030, $p < .05$; (5) = -0.0264, $p < .10$; (6) = -0.0594, $p < .05$; (7) = -0.0262, $p < .10$; (8) = -0.0592, $p < .05$); therefore, H2 is rejected. BA has a positive, significant coefficient (3), (5)-(8) ((3) = 0.1157, $p < .01$; (5) = 0.1147, $p < .01$; (6) = 0.1147, $p < .01$; (7) = 0.1582, $p < .01$; (8) = 0.1583, $p < .01$), accepting H1, given that SMEs in associations/clusters take more circular actions than nonmembers (all other variables being constant).

Consistent with mediation conditions, AF relates to BA and CE, and the BA coefficient attenuates when AF is included in regression (5), the effects of BA decrease ((3): = 0.1157, $p < .01$; (4) = 0.1147, $p < .01$); we interpret this as statistical evidence consistent with a partial indirect association (H4) rather than a definitive causal mechanism.

We used robust standard errors clustered at the country level to correct for heteroscedasticity and account partially for within-country correlations. To test for multicollinearity, we computed variance inflation factors (VIFs) and the condition index for each model. The highest observed VIF was 4.67, well below the threshold indicating multicollinearity concerns (Hair et al., 2010).

To assess the significance of the indirect effect, we applied the Aroian (1947), Goodman (1960), and Sobel (1982) tests, which differ in how the standard error is calculated. The results, presented in Table 5, indicate statistical significance at the 1 percent level across all three tests, rejecting the null hypothesis. These findings are consistent with partial mediation in cross-sectional data, as the effect of BA on CE is not reduced to zero when AF is introduced. In sum, the data are consistent with BA, showing a positive indirect association with CE via AF.

The IQ variable is positive and significant in columns (3): = 0.0999, $p < .10$; (4): = 0.1107, $p < .10$; (5) = 0.1030, $p < .10$; (6) = 0.1112, $p < .10$; (7) = 0.1087, $p < .10$; (8) = 0.1170, $p < .05$. Therefore, it is possible to analyze the moderating effect of IQ on the model's relationships.

The results show that IQ*AF moderation has a positive effect on CE: (6) = 0.0341, $p < .10$; (8) = 0.0341, $p < .10$). Therefore, H6 is accepted. On the other hand, IQ*BA had no effect on CE. Therefore, we reject H5.

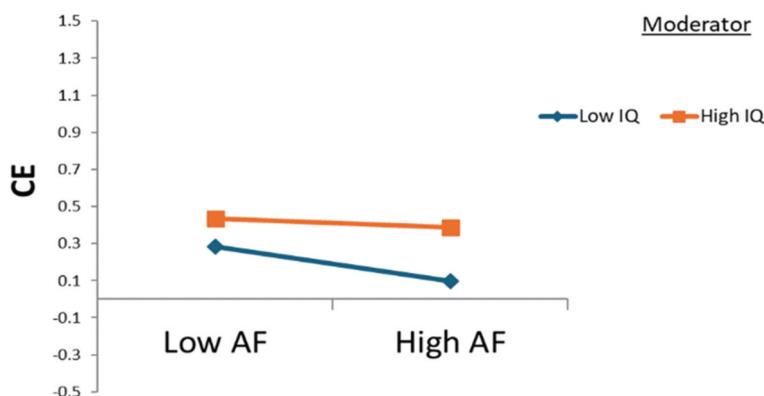
The moderation analysis (Figure 2) shows that the negative slope of AF over CE decreases as IQ increases. This suggests that IQ modifies the AF-CE

Table 5. Indirect effects tests.

	AF mediator measurement		
	Test statistics	Std. Error	P-value
Sobel test	-3.27	0.01	0.00
Aroian test	-3.06	0.01	0.00
Goodman test	-3.21	0.01	0.00

AF = perceptions of the ease of access to finance.

Source: Own elaboration.



Note. CE = implementation of circular economy actions;
AF = perceptions of the ease of access to finance;
IQ = institutional quality

Figure 2. Moderator role of IQ in the AF-CE relationship. CE = implementation of circular economy actions.

