The contribution of digitalisation, channel integration and sustainability to the international performance of industrial SMEs

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Abstract

Purpose – The purpose of this paper is to understand the contribution of digitalisation, channel integration and sustainability to the improvement of industrial small and medium-sized enterprises (SMEs)' international performance.

Design/methodology/approach – Based on a review of the literature, the authors developed a research model that included six hypotheses about the relationships between the constructs studied: digitalisation, channel integration, sustainability and international performance. The structural equation model was tested with data from a survey answered by 200 exporting industrial SMEs, by means of partial least squares regression.

Findings – The digitalisation of SMEs contributes positively to channel integration and sustainability, while channel integration is positively related to their international performance. Although a direct relationship between digitalisation and international performance was not observed, a mediated relationship through channel integration was confirmed. Additionally, the multi-group analysis according to the level of internationalisation revealed that sustainability positively influences the international performance of companies with a high degree of internationalisation.

Originality/value – This study is original insofar as it examined the role of digitalisation in the international performance of industrial SMEs, considering the mediating role of sustainability and channel integration.

Keywords Digitalisation, Sustainability, Channel integration, International performance, Industrial SMEs

Paper type Research paper

1. Introduction

Recent studies (e.g. Denicolai *et al.*, 2021) consider innovation, sustainability and internationalisation as key paths for business growth in modern economies. These strategic factors are interlinked in companies' efforts to grow in a global context. As a consequence of the COVID-19 pandemic, the role of digitalisation in international development has become evident (Sidanti, 2021). Digitalisation involves the coordination of value chain activities using Internet infrastructures and web-based and mobile technologies, known as digital technologies and impacts different business functions and activities. Digitalisation would be a key competitive asset if it enables companies to develop their business models, improving capabilities that facilitate relationships with members of the value chain (Ritter and Pedersen, 2020) that could have a positive effect on sustainable production (Seuring *et al.*, 2022).

The interaction between digitalisation and sustainability is an unexplored field that warrants more in-depth research (Del Rio Castro *et al.*, 2021). The digital revolution may have a dual effect on sustainability (Guaita Martínez *et al.*, 2022), on the one hand; it may increase energy consumption, on the other hand; it offers opportunities to implement environmentally friendly practices. The sustainable development goals (SDGs) set out in the United Nations' 2030 Agenda provide impetus to address the challenges of sustainability in the business sphere. However, as Gupta *et al.* (2020) emphasise, there is a knowledge gap on the mutual

relationships between digital development and the SDGs. Sustainable practices include providing organisations with the vision of a unified and combined effort with business stakeholders (Li *et al.*, 2018), amongst which the members of distribution channels are found. Likewise, the growing importance of sustainability in the internationalisation of companies was highlighted by Gomez-Trujillo and Gonzalez-Perez (2020), who suggested that future studies continue researching on both topics supported by quantitative methodologies and considering the analysis of specific industries and geographies. In this line, Barbosa *et al.* (2022) obtained that as firms develop an international orientation they build collaborative relationships with partners that have a positive effect on environmental performance. As value chains become global and digital, business models become more complex; organisations must be able to integrate relationships with a network that brings together the key players (Parida *et al.*, 2019). Readiness to implement digital processes will be a key for smaller companies to join digitalised international value chains (Chen, 2019) and connect in integrated business networks (Rehm and Goel, 2017).

Research on digitalisation and internationalisation is rather recent and heterogeneous, since the relationship has been approached from different perspectives, showing that it still requires further investigation (Bergamaschi *et al.*, 2020). Although ICTs play an important role in the control, integration and consolidation of international operations (Kim *et al.*, 2018), they are rarely examined as determinants of the international development of small and medium-sized enterprises (SMEs) (Dethine *et al.*, 2020; Lee *et al.*, 2019a, b). Further research in this field is essential due to the importance of SMEs, which account for more than 99% of companies in the European Union (EU) (European Parliament, 2021). The key role of digitalisation in the international development of SMEs seems clear but needs more research; according to Lacka *et al.* (2020, p. 7) "technological advancements can assist SMEs in their internationalisation efforts, yet those have not been explored" and "encourage further research into SMEs' internationalisation with a focus on technologies". Similarly, Denicolai *et al.* (2021) identified the need for more in-depth research into how SMEs' digital advancement opens or inhibits real future options for international growth. In fact, Coviello *et al.* (2017) observed that researchers had not adequately responded to the opportunities that the digital context holds for firms' internationalisation.

Building on the aforementioned research gaps, the main aim of this study is to assess the interrelationships between the concepts of digitalisation, channel integration and sustainability and their joint effect on SMEs performance. In this way our study contributes to the existing literature by combining two lines of research on international business performance, namely, digitalisation and sustainability, by focussing on industrial SMEs and considering the role of distribution channel integration.

