

Digitalisation and SMEs internationalisation: The Mediating role of Eco-innovation

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Abstract

This study extends the Resource-Based View (RBV) framework and builds on existing scholarly works to examine the relationship between digitalisation, eco-innovation, and SME internationalisation. Using data from 300 SME owner-managers operating in the UK, the findings suggest that digitalisation positively impacts eco-innovation. In addition, we also found that eco-innovation has a positive impact on SME internationalisation. Furthermore, the results indicate that eco-innovation mediates the relationship between digitalisation and SME internationalisation. These findings highlight the pivotal role of eco-innovation and digitalisation in enabling SMEs to thrive in international markets.

Keywords: Eco-innovation, digitalisation; SMEs internationalisation; UK.

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Introduction

Digitalisation has emerged as a transformative force in the internationalisation of small and medium enterprises (SMEs) (Bhandari et al., 2023). Digital tools such as e-commerce platforms, cloud solutions, and data analytics enable SMEs to transcend traditional barriers to international markets, offering broader access, streamlined operations and enhanced customer engagement (Montresor and Vezzani, 2023; Calza et al., 2023). Digitalisation allows SMEs to adapt to dynamic global market conditions in real time. Scholars argue that digitalisation equips SMEs with tools to access global markets, streamline operations, and engage with international customers (Deng et al. 2021). However, the literature provides mixed findings on the digitalization – SME internationalization link. Studies highlighted the positive impact of digitalisation on SMEs' internationalisation efforts. Rovira Nordman and Tolstoy (2011) found that digital tools significantly reduce exporting and international marketing costs. Similarly, Cassetta et al. (2020) argue that digitalisation enhances SMEs' ability to collaborate with international partners, manage supply chains, and adapt to foreign market demands (Lee et al., 2012). However, the cultural and regulatory differences in digital environments can create complexities for cross-border operations. Ding et al (2024) found that the digitalization degree weakens the relationship between international experience and internationalization speed in developed and emerging economies. This reflects that this relationship is not direct and complicated.

Recently, the integration of digitalisation and eco-innovation strategies has the potential to generate synergistic benefits (Abdalla et al., 2024). Eco-innovations, defined as innovations that reduce environmental impact or optimise resource efficiency, are increasingly recognised for their potential to enhance SMEs' competitiveness in international markets (Passaro et al., 2023). For instance, digital platforms can effectively communicate the value of eco-innovative products to environmentally conscious global audiences, thereby accelerating market reach and growth (Usman et al., 2024). By adopting sustainable practices such as cleaner production processes and resource-efficient technologies, SMEs can simultaneously align with global sustainability goals and gain business advantages, including cost reductions, operational efficiencies, and enhanced reputations (Cainelli et al., 2020; Mady et al., 2023). These attributes are particularly relevant in a global marketplace where consumers and stakeholders prioritise environmental responsibility, positioning eco-innovative SMEs as attractive and competitive entities in international markets (Hernández et al., 2024). However, without complementary capabilities such as eco-innovation, the value of digitalisation may remain underutilised or misaligned with global market demands (Chen et al., 2019).

While existing research highlights the individual roles of eco-innovations and digitalisation in fostering internationalisation, critical gaps remain in how these two factors interact (Montresor and Vezzani, 2023; Marco-Lajara et al., 2023). Eco-innovations often face challenges in scalability due to their dependence on specific regulatory and market conditions (Marco-Lajara et al., 2023). Without digital tools to adapt these innovations to diverse markets or to effectively communicate their value propositions, their direct impact on internationalisation may be limited (Passaro et al., 2023). Furthermore, the literature addressing the role of eco-innovation in SME's internationalization remains sparse (Peñasco et al., 2017).

To address this gap, the study seeks to answer the following research question: How does eco-innovation mediate the relationship between digitalisation and SMEs' internationalisation? To answer this research question, we use survey data collected from 300 SMEs in the UK. Building on the resource-based view (RBV) theory, the study posits that eco-innovation enabling SMEs to leverage their digital resources in international markets strategically. The RBV framework provides a robust theoretical lens for understanding how firms achieve competitive advantage

by strategically deploying internal resources and capabilities (Abdesselam et al., 2024). In this context, eco-innovations and digital competencies are viewed as critical resources that, when integrated, enhance SMEs' ability to expand internationally.

This study makes several key contributions. First, it integrates two underexplored domains, eco-innovation and digitalisation, within the context of SMEs' internationalisation, offering a novel conceptual framework that advances theoretical understanding. Second, it provides empirical evidence for the mediating role of eco-innovations, addressing critical gaps in the literature and demonstrating how digital tools can amplify the internationalisation benefits of eco-innovations. Third, the study highlights the practical implications of these findings. For SMEs, it highlights the strategic importance of embedding digitalisation into eco-innovation strategies to enhance global competitiveness. For policymakers, it emphasises creating supportive ecosystems that promote adopting digital and eco-innovative practices, fostering sustainable economic growth.