Table 6. Hypotheses testing results.

Hypothesis	Expected relationship	Result	Significance	Conclusion
H1	BA → CE (+)	$\beta = 0.1157$	$p < .01$	Accepted
H2	AF → CE (+)	$\beta = -0.0302$; $\beta = -0.0264$; $\beta = -0.0594$; $\beta = -0.0262$; $\beta = -0.0592$	$p < .05$; $p < .10$; $p < .05$; $p < .10$; $p < .05$	Rejected
H3	BA → AF (+)	$\beta = -0.2387$; $\beta = -0.3729$	$p < .01$; $p < .01$	Rejected
H4	BA → AF → CE	Sobel = -3.27 Aroian = -3.06 Goodman = -3.21	$p < .01$	Accepted
H5	IQ moderates AF → CE	$\beta = 0.0341$	$p < .10$	Accepted
H6	IQ moderates BA → CE	Not significant	-	Rejected
H7	IQ moderates BA → AF	Not significant	-	Rejected

relationship; that is, in high-IQ countries, AF is not as decisive in CE as it is in weak-IQ countries.

The results suggest that BA has a partial compensatory effect in countries with low IQ, given that it has a direct, positive impact on AF, an indirect, positive impact on CE through AF, and, in addition, IQ moderates the AF-CE relationship. Table 6 shows briefly to what extent our hypotheses are confirmed or not.

Robustness checks

A central concern in causal inference using cross-sectional data is the potential endogeneity of key explanatory variables such as BA membership and AF. Reverse causality is plausible: SMEs already engaged in CE activities may be