2. Conceptual framework

2.1 Digitalisation

Digitalisation in a company consists of the application of digital technologies and infrastructures in business, economy and society (Autio, 2017). Organisations that adopt digital technologies transform their business models and create more business value (Mohamad *et al.*, 2019). Companies apply different types of digital technologies – such as electronic commerce, big data analysis, the Internet of Things or machine learning, amongst others – that allow them to create value (Lee *et al.*, 2019a, b). These digital systems make it easier for them to acquire knowledge and improve the construction of business networks (Lee and Falahat, 2019). Thus, digitalisation allows SMEs to join digitalised value chains (Chen, 2019) and belong to integrated business networks (Rehm and Goel, 2017). In fact, companies are investing more and more in ICTs that improve supply chain synchronisation and integration (Bharadwaj *et al.*, 2007; Yu *et al.*, 2017). From a supply chain perspective, digitalisation brings greater availability and real-time access to information, optimises logistics by boosting supply chain visibility (Kache

and Seuring, 2017), increases productivity, enhances product quality, provides flexibility, reduces time to market and improves sustainability (Denicolai *et al.*, 2021).

Although much research has been carried out on digitalisation and Industry 4.0, little is known about its impact on SMEs, (Mittal *et al.*, 2018) and sometimes the studies provide conflicting findings. However, due to the ever decreasing cost of technologies and their easier access by SMEs (Baur and Wee, 2015), digitalisation seems to be the best option for such firms to innovate, grow (Denicolai *et al.*, 2021) and advance their international development (Lee and Falahat, 2019). Companies must adapt to new market dynamics using ICTs as an important source of competitiveness (Thrassou *et al.*, 2020).

2.2 Distribution channel integration

The growing competition in markets and the growth of the Internet prompt companies to expand the use and variety of their distribution channels (Herhausen *et al.*, 2015), thus making their management more complex (Mosquera *et al.*, 2017). Distribution channel integration is a key factor for companies to avoid conflicts that can derive from the use of different marketing channels (Verhoef, 2012). Cao and Li (2015, p. 200) define channel integration as "the degree to which a firm coordinates the objectives, design and deployment of its channels to create synergies for the firm and offer particular benefits to its consumers".

The integration of a firm's distribution channels entails synchronising operations and decisions between channels, both online and offline, with effective communication and operation (Garcia Ortiz *et al.*, 2021). This integration between channels will guarantee that the different members of the channel manage the same information (Saghiri *et al.*, 2017). Focussing specifically on the context of retailing, Song *et al.* (2019) confirm that the main benefit of distribution channel integration is the ability to integrate information and logistics capacity. The different functions of the channels are integrated through communication, access to information, order fulfilment, product and price information management, transaction information management, customer service and reverse logistics (Kolbe *et al.*, 2021; Saghiri *et al.*, 2017).

2.3 Sustainability

Environmental sustainability seeks human welfare while protecting the resources necessary for human needs and ensuring that human activities do not generate excessive waste (Goodland, 1995). Today, environmental sustainability is a key growth path for firms (Denicolai *et al.*, 2021). Firms are increasingly called to implement sustainable practices and processes (Davis-Peccoud and Duchnowski, 2018) to reduce their impact on the environment and thus avoid compromising the availability of resources for future generations (Denicolai *et al.*, 2021).

Sustainability management benefits both firms and the environment, as it can influence process efficiency and productivity and support the development of more sustainable products and services (Baumgartner and Rauter, 2017). However, SMEs do not often use sustainability to enhance relationships with their stakeholders (McKeiver and Gadenne, 2005), and they only do so if they are pressured by the latter (Revell and Blackburn, 2007). Moreover Barbosa *et al.*, (2022) report that the effect of sustainability actions on economic performance in SMEs is lower than that in other companies due to their lower investment capacity.

3. Research model and hypotheses

In order to achieve our research objective, we developed a model (Figure 1) to measure the extent to which the level of digitalisation of SMEs, the application of sustainable practices and their degree of distribution channel integration affects their international performance, both directly and through the mediating role of channel integration and sustainability.
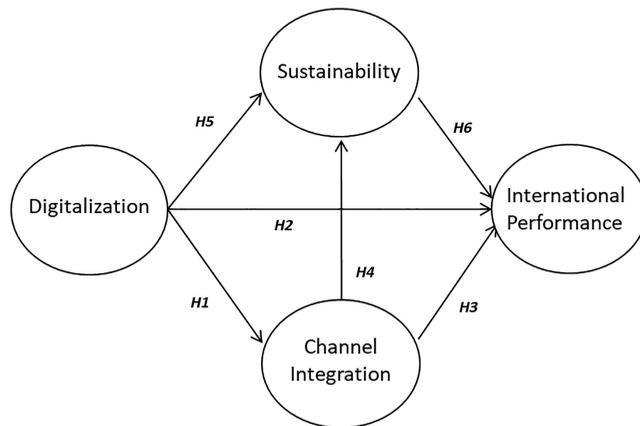
Figure 1.
Research model

3.1 Effects of digitalisation
The relationship between digitalisation and the integration of distribution channels has been addressed in the recent literature, both from the supply chain standpoint (Holmström *et al.*, 2019; Iddris, 2018; Kittipanya-ngam and Tan, 2019) and in the retail context (e.g. Hübner *et al.*, 2021; Sun *et al.*, 2020).