Theoretical background

Digitalisation and Resource-Based View (RBV)

Resource-Based View (RBV) is a foundational theoretical framework in strategic management that emphasises the role of a firm's internal resources and capabilities as key determinants of its competitive advantage and performance (Cuthbertson and Furseth, 2022). The RBV posits that firms achieve sustainable competitive advantage by acquiring, developing, and deploying resources that are valuable, rare, inimitable, and non-substitutable (VRIN). These resources include tangible and intangible assets, organisational processes, and firm-specific knowledge that enable firms to exploit opportunities and neutralise threats in their environment (Kozlenkova et al., 2014). Resources are broadly classified into physical, human, and organisational categories, and their strategic value depends on their alignment with the firm's objectives and external environment (Shibin et al., 2020). In the context of SMEs, the RBV provides a robust lens to examine how resource mobilisation and capability building impact internationalisation and innovation strategies (Montresor and Vezzani, 2023). It is particularly relevant when exploring the interplay between digitalisation, eco-innovations, and SMEs' Internationalisation (Ardito et al., 2021).

The Resource-Based View (RBV) has been widely applied in the literature to understand how digitalisation impacts firm performance and internationalisation (Bhandari et al., 2023). Past studies emphasise that digitalisation aligns with RBV's focus on leveraging unique and valuable resources to achieve competitive advantage (Elia et al., 2021). Digital technologies are dynamic capabilities that enhance resource integration, operational flexibility, and strategic responsiveness (Chaudhuri et al., 2022). For instance, Coober et al. (2023) demonstrate that digitalisation fosters the creation of valuable resources by enabling firms to access, process, and analyse large volumes of data. This data-driven approach enhances decision-making and strengthens customer relationships and innovation capabilities (Estensoro et al., 2022). Similarly, Cuthbertson et al. (2022) argue that digital technologies create rare and inimitable resources by embedding analytics and automation into core business processes.

Chaudhuri et al. (2022) highlight that digital platforms reduce the costs of entering foreign markets, while Bhandari et al. (2023) emphasise digital tools' role in expanding market reach and managing international operations. However, scholars also caution that digitalisation alone

may not achieve sustainable competitive advantage (Silvestri et al., 2023). As Bag et al. (2022) highlighted, digital capabilities require integration with other strategic resources, such as eco-innovations, to unlock their full potential. Without such integration, the benefits of digitalisation might remain underutilised or fail to address specific market needs (Cuthbertson et al., 2022). Thus, the literature highlights the need for digitalisation to complement other resources, such as eco-innovations, to achieve competitive outcomes. This view aligns with the RBV's emphasis on resource complementarities and the role of dynamic capabilities in sustaining competitive advantage.

Digitalisation represents a transformative capability that reshapes how firms create, deliver, and capture value (Chaudhuri et al., 2022). Firms enhance their operational efficiency, market reach, and strategic decision-making by integrating digital technologies, such as artificial intelligence, cloud computing, and big data analytics (Amankwah-Amoah et al., 2024). From the RBV perspective, digitalisation qualifies as a dynamic capability. This higher-order capability allows firms to adapt, integrate, and reconfigure internal and external resources to respond to rapidly changing environments (Lin and Wu, 2014). For SMEs, digitalisation facilitates access to international markets by enabling cost-efficient communication, real-time market analysis, and enhanced customer relationship management (Catanzaro et al., 2019). It also supports innovation by fostering collaboration, accelerating knowledge flows, and enabling rapid eco-innovation scaling (Chandra et al., 2012).

Eco-innovations refer to developing and applying new products, processes, and business models that reduce environmental impact and contribute to sustainability goals (Shibin et al., 2020). As a strategic resource within the RBV framework, eco-innovations enhance a firm's reputation, compliance with environmental regulations, and ability to address growing consumer demand for sustainable practices (Khanra et al., 2022). Eco-innovations are particularly critical for SMEs seeking to differentiate themselves in competitive markets. By embedding environmental considerations into their value proposition, SMEs can build a unique competitive advantage, enhance brand equity, and tap into green-conscious consumer segments globally (Bag et al., 2022). These innovations also foster long-term resilience by aligning with global sustainability trends and mitigating risks associated with regulatory changes (Do et al., 2022). Furthermore, eco-innovations can signal credibility, attracting environmentally conscious partners and investors in international markets (Chaudhuri et al., 2022).