**Table 7.** Instrumental variable analysis.

Variables	(1) BA		(2) BA		(3) AF		(4) BA		AF
	(1)	(2)	(1)	(2)	(3)	(4)	(1)	(2)	
Panel A. First-stage results.									
BAVG COUNTRY	0.9510*** (0.039)	0.9509*** (0.039)	0.0320** (0.014)	0.0315** (0.014)	—	—	0.9408*** (0.067)	—	-0.0955 (0.082)
NEAREUCOUNTRY	—	—	—	—	-0.2380*** (0.025)	0.0582** (0.027)	0.0258 (0.032)	0.0237*** (0.024)	—
NOTSOURCES	—	—	—	—	0.0051*** (0.022)	0.0230 (0.017)	0.0651*** (0.022)	0.0651*** (0.022)	—
QUALSUPP	—	—	—	—	0.0443*** (0.013)	0.0163 (0.011)	0.0445*** (0.013)	0.0445*** (0.013)	—
AGE	0.0122** (0.004)	0.0122** (0.005)	0.0122** (0.005)	0.0122** (0.005)	0.0185*** (0.003)	-0.0058 (0.009)	0.0164** (0.007)	-0.0059 (0.009)	—
EMP	0.0185*** (0.005)	0.0033** (0.003)	0.0033 (0.002)	0.0033 (0.002)	0.0090 (0.006)	0.0024 (0.005)	0.0093 (0.006)	0.0024 (0.005)	—
TUR	-0.0008 (0.003)	-0.0008 (0.003)	-0.0008 (0.003)	-0.0008 (0.003)	0.0180* (0.011)	0.0045 (0.008)	0.0162 (0.011)	0.0045 (0.008)	—
GDP	0.0010 (0.003)	0.0010 (0.003)	0.0010 (0.003)	0.0010 (0.003)	0.0069 (0.006)	0.0017 (0.005)	0.0087 (0.006)	0.0087 (0.006)	—
INF	0.0000 (0.000)	0.0000 (0.000)	0.0000 (0.000)	0.0000 (0.000)	0.0003 (0.000)	0.0001 (0.000)	0.0004 (0.000)	0.0004 (0.000)	—
BD	0.0028 (0.012)	0.0028 (0.012)	0.0028 (0.012)	0.0028 (0.012)	0.1257*** (0.031)	-0.0170 (0.025)	0.1307** (0.031)	0.1307** (0.031)	—
IQ	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SEC	-0.1331*** (0.051)	-0.1331*** (0.050)	-0.1331*** (0.050)	-0.1331*** (0.050)	0.1529 (0.160)	-0.1915 (0.13)	0.133 (0.160)	0.133 (0.160)	—
Constant	0.0212 (0.052) ($p = .689$)	—	—	—	—	—	—	—	—
Athrho	$\chi^2 (1) = 0.16$ ($p = .689$)	—	—	—	—	—	—	—	—
Wald test of exogeneity	—	—	—	—	—	—	—	—	—
R ² /Adj. R ²	—	—	—	—	—	—	—	—	—
F test	—	—	—	—	—	—	—	—	—
Durbin-Wu-Hausman test	—	—	—	—	—	—	—	—	—
Sargan test	—	—	—	—	—	—	—	—	—
Stock-Yogo	—	—	—	—	—	—	—	—	—
Observations	7,659	7,659	440,348 (>19,93, 10% level)	7,659	54,55 (>19,93, 10% level)	1,429	26,51 (>16,87, 10%)	1,427	—
Variables	AF	AF	CE	CE	CE	CE	CE	CE	CE
Panel B. Second-stage results									
BA	-0.1896 (0.139)	0.3528*** (0.0318)	—	—	-0.1709*** (0.082)	0.3473*** (0.076)	—	—	—
AF	—	—	0.0130*** (0.004)	0.0130*** (0.004)	0.0302** (0.012)	-0.1351* (0.083)	0.0211* (0.0127)	0.0211* (0.0127)	0.0211* (0.0127)
AGE	0.0925*** (0.019)	0.0391*** (0.014)	0.0246*** (0.003)	0.0246*** (0.003)	0.0225*** (0.008)	0.0178** (0.007)	0.0178** (0.007)	0.0178** (0.007)	0.0178** (0.007)
EMP	0.0323*** (0.009)	0.0323*** (0.009)	0.0002 (0.002)	0.0002 (0.002)	0.0142** (0.005)	0.0101* (0.005)	0.0101* (0.005)	0.0101* (0.005)	0.0101* (0.005)
TUR	0.0026 (0.015)	0.0026 (0.015)	-0.0104*** (0.004)	-0.0104*** (0.004)	-0.0147 (0.009)	-0.0118 (0.009)	0.0028 (0.0056)	0.0028 (0.0056)	0.0028 (0.0056)
GDP	0.0293*** (0.015)	0.0293*** (0.015)	0.0020 (0.002)	0.0020 (0.002)	0.0102* (0.005)	0.0007* (0.000)	0.0000 (0.000)	0.0000 (0.000)	0.0000 (0.000)
INF	-0.0005 (0.000)	—	0.0004*** (0.000)	0.0004*** (0.000)	0.0007* (0.000)	0.1397*** (0.000)	0.1222*** (0.029)	0.1222*** (0.029)	0.1222*** (0.029)
BD	0.4068*** (0.046)	—	0.0847*** (0.011)	—	—	—	—	—	—
IQ	—	—	—	—	—	—	—	—	—

(Continued)

**Table 7.** (Continued).

Variables	(1)		(2)		(3)		(4)	
	BA	AF	BA	AF	Yes	AF	BA	AF
SEC	Yes		Yes		Yes		Yes	
Constant	-0.8343*(0.193)		0.2486*** (0.083)		0.253* (0.136)		0.3761** (0.140)	
Wald χ^2	287.18***		1119.33***		215.66***		231.03***	
Observations	7,659		7,659		1,429		1,427	

This table reports the first- and second-stage regression of the instrumental variable analysis. The independent variables in the second-stage analyses are AF (1) and CE (2) (3) (4). Results from columns 1 and 2, consider BA endogenous; column 3, AF endogenous, and column 4, BA and AF endogenous. ***, **, * indicate statistical significance at the 1%, 5%, and 10% level, respectively; robust s.e. clustered by country in parenthesis; CE = implementation of circular economy actions; AF = perceptions of the ease of access to finance; BA = membership of business associations/ industrial clusters; BAAVG COUNTRY = the country average of BA excluding the focal unit; NEAREUCOUNTRY = the firm is located near a border with an EU country; NOISOURCES = the firm does not have the financial resources to grow; QUALSUPP = the quality of business support services; AGE = company age; EMP = number of employees; TUR = turnover; GDP = gross domestic product; INF = infraction; BP = bank development; IQ = institutional quality; SEC = sector.
Source: own elaboration.