ICTs have opened up new possibilities for the configuration of companies and involve important changes in their operational systems by changing the way firms communicate with their members, suppliers and customers, allowing these companies to achieve higher levels of integration with the latter (Cvetkovic, 2017). The adoption of digital elements (common databases, video conferences, teleconferences and shared screens) by strategic partners fosters not only the establishment of a common working language but also the reduction of the degree of inter-organisational uncertainty and the improvement of mutual understanding (Bahri Korbi *et al.*, 2019). Digitalisation has positive effects in channel integration by facilitating channel management activities and processes (Wu *et al.*, 2022). In an omnichannel context, the increasing connectivity of devices, advances in artificial intelligence and automation present the opportunity for a more seamless integration of the distribution and supply chain (Song *et al.*, 2021). Castorena *et al.* (2014) confirm that companies incorporating ICTs in their supply chain relationships obtain good results, allowing them to achieve better control of human resources and records management, product quality control and any agreements entered into with suppliers; these are aspects that define integration and which can be extrapolated to relationships with distribution channel members. The adoption of digital technologies can improve the efficiency of channel activities and the integration of distribution channel companies (Kim *et al.*, 2006), as increased digitalisation is a building block in implementing channel integration processes (Song *et al.*, 2021).

Based on the information presented above, we considered the following hypothesis:

H1. Digitalisation has a positive effect on channel integration.

Westerlund (2020) highlights the positive role of ICTs and value networks for internationalisation; the more firms use Internet hardware infrastructures and mobile software technologies, the better they can leverage their foreign assets, achieving larger shares of foreign sales (Vadana *et al.*, 2020). The increased use of technologies has an impact on companies, allowing them to transform their operations and value propositions, as well as improving interaction with customers. When applied to commercial functions, digitalisation may imply new opportunities for internationalisation (Hervé *et al.*, 2020).

The digitalisation of companies would boost their international expansion due to its positive impact on their capabilities and skills, allowing SMEs to be more competitive internationally (Dutot *et al.*, 2014; Lee *et al.*, 2019a). The use of ICTs facilitates the acquisition of knowledge about foreign markets and international competitors, as well as the creation of business networks (Cassetta *et al.*, 2019; Lee *et al.*, 2019b). ICTs enable companies to develop dynamic capabilities, making them more agile and strengthening their ability to operate in complex environments (Fish and Ruby, 2009), in turn improving international competitive performance (Mikalef and Pateli, 2017).

ICTs also act as a lever to overcome the difficulties SMEs face in foreign markets (Dethine *et al.*, 2020), increase and integrate information throughout the supply chain, with distributors and with partners in general (Cassetta *et al.*, 2019), and obtain relevant and necessary information on foreign markets (Neubert, 2018) and their competitors (Cassetta *et al.*, 2019). Ultimately, digitalisation drives growth through knowledge sharing and capacity building for global operations (Mäki and Toivola, 2021).

Although SMEs find it difficult to undertake coherent global digital transformation processes, those that have already embarked on their digital transformation are more competitive (Dethine *et al.*, 2020). Velinov *et al.* (2020) studied a sample of EU exporting SMEs, confirming that digitalisation awareness is a critical factor for success in international markets. Thus, we considered the following hypothesis:

H2. Digitalisation has a positive effect on international performance.

3.2 Effects of distribution channel integration

The integration of a firm's supply chain has a significant impact on export results (Sutduean *et al.*, 2019); it is worthwhile questioning whether this relationship also occurs in the downstream part of the chain, basically made up of the distribution channel. Firms must consolidate their relationships with partners, distributors and customers and adapt their routines accordingly if they want to achieve a sustainable competitive advantage in their internationalisation processes (Peng and Lin, 2021).

Export contracts offer exporters little control as control is transferred to distributors; to the extent that actions are carried out that involve the integration of channel members through information systems, alliances or other types of agreement, control, risk and responsibility are shared, maximising efficiency and favouring greater international performance (Robles, 2011).

Distribution channel integration is an important source of competitive advantages for companies; through concurrent operations in online and offline channels, coordinating functions and creating synergies, firms would improve their business results (Pentina and Hasty, 2009). The integration of distribution channels allows firms to further develop their capabilities (Cao and Li, 2015), resulting in an improvement in customer satisfaction, loyalty and trust and a reduction in perceived risk (Cooper *et al.*, 2006; Li *et al.*, 2018; Neslin and Shankar, 2009). As a result of the quality of their interactions with stakeholders in the network, which include members of the distribution channel, SMEs can achieve objectives and progress in their internationalisation processes (Garcia Ortiz *et al.*, 2021). Accordingly, distribution channel integration is expected to allow companies improve their competitiveness, strategic positioning and participation in the market and subsequently improve their international results (Kolbe *et al.*, 2021). Thus,

H3. Channel integration has a positive effect on international performance.