Internationalisation refers to how firms expand their operations beyond domestic borders, leveraging their resources and capabilities to enter and compete in foreign markets (Lin and Wu, 2014). For SMEs, internationalisation is often a critical pathway for growth, diversification, and learning (Shibin et al., 2020). Within the RBV, successful internationalisation depends on the firm's ability to deploy VRIN resources to overcome the liability of foreignness and effectively navigate diverse institutional environments (Kozlenkova et al., 2014). SMEs often face resource constraints, making the strategic utilisation of digitalisation and eco-innovations essential for reducing barriers to international entry and enhancing global competitiveness (Marco-Lajara et al., 2023). Internationalisation also allows SMEs to capture new revenue streams and diversify risk across geographies (Sui and Baum, 2014). Building on the RBV, this study explores how eco-innovation mediates the relationship between digitalisation and SMEs' internationalisation.

Digitalisation enhances SMEs' operational efficiency and agility, enabling them to effectively integrate eco-innovations into their value chain and capitalise on emerging opportunities in foreign markets (Sahoo et al., 2024). For example, advanced analytics can identify potential

international partners with shared sustainability goals, while e-commerce platforms facilitate seamless cross-border transactions for eco-innovative products (Ruivo et al., 2015). By embedding digital tools into their internationalisation strategies, SMEs can achieve a synergistic alignment of sustainability and global growth objectives (Alkaraan et al., 2024). Digitalisation also accelerates the feedback loop between international customers and eco-innovation development, fostering continuous improvement and market alignment (Chaudhuri et al., 2022). Figure 1 shows the conceptual framework of this study.

Insert Figure 1 about here.

Hypotheses development

Digitalisation and Eco-innovation

The relationship between eco-innovations and digitalisation has gained increasing attention in recent literature, with scholars exploring whether these two strategic domains reinforce or constrain each other (Montresor and Vezzani, 2023). On the one hand, eco-innovations often require advanced technological support to achieve their full potential (Usman et al., 2024). Digital technologies enable firms to streamline eco-innovation processes by improving data collection, analysis, and implementation efficiency (Bag et al., 2023). For example, Internet of Things (IoT) solutions and big data analytics facilitate the monitoring and optimisation of resource consumption in eco-innovative processes, thus amplifying their impact (Mishra et al., 2024). Several studies have highlighted the synergistic relationship between eco-innovations and digitalisation. Digital tools enhance eco-innovations scalability and provide platforms for engaging with stakeholders who prioritise sustainability (Usman et al., 2024). By leveraging digital technologies, firms can integrate eco-innovations into their operations, reducing costs and expanding their reach. For instance, cloud-based systems enable real-time energy tracking and foster more sustainable practices in production and distribution (Montresor and Vezzani, 2023).

Conversely, some scholars suggest that digitalisation may impose challenges for eco-innovations. For instance, the high costs of adopting digital technologies and the complexity of integrating them with sustainability-oriented initiatives may deter some firms from fully committing to eco-innovations (Peñasco et al., 2017). Additionally, concerns about the environmental impact of digital technologies themselves, such as increased energy consumption in data centres, have been raised (Xu et al., 2023). However, the overall literature consensus leans towards a positive relationship, especially as digital technologies become more accessible and environmentally friendly (Montresor and Vezzani, 2023; Mishra et al., 2024; Usman et al., 2024). Building on these insights, we argue that digitalisation is a critical enabler of eco-innovations. Digitalisation amplifies the effectiveness and reach of eco-innovative solutions by providing the infrastructure and tools necessary for innovation. For SMEs, digital platforms, cloud computing, and AI-driven analytics reduce operational barriers and facilitate the adoption of eco-innovations (Amankwah-Amoah et al., 2024). Moreover, the increasing demand for sustainability in global markets creates a strong incentive for firms to integrate digitalisation with eco-innovations as complementary strategies (Cattani et al., 2023).

H1: There is a positive relationship between digitalisation and Eco-innovation

Eco-innovation and SMEs internationalisation

The relationship between eco-innovations and SME internationalisation has been a growing area of interest in the literature, reflecting the increasing relevance of sustainability in global business strategies (Hosano et al., 2024). Several studies highlight that eco-innovations can positively influence SMEs' internationalisation by providing unique competitive advantages (Veronica et al., 2020). For instance, research suggests that eco-innovative products or processes can serve as a differentiation strategy, allowing SMEs to capture niche markets that value environmental responsibility (Akter et al., 2023; Cano-Kollmann et al., 2018). Eco-innovations align SMEs with the growing demand for sustainable products and practices, particularly in international markets with heightened environmental regulations and consumer awareness (Tatoglu et al., 2014). On the other hand, some scholars note potential challenges that might hinder eco-innovations direct contribution to internationalisation. Eco-innovative solutions often require significant customisation to fit different countries' regulatory and market conditions (Freixanet and Renart, 2020). This complexity could limit scalability and act as a barrier to rapid international expansion. Additionally, the upfront costs associated with eco-innovation development may strain SMEs with often limited financial resources, potentially dampening their ability to compete globally (Hessels and Parker, 2013).