more likely to join associations, and financially constrained firms may selectively seek membership in search of support. Concerns about simultaneity, reverse causality, and endogeneity are well recognized in the management literature (Antonakis et al., 2010; Hamilton & Nickerson, 2003; Semadeni et al., 2014).

To address this, we employed IV methods. Specifically, IV-Probit was used for the AF equation (binary outcome and endogenous binary regressor), while 2SLS was used for CE (continuous outcome). As reported in Table 7, in the IV-Probit estimations BA does not significantly predict AF once instruments are included, and the Wald test of exogeneity ($p = .69$) indicates no endogeneity. In the 2SLS estimations, instruments are strong (first-stage F-statistics $>$ Stock—Yogo thresholds), and overidentification tests do not reject instrument validity. The Durbin–Wu–Hausman tests suggest that BA and AF may be endogenous, yet the second-stage results remain consistent in sign and magnitude with the OLS estimates.

These results confirm that BA is positively associated with CE, AF remains negatively associated, and IQ retains its enabling role. While causal inference is inherently limited in cross-sectional designs, the convergence of OLS and IV estimates strengthens confidence that findings are not driven by endogeneity bias (Antonakis et al., 2010; Wooldridge, 2010). This convergence implies that our findings are not artifacts of endogeneity, but reflect stable and robust associations.

In addition, a split-sample analysis by IQ shows that AF negatively affects CE only in low-IQ countries, while BA has a positive and significant effect in both contexts. IQ itself is significant only in the high-IQ group, underscoring its role as an enabling institutional factor.

Taken together, these additional checks reinforce the robustness of our findings while also highlighting the contextual relevance of institutions.

Discussion and conclusions

Discussion

The study's results suggest that, in the context of CE strategies, SMEs may benefit from belonging to business associations/industrial clusters and from perceiving easier access to finance. Specifically, being a member of a business association/industrial cluster is positively associated with the implementation of CE actions, which supports previous arguments about the importance of extending these relationships (Ferasso et al., 2024; Liu, 2014). This interpretation is consistent with other SCT studies (De Chiara, 2016; Hock-Doepgen et al., 2021; Putnam, 2015), which argue that business networks (the linking dimension of SCT) strengthen collaboration and access to shared resources. Conversely, the results also

indicate that SMEs reporting greater financial constraints appear, on average, to engage in more circular actions, though this finding should be treated cautiously given its modest size and potential context-specific influences.

From a policy perspective, these results illustrate how non-financial interventions (BA) such as networking platforms, advisory services, and knowledge-sharing initiatives operate as enabling mechanisms that lower barriers and facilitate SME engagement in the circular economy. This suggests that, within a theory of change perspective, the pathway from financial perceptions to CE adoption is not linear but contingent under conditions of scarcity, non-financial supports, and entrepreneurial bricolage can substitute for capital-intensive investments. Our findings confirm that non-financial supports (for example, business associations, advisory networks) operate as enabling forms of social and human capital that complement financial capital. This aligns with Dvoulety's (2023) evidence that non-financial instruments reinforce firms' capacity to leverage financial resources effectively.

To interpret the paradoxical mediation result, we consider two complementary perspectives. On the one hand, negative perceptions of access to finance may reflect genuine resource constraints that limit SMEs' ability to undertake resource-intensive CE investments. Prior research highlights financing barriers as one of the most influential obstacles to SME sustainability and circular practices (for example, Durrani et al., 2024). Under this view, perceptions of poor financial access capture real constraints that hinder CE adoption. On the other hand, financial scarcity can paradoxically act as a driver of innovation. Building on the notion of constraint-driven innovation (Radjou et al., 2012) and the Porter hypothesis (Porter & Linde, 1995), resource scarcity and external pressures can, under certain conditions, act as stimuli for efficiency improvements and eco-innovation. Rather than being solely limiting, such constraints may encourage firms (particularly SMEs) to experiment with frugal or process-oriented solutions that enhance sustainability.