Membership of business networks not only allows firms to improve their export results, but also fosters progress towards sustainability (Yang and Liu, 2012). Developing and managing relationships with stakeholders is a key to an organisation's ability to deploy sustainability

initiatives (Maignan *et al.*, 2005). More specifically, the ability to integrate information between the firm and its suppliers and distributors allows the firm to acquire and take advantage of knowledge to develop sustainability initiatives in its network (Bouchery *et al.*, 2012). Collaborative strategies between chain members through for example collaborative innovation and collaborative processes can drive sustainable performance by improving capabilities' performance and resource utilisation (Chauhan *et al.*, 2022).

A growing number of studies in very different geographical settings have examined how alliances and networks of companies influence the application of sustainable practices by companies (Bojnec and Tomšič, 2021). The development of other partner relationships with sustainability objectives has also been explored, although their results have been limited and specific (Barbosa *et al.*, 2022). Company sustainability initiatives generally require the involvement of a wide variety of partners within the chain to achieve sustainability (Ageron *et al.*, 2012), being relationships between partners a driving factor for achieving sustainable success (Redante *et al.*, 2019); greater integration with members of the supply chain in initiatives and sustainability programmes allows firms to not only reduce costs, share responsibilities and acquire innovation capabilities, but also have a greater social and environmental impact for society (Aray *et al.*, 2021). Based on the above, the following hypothesis was considered:

H4. Channel integration has a positive effect on firm sustainability.

3.3 Effect of digitalisation on sustainability

Industry 4.0. helps to attain sustainability goals (Jayashree *et al.*, 2022). Sustainability, from an innovation perspective, would focus on the incorporation of new or improved materials, processes and means that achieve more sustainable and efficient environmental processes, enabling the development of high added value products, processes and services (Igartua *et al.*, 2018). The literature on the relationship between digitalisation and sustainability highlights the potential of ICTs for improving an SMEs' environmental performance (Isensee *et al.*, 2020; Levy and Powell, 2005). A literature review carried out by Del Rio Castro *et al.* (2021) reveals the growing added value generated by digitalisation – through novel sources of data, improved analytical capabilities and collaborative digital ecosystems – to achieve the sustainable development goals. Piccarozzi *et al.* (2018) suggested that one of the great benefits of digitalisation is sustainability, due in part to proper knowledge management and the focus on processes for improving sustainability on the part of digitalised firms. Ha *et al.* (2022) confirmed that in the EU context, digital transformation processes enhance environmental performance in the long term. Digital technologies can play an important role in the development of an efficient base in the use of resources that enhances sustainability (Demartini *et al.*, 2019). Thus, the relationship between digitalisation and sustainability in SMEs is based on the premise that these firms, in order to achieve sustainability goals, must commit to the use of digital technologies, allowing them to integrate sustainable principles into business operations (Baggia *et al.*, 2019).

Based on the foregoing, we proposed the following hypothesis:

H5. Digitalisation has a positive effect on firm sustainability.

3.4 Effect of sustainability on international performance

Firms that adopt sustainable business approaches focus on rethinking products and processes that improve efficiency and minimise waste by reducing costs (Ruzzier *et al.*, 2020). A firm's engagement in environmentally friendly activities can prompt a positive response from the international market (Xu *et al.*, 2018). The aforementioned authors indicate that if companies improve technologically, they can produce sustainable and low-cost products, obtaining competitive advantages to expand abroad.

Different studies have shown the relationship between sustainability and internationalisation of firms from different perspectives. Bojnec and Tomšič (2021) demonstrated that corporate sustainability is positively related with internationalisation, this relationship being influenced by the creation of business networks; Xu *et al.* (2018) claim that foreign clients are willing to pay a premium for the services of firms that operate in accordance with sustainable and environmentally responsible standards, suggesting that a firm's environmental Corporate Social Responsibility (CSR) can accelerate international expansion.

Moreover, companies, when selecting foreign markets, must respect and comply with the environmental regulations and sustainability objectives of each specific market; in this respect Ruzzier *et al.* (2020) suggest that international performance would be related to a firm's sustainable attitude. Given the evidence regarding the possible positive relationship between sustainability and internationalisation, we proposed the following hypothesis:

H6. Sustainability has a positive effect on international performance.

4. Methodology
4.1 Questionnaire design and measurement scales
To test the model, a questionnaire-based quantitative study was developed. The review of the literature allowed us to identify the indicators for measuring the variables based on previously validated scales. These indicators were adapted to the industrial sphere addressed in this study. Likert scales from 1 (totally disagree) to 7 (totally agree) were used.