However, studies suggesting neutral or negative effects are less conclusive and often contingent on specific contexts, such as underdeveloped regulatory frameworks or insufficient market incentives for eco-innovative products (Nyamrunda and Freeman, 2021). The prevailing view in the literature leans toward a positive relationship, particularly when eco-innovations are coupled with complementary capabilities such as effective marketing and digital tools to communicate their value to diverse international audiences (De Marchi et al., 2022). Eco-innovations provide SMEs with distinctive offerings that resonate with the increasing global emphasis on sustainability, enabling them to differentiate themselves in competitive international markets (Golgeci et al., 2021). Furthermore, eco-innovations can help SMEs meet or exceed environmental standards in export markets, reducing compliance risks and fostering trust with international partners (Ghauri et al., 2021). The positive impact of eco-innovations is amplified by growing environmental awareness among global consumers and businesses (Chang and Gotcher, 2020).

By demonstrating a commitment to sustainability through eco-innovative practices, SMEs can enhance their reputational capital, attract environmentally conscious customers, and build long-term relationships with stakeholders in foreign markets (Sekyere and Jalali, 2024). These factors create a virtuous cycle, where eco-innovations open doors to new markets and strengthen SMEs' ability to sustain and grow their international presence.

H2: There is a positive relationship between Eco-innovation and SME's Internationalisation

The mediating role of Eco-innovation

Eco-innovation has increasingly been recognised as a critical mediator in various organisational contexts, including the relationship between digitalisation and

internationalisation (Marco-Lajara et al., 2023). While digitalisation has been lauded for its transformative potential, its direct influence on SMEs' internationalisation is not always straightforward (Nambisan et al., 2019). Scholars argue that digitalisation equips SMEs with tools to access global markets, streamline operations, and engage with international customers (Deng et al 2021). However, without complementary capabilities such as eco-innovation, the value of digitalisation may remain underutilised or misaligned with global market demands (Chen et al., 2019).

Eco-innovations help translate the capabilities enabled by digitalisation into competitive advantages tailored for international markets. Studies suggest that eco-innovations complement digital tools by creating sustainable, market-differentiated offerings that appeal to environmentally conscious customers (Reuber et al., 2021). For instance, digital platforms can enhance the visibility of eco-innovative products, while eco-innovations provide substantive content that resonates with international market preferences for sustainable solutions (Zeng et al., 2023). Furthermore, eco-innovation may mediate the relationship by addressing regulatory and reputational barriers in international markets (Marco-Lajara et al., 2023). Digitalisation alone cannot ensure compliance with stringent environmental standards in foreign markets (Li et al., 2024). Eco-innovations fill this gap by enabling SMEs to meet such standards, thus facilitating smoother international market entry (Reuber et al., 2021).

Although digitalisation reduces traditional barriers to internationalisation, such as geographical and logistical challenges, it does not inherently provide SMEs with a unique competitive edge in saturated global markets (Chen et al., 2019). Digital tools are widely accessible and relatively easy to replicate, meaning they may fail to create sustainable competitive advantages (Zahra et al., 2022). Moreover, digitalisation often emphasises efficiency and connectivity but lacks intrinsic alignment with the growing global demand for sustainability. Without eco-innovations, digital capabilities might remain generic or fail to address the specific needs of international stakeholders who prioritise environmental responsibility (Reuber et al., 2021). For example, an SME with advanced digital tools without eco-innovative products may struggle to differentiate itself in environmentally conscious markets.

Eco-innovations act as a bridge, converting digitalisation's operational and strategic benefits into impactful internationalisation outcomes. By integrating eco-innovations with digital capabilities, SMEs achieve a unique market position by creating sustainable value propositions that resonate with environmentally conscious consumers (Lee et al., 2023). Eco-innovations ensure compliance with stringent environmental regulations in international markets, which digitalisation alone cannot address, and enhance reputational capital by amplifying visibility through digital platforms (Luo, 2021). In this way, eco-innovations are not merely complementary to digitalisation but are essential for translating its potential into tangible internationalisation benefits. Drawing on the resource-based view framework, this study posits that eco-innovations mediate the relationship between digitalisation and SMEs' Internationalisation.

H3: Eco-innovation mediates the relationship between Digitalisation and SME's Internationalisation.