Empirical evidence supports this interpretation. Despite barriers such as limited financial resources and technical capabilities, SMEs often engage in relatively low-cost, high-impact CE practices (such as recycling, resource efficiency, or closed-loop processes) that demand little upfront investment but yield immediate operational savings (De Jesus & Mendonça, 2018; Rizos et al., 2016). Recent studies have confirmed that frugal innovation and entrepreneurial bricolage enable SMEs to pursue circular strategies under resource constraints, of which financial limitations are a critical dimension (Dost et al., 2025; Perera & Badir, 2025; Ur Rehman et al., 2024). This dual perspective is consistent with the resource-based view. While significant CE investments require substantial resources, SMEs can still progress toward circularity through incremental or frugal practices when motivated by necessity. Thus,

perceptions of poor financial access may either signal an actual barrier or reflect adaptive innovation pathways that emerge under resource scarcity.

Nevertheless, these findings should be interpreted with caution, as they may reflect context-specific dynamics rather than universally generalizable relationships. Prior research has shown that the influence of financial constraints on sustainable practices adoption varies substantially across countries and sectors, depending on institutional quality, cultural norms, and regulatory frameworks (Demirel & Danisman, 2019; Horbach et al., 2012).

Differences with Tang (2022) and Jesus et al. (2023) may be due to measurement validity and theoretical specification issues. While our indicator of “perceived ease of access to finance” derives from a broad Eurobarometer item, other studies have relied on more specific measures (for example, actual credit volume, loan conditions, or investment intensity). Such methodological differences may partly explain divergent results, since perceived financial access does not necessarily coincide with actual access to financial resources (Demirel & Danisman, 2019; Ghisetti & Rennings, 2014). Future research should systematically compare different operationalizations to strengthen construct validity.

An additional observation is that SMEs that are members of an association/cluster tend to report greater difficulties in perceiving ease of access to finance. This result contributes to ongoing discussions on the relationship between associations/clusters and financing (along the lines of Owolabi & Pal, 2012; Öztürk & Mrkaic, 2014), but also the perception of access to finance as a problem (Bańkowska et al., 2020). This may lead us to develop models where there may be contradictions between perceptions and the achievement of financing. This paradox underscores the need for complementary non-financial policies that not only mobilize resources but also address perception gaps, for example, through BA mentoring, training, or simplified procedures that reduce uncertainty in financial relations.

We found some evidence that IQ may positively moderate the relationship between SMEs’ perceptions of ease of access to finance and taking circular actions, suggesting that, in low-IQ countries, companies find support mechanisms for their circular actions not based on perceptions of ease of access to finance. This points to the potential value of integrating IQ into analyses of financing and national development (as discussed by Zeqiraj et al., 2022). However, IQ was not found to exert a significant moderating effect in the association/cluster membership-circular actions relationship, nor between association/cluster membership and perceptions of ease of access to finance, which could indicate that SME associations/clusters operate independently of the local institutional quality environment.

This confirms that IQ functions as a precondition in the causal chain, enabling non-financial public policies to deliver their intended outcomes. Where institutions are strong, business association membership and advisory

programs become more effective; where institutions are weak, associations may partially compensate, but outcomes remain uneven.

While the theoretical model tested in this study provides novel insights, some hypotheses were not validated by the empirical analysis. This outcome should not be interpreted as a weakness but as an indication that the mechanisms linking financing, IQ, and association membership to circular adoption are more nuanced than initially assumed. Future studies could refine the model by: (i) incorporating alternative measures of financial access that capture both perceptions and objective conditions, (ii) exploring additional moderating factors such as sectoral dynamics or regional policies, and (iii) employing longitudinal or experimental designs to better assess causal mechanisms. These steps would improve the explanatory power of the model and advance the understanding of when and how SMEs adopt circular practices.