For the digitalisation construct, we used the scale proposed by Lee (2020) that measures the degree of ICT use in SMEs. For the channel integration construct, we used the scale proposed by Song *et al.* (2019) that measured supply chain integration in the downstream part of the chain, providing data on both the integration between channel agents and between online and offline channels. The scale used to measure the sustainability activities carried out by the company was the recent scale tested by Denicolai *et al.* (2021). Finally, for the international performance construct, we used the well-established scale described by Zou *et al.* (1998), which uses nine items to measure the evolution of firm export activity in the last five years, considering financial performance, strategic performance and satisfaction with export activity.

A pretest was carried out with five company managers to make sure the questions were understood correctly. As a result, some items were slightly reworded, particularly those corresponding to the channel integration scale developed by Song *et al.* (2019). Annex 1 contains the final scales.

4.2 Scope
The study population was defined as Spanish exporting industrial SMEs. In Spain, SMEs account for 99.8% of companies; of these, 8.21% are industrial (108,393 companies) (Ministry of Industry, 2019). Although more and more Spanish SMEs are beginning to use social networks, electronic invoices, cloud services and e-commerce, the digital transformation that the transition to the new paradigm of Industry 4.0 entails remains pending (Ministry of Industry, 2019). Spain ranks 11th in EU's Digital Economy and Society Index (European Commission, 2020). As regards the integration of digital technology, it ranks 13th, indicating that Spanish companies take advantage of the opportunities offered by digital technologies in line with the EU average; 43% of firms have electronic information exchange systems (compared to the EU average of 34%); 19% of SMEs sell online but only 7% sell to other EU countries (European Commission, 2020).

The Sustainable Development Report 2021 ranks Spain 20th out of a total of 165 countries in terms of sustainable development (SDSN, 2021). However, the results are different in the case of the achievement of the Sustainable Development Goal 9 (SDG 9) related to the industry, with Spain ranking below the European average. Recently, Guaita Martínez et al. (2022) showed that even though EU countries have common patterns of response to climate and environmental challenges, Spain is in the 20th position out of 27 in the ranking by the digital and sustainable index built by the authors.

As regards international development, Spain ranks 16th in the world ranking of exporters. In 2020, 55,133 Spanish companies exported regularly (Ministry of Industry, Commerce and Tourism, 2021); SMEs generate a relatively high proportion of Spanish exports, accounting for 98.4% of all exporters in the country, but they are smaller in size than their European counterparts.

4.3 Data collection and sample profile
The information was collected in July 2021. Interviews were held with the managers of 200 industrial companies that met the requirements of being manufacturing and exporting SMEs. Table 1 shows that in general the companies are small but generate a large volume of exports.

4.4 Data analysis
The data were analysed according to the variance-based structural equations method, using the statistical tool SmartPls version 3.3.3. The partial least squares (PLS) method provides a structural equation modelling (SEM) approach that allows researchers to analyse simultaneous causal relationships with interactive effects between manifest and latent variables, as well as providing fewer contradictory results than the regression analysis in terms of detecting mediation effects (Ramli et al., 2018).

Annual turnover	n	%	The number of employees	n	%
Less than 1 million	31	15.5	1 to 10	37	18.5
1 to 5 million	106	53.0	11 to 50	95	47.5
5 to 10 million	34	17.0	51 to 100	39	19.5
10 to 50 million	25	12.5	101 to 250	29	14.5
More than 50 million	4	2.0	Total	200	100.0
Total	200	100.0			

The sector of industrial activity	n	%	% of international sales	n	%
Iron, steel, metallurgy and machinery	48	24.0	Less than 10%	54	27.0
Furniture	36	18.0	From 11 to 25%	45	22.5
Food	31	15.5	From 26 to 50%	40	20.0
Textile, footwear and clothing	22	11.0	From 51 to 75%	35	17.5
Chemicals, pharmaceut. and healthcare	21	10.5	More than 75%	26	13.0
Toys	13	6.5	Total	200	100.0
Household equipment	12	6.0			
Plastics	5	2.5			
Construction	4	2.0			
Ceramics	3	1.5			
Other	5	2.5			
Total	200	100.0			

Table 1.
Sample

5. Results

5.1 Measurement model

The reliability and validity of the scales were verified considering commonly accepted criteria (see Tables in Annex 2). The load of each indicator in the corresponding factor was higher than 0.7, the values of the average variance extracted (AVE) exceeded the recommended threshold of 0.5 and the simple reliability (Cronbach's alpha) and composite reliability values exceeded the recommended threshold of 0.7 (Hair *et al.*, 2022). Discriminant validity was assessed based on the observation of cross loadings, the Fornell–Larcker criterion, and the multitrait–multimethod (MTMM) matrix.