Methods

Sample and data collection

We assessed the hypotheses using a sample of SMEs operating in the UK. Data was collected between July and October 2024 through an online survey questionnaire. The survey was distributed to SME founders via an electronic link on the Prolific online research platform. The survey's cover page outlined its main purpose and included the items used to measure the study variables. We initially recruited a sample of 780 top managers from SMEs, focusing on owner-managers in firms engaged in international activities. To align with the European Union's definition of SMEs (European Commission, 2003), we restricted our sample to owner-managers operating businesses with fewer than 250 employees. A total of 335 responses were received, yielding a response rate of 42.94%. After reviewing the questionnaires, 35 responses were excluded due to incomplete answers. Consequently, the final dataset comprised 300 complete responses, resulting in a response rate of 38.46%.

Non-response bias

To test non-response bias, we adopted the approach outlined by Wagner and Kemmerling (2010), which involves comparing the responses of complete and incomplete surveys using independent sample t-tests. The results revealed no significant differences between the two groups, indicating that non-response bias was not a concern in our study. Furthermore, we adopted Armstrong and Overton's (1977) technique, which examines differences between early and late respondents. Independent sample t-tests confirmed no significant differences between these groups, further validating that non-response bias did not affect our findings.

Sample Characteristics

Table 1 presents the demographic characteristics of the sample. Most respondents (57%) were male, aged 25 years or younger to over 56, ensuring a diverse representation across age groups. The majority of the SMEs had been operational for an average of seven to eight years (57%) and employed between 11 and 30 staff members (24%). Their primary business activities were concentrated in the commercial (49%) and industrial (21%) sectors, collectively accounting for 70% of the industries represented.

Insert Table 1 about here.

Measures

Established scales from prior research were employed in the survey instrument. To ensure accurate understanding and interpretation by the venture founders, the scales were adapted as necessary to align with the context and characteristics of the target participants. Additionally, a pilot test was conducted with nine business owners to enhance the study's face validity. Based on their feedback, some measures were rephrased to suit their profiles and the UK context better.

Dependent variable. We measured our dependent variable, SME internationalisation, using four items from Adomako, Opoku & Frimpong (2017). Examples of items are 'Entering new foreign markets', 'Expanding the firm's international operations'. The items were measured on a 7-point scale, with 1 for 'strongly disagree' and 7 for 'strongly agree'.

Independent variable. We evaluated digitalisation using five items by El-Baz and Ruel (2024). Example of items are ‘Our organisation is capable of acquiring important digital technologies’, ‘Our organisation is capable of designing adequate response to digital transformation’. Such digitalisation was measured on a 7-point scale with 1 for 'strongly disagree' and 7 for 'strongly agree'.

Mediating variable. We measured eco-innovations using the six items developed by Chang and Gotcher (2020). Example of items are ‘Use of cleaner manufacturing processes to generate savings and prevent pollution (e.g., energy, water, and waste)’ , ‘The company chooses materials for the product that consume the least amount of energy and resources for conducting product development or design’. The scale is a 7-point scale with 1 for 'strongly disagree' and 7 for 'strongly agree'.

Control variables. We incorporated several control variables in our analysis that affect SME's internationalisation at the owner and SME levels. At the owner level, we controlled for the owners' gender, age, and education. We controlled for the gender, coding it as 1= male and 0 = female. Owners' age was controlled because the CEO's age could reflect their confidence level in decision-making. With increased tenure and experience, CEOs accumulate substantial international exposure, which may shape their decision-making process concerning Internationalisation (Oesterle et al., 2016). We also controlled for the owner's education as a categorical variable: 1= High school to 5= other qualifications. At the firm level, we controlled for the firm's size, age, international experience and industry. Firm age was assessed based on the years since the establishment, while the total number of employees measured firm size. International experience was controlled (Adomako, Opoku & Frimpong 2017) by asking the respondent the following question ‘How many years of international experience do you have in terms of time spent working and living outside of UK?’ as it can impact learning activities within international markets (Goerzen & Beamish, 2003). We controlled for industry type using a categorical variable: 1= industrial, 2= commercial, 3= services, 4= agricultural.

Analysis

Reliability and validity assessment

To evaluate the validity and reliability of the primary constructs, we performed a confirmatory factor analysis (CFA) using the maximum likelihood (ML) estimation method in AMOS 28. The results demonstrated that the model fits the data acceptably, with fit indices as follows: $\chi^2/df = 891.368/149$; comparative fit index (CFI) = 0.82; standardised root mean square residual (SRMR) = 0.7; root mean square error of approximation (RMSEA) = 0.6; and Tucker-Lewis index (TLI) = 0.7. Table 1 presents the standardised estimates for the CFA constructs, revealing that all item factor loadings exceeded 0.5. In alignment with Bagozzi and Yi (1988), the significant factor loadings ($p < 0.01$) confirm convergent validity. Furthermore, the average variance extracted (AVE) values exceeded the 0.50 threshold, providing additional evidence for adequate convergent validity (Fornell & Larcker, 1981). To assess internal consistency, we employed Cronbach's alpha as a measure of reliability. The findings showed that Cronbach's alpha values surpassed 0.70, indicating satisfactory reliability. Moreover, composite reliability (CR) values also exceeded 0.70, reinforcing the robustness of our constructs, consistent with the guidelines provided by Netemeyer et al. (2003).