Theoretical implications

This study offers several theoretical insights First, by embedding non-financial public entrepreneurship policies within the SCT framework, the study clarifies how intangible resources (trust, legitimacy, and knowledge) translate into practical support mechanisms for SMEs.

Second, this study applies and adapts SCT to the circular economy context of SMEs, showing both enabling and constraining effects of business associations on resource perceptions. While SCT generally predicts positive network benefits, our findings reveal that association membership may also heighten awareness of financing barriers, thereby complicating the expected relationship. We consider this paradox valuable, as it nuances SCT predictions and highlights boundary conditions for its application in sustainability transitions.

Third, we found empirical evidence suggesting that association/cluster membership may facilitate SMEs' transition toward the circular model. This illustrates an application of SCT in the sustainability field and contributes to addressing the research gap identified by Ferasso et al. (2024).

Fourth, we found evidence consistent with a mediating role of SMEs' perceptions of ease of access to finance. The results indicate a partial indirect association between association/cluster membership and circular actions via these perceptions. This emphasizes the need to consider financial (Vu & Le, 2022) and non-financial variables (Dvouletý et al., 2021) in studies into SME corporate sustainability.

Fifth, we observed that IQ appears to positively moderate the relationship between SMEs' perceptions of ease of access to finance and their taking of circular actions; thus, the analysis of IQ is important in the transition to

sustainable models. This confirms that IQ is not just a contextual background but an active moderator that determines whether non-financial entrepreneurship policies can achieve systemic impact.

Our findings tentatively suggest that, in low institutional quality countries, association/cluster membership may partially compensate. However, it is not clear whether there is a substitution effect of business association/cluster membership on IQ and on perceptions of ease of access to finance, which requires further analysis in future research.

Practical implications

From an applied perspective, the findings of this study offer tentative insights for entrepreneurs, policymakers, and associations/clusters interested in boosting circularity in the SME sector.

First, the results suggest that association/cluster membership may play an important role in supporting the adoption of circular models. Partnerships could be strengthened as platforms for knowledge exchange, collaboration, and access to resources, thereby fostering business ecosystems that support sustainable strategies. These implications should be interpreted with awareness of the study's cross-sectional design, and future longitudinal or panel data would further strengthen the causal interpretation.

Second, our findings suggest that business associations should be recognized as key intermediaries of non-financial public entrepreneurship policies, from mentoring and training to incubation, digital support, and regulatory hubs, ensuring that SMEs receive comprehensive support beyond finance.

Third, the results suggest that SMEs may benefit from financial strategies that help them overcome economic constraints in their transition to the circular economy. Policymakers could consider facilitating access to financing. Financial intermediaries should develop products and services tailored to the needs of SMEs, such as preferential-rate loans, specialized investment funds, and financing schemes based on companies' environmental performance.

Fourth, policy actions currently support SME circularity. In the European Union, several instruments are already operationalizing the transition for smaller firms. First, market-shaping regulation under the Ecodesign for Sustainable Products Regulation introduces circularity by design requirements and the Digital Product Passport, reducing information frictions along supply chains and enabling secondary markets for repair, remanufacturing, and recycling (European Commission, 2025; European Union, 2024). Second, disclosure and finance alignment, via the Corporate Sustainability Reporting Directive and the EU Taxonomy for sustainable activities, increase the salience and comparability of environmental performance, channeling capital toward circular investments by SMEs and their financiers (European Union, 2022, 2020). Third, dedicated finance vehicles complement bank lending: the Invest

EU SME window supports circular projects and guarantees, while the European Investment Bank and the European Bank for Reconstruction and Development offer targeted credit lines and technical assistance for green and circular upgrades (European Bank for Reconstruction and Development, 2025; European Commission, 2025). Beyond the EU, China's Circular Economy Promotion Law and Japan's Basic Act for Establishing a Sound Material Cycle Society provide national frameworks that have inspired sector-specific circular programs for SMEs (Ministry of the Environment, Government of Japan, 2000). Consistent with our results, these instruments can strengthen the association-finance-circularity nexus by lowering transaction costs, improving the credibility of circular investments, and scaling capability building, especially where institutional quality is high and implementation capacity is strong (OECD, 2023).