5.2 Analysis of the structural model and contrast of hypotheses

To analyse the predictive capacity of the structural model, the R^2 was first evaluated using the bootstrapping technique, which indicates the amount of variance of the construct explained by the model, which had to be greater than 0.1 (Falk and Miller, 1992). As shown in Figure 2, the channel integration and international performance constructs exceeded that value. Secondly, the predictability of the model was evaluated by applying the Stone-Geisser Q^2 test described by Chin (1998) for each dependent construct using the blindfolding procedure. It was verified that all the constructs exceeded the value 0, thus confirming the predictive capacity of the model.

Hypothesis tests were performed to assess the significance of the model using the 5,000-subsample bootstrapping test and a two-tailed student's t-distribution test with a significance of 0.05. The results are shown in Table 2, which also includes the standardised regression coefficients or betas. The sign of the significant coefficients allows us to know the direction of the relationship and thus accepting or rejecting the hypotheses, while the size of the coefficients indicate the intensity of the relationship; being standardised coefficients they can be compared with each other to observe the variables that have a stronger influence on the dependent variables.

Our study showed a significant effect of digitalisation on channel integration ($\beta1 = 0.534$, p value < 0.001); thus H1 is supported. The effect of digitalisation on international performance is also supported ($\beta3 = 0.327$ and p value < 0.001) that confirms H3. Moreover,
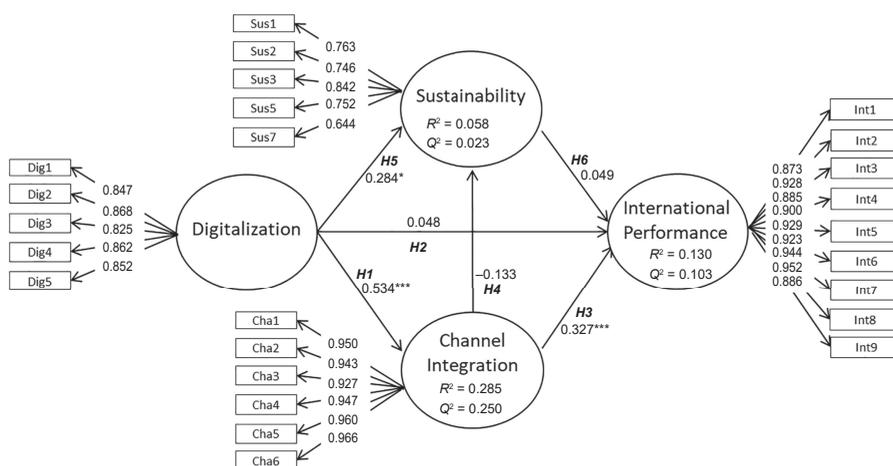
Figure 2.
Structural results and significant relationships

Note(s): *p-value < 0.05; **p-value < 0.01; ***p-value < 0.001

we observe that the effect of digitalisation is stronger on channel integration than on sustainability. As shown on Table 2, the effect of digitalisation on international performance is not significant ($\beta2 = 0.048$ and p value $= 0.647$); thus H2 is rejected. Channel integration has a significant effect on international performance ($\beta5 = 0.284$ and p value < 0.05) but not on sustainability ($\beta4 = -0.133$ and p value $= 0.183$); thus H5 is accepted but H4 is not. Finally, the results do not allow us to accept H6 that suggested that sustainability impacted positively international performance ($\beta6 = 0.049$ and p value $= 0.536$). To explore further, the results of our model estimation in the next section, we explore mediation and moderation effects.

5.3 Indirect effects: mediation

As our model includes not only direct effects of the three constructs of digitalisation, channel integration and sustainability on performance, but also indirect effects, we tested if the intermediate constructs are mediators in the indirect relationship. In accordance with Hair et al. (2022, p. 229), the analysis of the strength of the relationships of mediating constructs with other constructs enables to identify the underlying mechanisms of the cause–effect relationships between an exogenous and an endogenous construct; therefore, we investigated whether this type of mediation relationship existed in our model. Based on the analysis of the specific indirect effects identified using the bootstrapping technique, we confirmed (Table 3) the existence of a total mediation effect of channel integration between digitalisation and international performance since the relationship between digitalisation and international performance was not directly significant ($\beta2 = 0.048$ and p value $= 0.647$), but it was significant through the channel integration variable ($\beta1 \times \beta3 = 0.174$ and p value $= 0.005$).