Insert Table 2 about here.

Common Method Bias

Procedural and statistical approaches were implemented to address the potential issue of common method bias in the survey design. First, following the insights of Siemsen, Roth, and Oliveira (2010), it was considered that common method bias is less of a concern in studies focusing on indirect effects. Second, this study collected the independent, dependent, and moderating variables at two distinct time points. This temporal separation minimised the bias commonly associated with cross-sectional designs, as Podsakoff, MacKenzie, and Podsakoff (2012) recommended. Third, the survey items were refined with clear and precise language in collaboration with industry practitioners, ensuring their relevance and clarity (MacKenzie and Podsakoff, 2012). The items were deliberately distributed throughout the survey to prevent respondents from perceiving potential relationships among the study variables (Nagy et al., 2022).

Additionally, the respondents' high levels of education, experience and assurances of anonymity and confidentiality further reduced potential bias (MacKenzie and Podsakoff, 2012; Podsakoff et al., 2003). Statistically, Harman's single-factor test was conducted to detect the presence of common method bias. Principal component analysis (PCA) without rotation was applied to the study variables, revealing five factors with eigenvalues greater than 1.0, collectively explaining 37.45% of the total variance. The first factor accounted for only 8.33% of the variance, with no single factor dominating. This outcome suggests that common method bias did not significantly influence the study's results.

Results

Table 3 presents the descriptive statistics and correlation matrix for the variables examined in the study. Following a regression analysis, we calculated the variance inflation factor (VIF) to assess multicollinearity. The results indicated that all VIF values were below the threshold of 10, with an average VIF of 2.04. These findings confirm the absence of multicollinearity, suggesting that the independent variables are not highly correlated (Hair et al., 2010).

Insert Table 3 about here.

We utilised the Process Macro (Hayes, 2013) to examine the direct and indirect connections between digitalization and SME internationalisation. Table 3 shows the results of the hypotheses testing. Hypothesis 1 proposed that there is a positive relationship between digitalisation and eco-innovation. The results show a positive role of digitalization in enhancing eco-innovation strategies at a significant level ($B = 0.77, p < 0.05$), which indicates that H1 was accepted. Hypothesis 2 proposed a positive relationship between eco-innovations and SME internationalisation. The results showed a significant relationship between eco-innovations and SME internationalisation ($B = 0.17, p < 0.05$), which indicates that H2 was accepted. Finally, we tested hypothesis 3, which focused on testing the mediating role of eco-innovation on the digitalisation - SMEs internationalisation link. Table 5 shows the mediation analysis results about the significant and indirect effect of eco-innovations on the relationship between digitalisation and SME internationalisation (CI between 0.04 and 0.23). the analysis also showed a partial mediation impact of eco-innovation and hypothesis 3 is also accepted.

Insert Table 4 about here.

Insert Table 5 about here.

Discussion

This study examines the relationship between digitalisation and SME internationalisation and the main mechanisms that affect this relationship. Based on the RBV, we found a positive relationship between digitalisation and SME internationalisation. This study is in line with previous studies (Rovira Nordman & Tolstoy, 2011) that digitalisation is considered a critical enabler of internationalisation, particularly for SMEs, as digital tools and technologies reduce traditional barriers to entry in international markets by facilitating communication, enhancing market analysis, and streamlining operations (Bag et al., 2023). In addition, we found that eco-innovation positively mediates the relationship between digitalisation and SME internationalisation, as eco-innovations help translate the capabilities enabled by digitalisation into competitive advantages tailored for international markets.

Theoretical implications

This study makes several key contributions to the digitalization and the internationalization literature (Ardito et al., 2024). First, it integrates two underexplored domains, eco-innovation and digitalisation, within the context of SME internationalisation (Abdesselam, Kedjar and Renou-Maissant, 2024), offering a novel conceptual framework that advances theoretical understanding. Bridging these domains highlights their interdependence and sheds light on how they jointly influence SMEs' ability to compete globally in a rapidly changing business environment (Ardito et al., 2024). Second, it provides empirical evidence for the mediating role of eco-innovations, addressing critical gaps in the literature (Chen et al., 2019; Reuber et al., 2021) and demonstrating how digital tools can amplify the internationalisation benefits of eco-innovations. This empirical insight offers practical implications, guiding policymakers and business leaders in leveraging digital technologies to enhance the environmental and economic performance of SMEs (Luo, 2021).