Fifth, nonetheless, evidence on the moderating role of IQ suggests that policies should be adapted to each context. In low-IQ countries, to address the lack of efficient institutional and financial structures, governments might view associations/clusters as potentially important supports for SMEs. In countries with weak institutions, policy entrepreneurs should prioritize soft interventions that build trust and reduce information asymmetries, while in strong institutional contexts these interventions can be scaled and combined with financial mechanisms for greater impact.

Sixth, the results also indicate that SMEs' perceptions that they face difficulties in access to finance need not always be an obstacle to circularity—in some cases, they might incentivize innovative solutions. This finding suggests that policies should focus on boosting innovation in SMEs and promoting business models based on resource efficiency, reuse, and industrial symbiosis.

Finally, associations/clusters could potentially take on a stronger role as facilitators of sustainability-focused financing. Strategic alliances between banks, investors and public bodies can create circular economy-specific financial mechanisms, improve SMEs' perceptions of the access to finance process and reduce the economic and bureaucratic barriers they currently face.

Limitations and future research lines

This study has limitations. First, while we acknowledge that the use of secondary data, such as that from the Flash Eurobarometer 486, may involve potential limitations, such as limited detail on sectoral sampling or non-response rates, this database has been widely employed in high-impact academic studies. Its methodological rigor and broad coverage across European and non-European SMEs make it a reliable source for large-scale research. Nevertheless, relying on a cross-sectional secondary source such as Flash Eurobarometer 486 imposes hard constraints on variable design and construct coverage. Beyond the issues already acknowledged, the data set lacks direct

measures of human and intellectual capital, dynamic capabilities, and organizational learning—dimensions that theory and policy increasingly view as complementary to financial and social capital in shaping SME sustainability. As credible alternatives, future work should integrate multi-source data (linking survey responses with administrative records and financial statements) and develop sector- and region-specific modules to recover missing heterogeneity in skills, knowledge assets, and capability building. In doing so, researchers would move beyond perception-only indicators and improve both construct validity and policy relevance of CE analyses in SMEs.

Second, the use of secondary data from Flash Eurobarometer 486 implies constraints regarding variable selection, measurement accuracy, and potential omitted constructs such as dynamic capabilities, environmental performance, or organizational learning. Future studies could overcome these issues by collecting primary data or integrating multi-source data sets that capture firm-level, sectoral, and institutional dimensions in greater detail.

Third, the cross-sectional design limits causal inference. Longitudinal or panel data could allow researchers to examine temporal dynamics in SME circular transitions, capturing how business association membership and financial perceptions evolve over time. Experimental and quasi-experimental designs could also enhance causal validity.

Fourth, the study does not examine specific sectors within SMEs, and the circumstances may differ between sectors. Future sectoral-focused studies might identify differences in the implementation of circular actions based on business type.

Fifth, institutional quality is measured at the country level; that is, regional variations are not addressed. Future studies might explore IQ at the regional level to gain a more nuanced understanding of its influence.

Sixth, although our CE measure is consistent with prior research (Ardito et al., 2021; Darmandieu et al., 2022; Suchek et al., 2024) and widely used sustainability indices (Esty et al., 2005; UNDP, 2009), it necessarily assumes equal weight for actions of potentially different transformative impact (for example, recycling versus developing sustainable products). While reliability ($KR-20 = 0.67$) and factor analysis support the coherence of the construct, we acknowledge that future research should explore alternative weighting schemes, validate CE indices against objective environmental performance indicators, and assess longitudinal consistency. Future research could employ multi-item scales or latent-variable modeling to capture the multidimensional nature of the circular economy.