Hypothesis		Standardized β	t statistics	p value
H1	Digitalisation → channel integration	0.534	7.071	0.000***
H2	Digitalisation → international performance	0.048	0.458	0.647
H3	Channel integration → international performance	0.327	3.617	0.000***
H4	Channel integration → sustainability	−0.133	1.333	0.183
H5	Digitalisation → sustainability	0.284	2.545	0.011*
H6	Sustainability → international performance	0.049	0.619	0.536
Note(s): *p value < 0.05, **p value < 0.01 and ***p value < 0.001				

Table 2.
Model hypothesis testing results

	Standardized β	Sample average (M)	Standard deviation (STDEV)	t statistics (|O/STDEV|)	p value
Channel integration → sustainability → international performance	−0.007	−0.007	0.014	0.466	0.641
Digitalisation → channel integration → sustainability → international performance	−0.003	−0.004	0.008	0.444	0.657
Digitalisation → channel integration → sustainability	−0.071	−0.072	0.057	1.238	0.216
Digitalisation → sustainability → international performance	0.014	0.015	0.023	0.595	0.552
Digitalisation → channel integration → international performance	0.174	0.182	0.063	2.786	0.005

Table 3.
Indirect effects

5.4 Multi-group analysis
In order to understand if the non-significant relationships were due to a different degree of internationalisation amongst the firms surveyed, we performed a multi-group analysis according to the level of internationalisation. To this end, the sample was divided into two groups according to the amount of international sales in relation to total sales. Group 1 included companies whose sales from exports were between 10 and 50% (139 companies). Group 2 included the companies whose exports accounted for more than 50% of their sales (61 companies). Before performing the multi-group analysis, measurement invariance was verified to ensure that the estimated inter-group differences did not originate from contents and/or meanings different to the latent variables between groups (Hair *et al.*, 2022). For this purpose, the measurement invariance of composite models (MICOM) approach was used (Henseler *et al.*, 2016) in three steps: (a) evaluation of configuration invariance, (b) evaluation of compositional invariance and (c) evaluation of the equality of means and variances. Following the MICOM approach, total measured invariance was established as a prerequisite for comparing and interpreting the specific differences between the coefficients of the Multigroup Analysis (MGA) groups. In accordance with Hair *et al.* (2022), multi-group analysis to compare data groups can be performed using different parametric and non-parametric approaches; thus, a PLS-MGA analysis and a parametric test were carried out (Table 4). These analyses revealed an overall significant difference between the two groups in the relationship between the sustainability and international performance variables. Thus, the bootstrap results showed a direct and significant relationship (β = 0.425 and *p* value < 0.001) between sustainability and international performance (H6) only for the group with high export activity. No significant differences were observed for the relationships of the other hypotheses since the differences between the path coefficients showed values greater than 0.05 and less than 0.95.

The direct positive relationship between sustainability and international performance proposed in Hypothesis H6 was not confirmed. However, the results of the multi-group analysis confirmed, albeit only for the group of main exporting firms, that sustainability does have a positive effect on international performance.

6. Conclusion and discussion
6.1 Contributions and discussion
This study contributes to the literature as it jointly examines the effect of sustainability, digitalisation and channel integration as drivers of the international performance of industrial SMEs is the first contribution of this study to the literature. More specifically, we add to existing knowledge by, first, examining the mediating role of sustainability and channel integration in the relationship between digitalisation and international performance, and second, analysing the moderating role of the level of internationalisation in the relationship between sustainability and international performance.

The confirmation of Hypothesis 1 indicates that the digitalisation of industrial SMEs improves the level of integration and coordination with logistics operators and stakeholders in both online and offline distribution channels. This result contributes to the scarce literature focussing on industrial companies highlighted by Kolbe *et al.* (2021).

One of the most surprising results obtained was the non-confirmation of Hypothesis 2; hence, it cannot be affirmed that digitalisation has a direct positive effect on international performance, since these results differ from those reported in the literature (Cassetta *et al.*, 2019; Dethine *et al.*, 2020; Neubert, 2018). However, when analysing the mediating role of the model constructs, an indirect effect of digitalisation on international performance was confirmed through channel integration (digitalisation → channel integration → international performance). This finding represents an original contribution to the academic literature. It not only confirms the findings reported in previous research, such as the study by Sutduean

| Hypotheses | Coefficients path (low-mid export) | Coefficients path (high export) | Confidence intervals 95% | | | | Path differences Coefficients path dif. (high export –low-mid export) | p value differences | |
			2.5% (low-mid export)	97.5% (low-mid export)	2.5% (high export)	97.5% (high export)		PLS-MGA	Parametric test
H1 Digitalisation → channel integration	0.602	0.200	0.409	0.735	−0.544	0.468	−0.402	0.052	0.060
H2 Digitalisation → international performance	0.089	−0.010	−0.230	0.356	−0.313	0.250	−0.099	0.626	0.686
H3 Channel integration → international performance	0.286	0.118	0.019	0.537	−0.257	0.394	−0.168	0.441	0.461
H4 Channel integration → sustainability	−0.175	−0.082	−0.394	0.195	−0.445	0.260	0.093	0.700	0.707
H5 Digitalization → sustainability	0.374	0.189	−0.034	0.597	−0.519	0.463	−0.185	0.541	0.495
H6 Sustainability → international performance	0.026	0.425	−0.175	0.186	0.042	0.596	0.398	0.029*	0.015*

Note(s): In Henseler's MGA method, a p value lower than 0.05 or higher than 0.95 indicates at the 5% level significant differences between specific path coefficients across two groups. $p < 0.05$

Table 4.
PLS-MGA analysis

et al. (2019), but also demonstrates the added value of the members of a distribution channel and their relationships in the internationalisation of industrial SMEs. This study therefore contributes to research on this relationship as suggested by Lacka *et al.* (2020). Notwithstanding, we suggest that this relationship requires further examination; although Hypothesis 2 was not confirmed in this study, the literature indicates that a direct relationship exists between the digitalisation and internationalisation of companies (Velinov *et al.*, 2020).