Practical implications

The study highlights the practical implications of these findings. For SMEs, it underscores the strategic importance of embedding eco-innovation into digitalisation strategies to enhance global competitiveness. Our research shows the pivotal role of eco-innovation and digitalisation in enabling SMEs to thrive in international markets. Managers should prioritise integrating digitalisation and eco-innovative strategies to align with global market demands and enhance competitiveness. These efforts facilitate internationalisation and contribute to SMEs' long-term sustainability and growth. For policymakers, it emphasises creating supportive ecosystems that promote adopting digital and eco-innovative practices, fostering sustainable economic growth. We also recommend that policymakers design initiatives that support SMEs in adopting eco-innovations and entering international markets. Such measures could foster a global ecosystem of sustainable enterprises while driving the adoption of green business practices. By doing so, SMEs can achieve dual objectives of international growth and environmental responsibility, creating value for businesses and society.

Limitations and future research directions

Our study is not without its limitations. First, the data we used were cross-sectional and limited to the United Kingdom, which restricts the generalizability of our findings to all SMEs globally. Since our results capture the behaviour of companies at a specific point in time, it is plausible that these behaviours could change as internal and external environments evolve. To address this, future researchers should conduct longitudinal studies to assess whether our findings remain valid over extended periods. Additionally, testing these findings in other countries would help establish the robustness of our conclusions and offer insights into the impact of digitalisation on SMEs across diverse contexts. Second, limitations may arise from our sample selection. Companies operating in more developed countries or larger emerging markets targeting regions with different socio-economic environments may exhibit substantially different behaviours. Future studies should explore samples from countries with contrasting socio-economic conditions to test whether our findings hold in these alternative contexts. Finally, our study focused exclusively on SMEs. Decision-making processes in larger firms are inherently more complex and may significantly influence their internationalisation strategies. Future research could expand on our work by examining the role of digitalisation in larger firms and analysing its impact on their degree of internationalisation.

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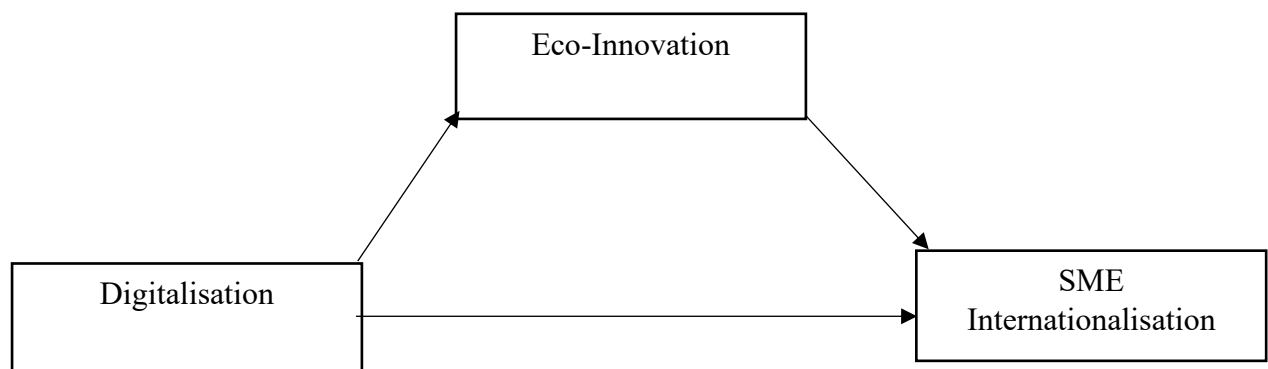


Figure 1
Conceptual Model

Table 1
Sample characteristics

Variables	Category	Frequency	Percentage
Gender	Male	170	57%
	Female	130	43%
Age	25 or younger	19	6%
	26-35	59	20%
	36-45	101	34%
	46-55	94	31%
	Over 56	27	9%
Education	High School	45	15%
	HND	31	10%
	Bachelors	135	45%
	Post	80	27%
	others	9	3%
Marital status	Married	175	58%
	Unmarried	111	37%
	Others	14	5%
Company size	10 or below	62	21%
	11-30	72	24%
	31-50	49	16%
	51 or above	117	39%
Company age	2 years	20	6%
	3-4 years	47	16%
	5-6 years	62	21%
	7-8 years	171	57%
Industry type	Industrial	61	21%
	Commercial	148	49%
	services	84	28%
	agricultural	7	2%