Seventh, another limitation of this study relates to the operationalization of business association membership. Due to the structure of the Flash Eurobarometer 486 survey, BA is measured as a simple binary variable indicating whether a firm reports membership in a business association, industry

cluster, or SME support organization. While this coding follows previous research using the same data set (for example, Succurro & Donati, 2025), it does not capture important nuances such as the type of association, level of engagement, frequency of interaction, or quality of support received. As such, the variable should be interpreted as a proxy for formal network participation rather than a comprehensive measure of social capital embeddedness. Future studies could enhance this dimension by employing multi-item engagement scales, richer administrative data, or qualitative methods to better examine the depth and mechanisms of associative collaboration among SMEs.

Eighth, despite the reassuring convergence across OLS, 2SLS, and IV-Probit specifications, some limitations remain. On the one hand, although our IV-Probit analysis suggests that BA is not endogenous to AF, IV models tend to be less precise than standard Logit/Probit estimates, particularly with complex survey data. On the other hand, instrument availability is inherently constrained in cross-sectional surveys. Although our instruments pass standard tests of relevance and validity, they may not capture all unobserved confounders (Larcker & Rusticus, 2010; Roberts & Whited, 2013). For these reasons, our results should be interpreted as robust associations rather than definitive causal claims, and future research using longitudinal or quasi-experimental designs is warranted.

Ninth, while institutional variables such as IQ are inherently complex, and unobserved institutional features may also play a role, our moderation and split-sample analyses provide supportive evidence of its relevance in shaping CE outcomes. We acknowledge that establishing strict exogeneity of institutional measures in cross-sectional data is challenging, but our approach offers a reasonable and transparent robustness check. Future research could build on this by using panel data or quasi-experimental designs to further strengthen causal inference.

Tenth, the empirical analysis did not validate all the hypotheses derived from the proposed model, which limits its explanatory power. This should be seen as a call for refinement rather than a weakness. Future research could address this by employing more detailed indicators of financial access, incorporating sector- and region-specific moderators, and applying longitudinal or quasi-experimental designs to capture causal dynamics. Such methodological and theoretical improvements would help determine under which conditions business associations, institutional quality, and financing jointly foster circular adoption in SMEs.

Finally, long-term analyses of the transition toward CE models should be undertaken—longitudinal studies that allow the observation of the evolution of business strategies and their impact on the sustainable performance of SMEs. It would also be valuable to incorporate qualitative analyses to complement the quantitative findings and provide a deeper perspective of the barriers/enablers of circularity in SMEs. In addition, it would be advisable to

analyze the possible substitution effect of association/cluster membership on IQ and on SMEs' perceptions of ease of access to finance.

In addition to methodological extensions, our findings also raise theoretical implications that deserve further attention. The contradictions with previous studies do not invalidate SCT, but suggest that its application to the SME circular economy context may benefit from being complemented by other perspectives. In particular, integrating SCT with institutional theory and resource dependence theory would allow researchers to capture how IQ, incentive structures, and power relations shape the effectiveness of business associations and access to finance in driving circular transitions. This complementary theoretical agenda would help explain why results differ across contexts and identify the conditions under which resource scarcity acts as a driver of innovation rather than a barrier.

We also consider it relevant that future research deepens the analysis of how SME business association membership acts as an intermediary of non-financial forms of public entrepreneurship and how these mechanisms shape SME circular transitions. Future research could also analyze how different forms of capital (financial, human, and social) interact to shape SME sustainability and circular transition outcomes. Subsequent studies could explore the effectiveness of different policy mixes that combine financial and non-financial instruments and examine how these dynamics unfold across different contexts of institutional quality.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

The work was supported by the Andalusian Public Foundation Centro de Estudios Andaluces (ROR: <https://ror.org/05v01tw04>) through project PRY122/22 titled "Reconciling Andalusian Companies with Their Environment: Proposals for Sustainable Corporate Governance [Crossref Funder ID 100019858]; Chair of Innovation and Smart Management for the green transition [8.07/5.14.6273]; PRY081/22 project titled: 'Seeking the sustainability of organizations in strategic sectors: tourism and bioeconomy' to the Andalusian Public Foundation Centro de Estudios Andaluces (ROR: <https://ror.org/05v01tw04>) [Crossref Funder ID 100019858]; Research Group "SME STRATEGIES" [SEJ-314 (PAIDI)].

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