N = 300

TABLE 2
Construct validity and reliability

Items	Factor loading	AVE	CR	Cronbach Alpha
Eco-innovations		0.51	0.89	0.89
ECO1: Use of cleaner manufacturing processes to generate savings and prevent pollution (e.g., energy, water, and waste).	0.71			
ECO2: The manufacturing process of the company effectively reduces the emission of hazardous substances or waste.	0.57			
ECO3: The company chooses materials for the product that consume the least amount of energy and resources for conducting product development or design	0.68			
ECO4: The company deliberately evaluates whether the product is easy to recycle, reuse, and decompose in conducting product development or design.	0.74			
ECO5: Our firm management often communicates experiences among various departments involved in eco-innovation.	0.69			
ECO6: Our firm management often uses novel management systems to manage eco-innovation.	0.74			
Digitalisation		0.72	0.88	0.88
D1: Our organisation is capable of acquiring important digital technologies.	0.77			
D2: Our organisation can identify new digital opportunities.	0.96			
D3: Our organisation is capable of designing adequate response to digital transformation.	0.80			
D4: Our organisation is up to date with state of the art of digital technologies.	0.70			
D5: Our organisation can develop innovative products/services/innovations using digital technologies.	0.78			
SME's internationalisation		0.77	0.96	0.96
INT1: Entering new foreign markets	0.83			
INT2: Expanding the firm's international operations	0.89			
INT3: Supporting start-up business activities dedicated to international operations	0.90			
INT4: Financing start-up business activities dedicated to international operations	0.90			

AVE = average variance extracted; CR = composite reliability

Table 3
Descriptive statistics and correlation matrix

	Mean	S.D.	1	2	3	4	5	6	7	8	9	10
1.Gender	0.57	0.49	1									
2.Age	2.83	1.05	0.01	1								
3.Education	2.92	1.04	-0.05	-0.05	1							
4.Firm Age	3.95	1.38	0.03	0.26**	-0.09	1						
5.Firm Size	2.74	1.18	-0.05	0.02	0.05	0.34**	1					
6.International experience	3.37	5.30	-0.02	0.14*	0.18**	-0.09	0.09	1				
7.Industry	2.66	1.52	-0.04	0.02	0.21**	0.04	-0.01	0.04	1			
8. Digitalisation	5.17	1.37	0.09	0.01	0.02	-0.07	-0.08	0.19**	-0.54	1		
9.Eco-innovation	4.95	1.45	0.17**	0.02	-0.01	-0.10	-0.08	0.18**	-0.08	0.75**	1	
10. Internationalisation	5.18	1.37	0.08	0.02	-0.02	-0.05	-0.02	0.16**	-0.15*	0.81**	0.69**	1

Notes: N= 300; *** p < 0.001, ** p < 0.01, *p < 0.05

Table 4
Regression Results

	Eco-innovation (Model 1)					SME internationalisation (Model 2)				
	<i>B</i>	<i>SE</i>	<i>t</i>	<i>LLCI</i>	<i>ULCI</i>	<i>B</i>	<i>SE</i>	<i>t</i>	<i>LLCI</i>	<i>ULCI</i>
Gender	0.30*	0.11	2.71	0.08	0.52	-0.04	0.09	-0.43	-0.22	0.14
Age	0.03	0.06	0.49	-0.08	0.52	0.01	0.05	0.27	-0.08	0.10
Education	-0.03	0.06	-0.51	-0.14	0.08	-0.02	0.04	-0.42	-0.11	0.07
Firm Age	-0.05	0.04	-1.06	-0.13	0.04	0.00	0.04	0.00	-0.07	0.07
Firm Size	0.00	0.05	0.02	-0.09	0.10	0.05	0.04	1.10	-0.04	0.13
International experience	0.01	0.01	0.786	-0.01	0.03	-0.00	0.01	-0.21	-0.02	0.02
Industry	-0.03	0.03	-0.81	-0.10	0.04	-.07**	0.03	-2.42	-0.13	-0.01
Digitalisation	0.77*	0.04	1.78	0.69	0.85	0.69*	0.05	13.78	0.59	0.78
Eco-innovation						0.17*	0.05	3.49	0.07	0.26
Constant	1.06**	0.36	2.93	0.35	1.76	0.93**	0.30	3.11	0.34	1.51
<i>R</i> ²			0.59					0.70		
<i>F</i>			50.72 *					73.16 *		

Notes: N= 300; *** p < 0.001, ** p < 0.01, *p < 0.05

Table 5
Mediation analysis

Mediator	Indirect effect	Boot SE	Boot LLCI	Boot ULCI
Eco-innovation				
	0.13	0.05	0.04	0.23