Our results indicate that distribution channel integration is an extremely relevant construct in research on industrial SMEs, since it was confirmed that channel integration has a direct effect on the international performance of these firms (H3). Furthermore, we agree with Storbacka (2019) that the management of the commitment between channel members, a key element for integration, is today a strategic priority. However, despite the important role that channel integration seems to play, one relationship that was not confirmed is its positive effect on the sustainable development of companies (H4). As regards the supply chain framework, the previous literature (e.g. Barbosa *et al.*, 2022; Ageron *et al.*, 2012; Aray *et al.*, 2021; Bojnec and Tomšič, 2021) has suggested that the relationships between partners positively influence sustainability.

We did confirm a direct effect of SME digitalisation on sustainability (H5) that coincides with previous findings reported by Del Rio Castro *et al.* (2021), Jayashree *et al.* (2022) or Guaita Martínez *et al.* (2022). However, we were unable to confirm the existence of a mediating relationship of sustainability between digitalisation and international performance in industrial SMEs, despite the fact that Dagnino and Resciniti (2021) recently stated that sustainability aspects will become increasingly important for digitalised companies seeking to internationalise their activities.

Since a direct relationship between sustainability and international performance (H6) was not confirmed for the total sample of companies, contrary to what has been suggested by some authors (Xu *et al.*, 2018), a multi-group analysis was carried out to shed more light on these results, confirming that sustainability only has a positive effect on international performance when a firm achieves a high level of internationalisation. This result is a novel contribution of our paper, indicating that sustainability will be a catalyst for the competitiveness of internationally oriented SMEs. Denicolai *et al.* (2021) claim that SMEs seem to make a trade-off between digitalisation and sustainability due to their scarce resources and capacities; in other words both variables compete with one another, and good international performance can only be achieved if SMEs focus their resources on one of these variables. Our results suggest that Spanish SMEs seem to have opted for digitalisation and channel integration, although for the most internationalised group of companies, sustainability does have a direct effect on international performance.

6.2 Contributions for management
This study provides interesting managerial implications stemming from the interplay between three key concepts – digitalisation, sustainability and channel integration – contributing to enhanced international performance of industrial SMEs. Our findings highlight the importance of SMEs continuing to invest in digitalisation as a starting point to improve international performance. First, digitalisation would help companies to advance in the implementation of sustainable practices. Particularly, as Guaita Martínez *et al.* (2022) state, digitalisation will contribute to sustainable production and consumption and ensure business continuity in pandemic situations. Second, digitalisation would contribute to increased channel integration, which in turn, enhances international performance. European SMEs should therefore continue investing in digitalisation by taking advantage of the support programmes that governments are currently placing at their disposal to facilitate the post-COVID recovery.

An interesting finding from our multi-group analysis suggests that sustainability impacts international performance when SMEs achieve a significant degree of internationalisation; thus, firms are encouraged to augment both digitalisation and international sales. To this end, SMEs should invest in ICTs that produce synergies with the internationalisation process, for example, applications that facilitate potential international buyers to communicate and place orders with the firm.

Channel integration efforts are essential for industrial SMEs to maximise international performance from their investments in digitalisation. The commitment to ICTs in the development of closer long-term relationships with channel members and other stakeholders – such as logistics companies – not only favours export performance but is crucial in the context of high uncertainty in supply chains caused by the COVID-19 pandemic. However, sustainable innovations by themselves will not result in best sustainability practices; a clear commitment of companies to the SDGs is necessary (Renn *et al.*, 2021).

Given that the more internationalised companies are capable of obtaining positive international results from their investments in sustainability, our recommendation is that sustainability should be central to their international strategies. SMEs may achieve this objective by carrying out, amongst others, the following actions: (a) equip themselves with qualified human resources to participate in initiatives such as the European "Lean and Green" platform (https://lean-green.eu/); (b) analyse in depth the sustainability requirements of governments and consumers in the different countries to which they export or wish to export and (c) communicate their commitment to sustainability to their clients by avoiding greenwashing.

6.3 Limitations and future lines of research

Research on the relationship between sustainability and internationalisation in the field of SMEs is still in an initial stage and will continue to yield novel and relevant contributions and conclusions, for which further research integrating quantitative and qualitative methods is necessary to consolidate our findings. In particular, our study found that digitalisation does not directly impact international performance, but through channel integration and sustainability. These findings need further support from studies undertaken in similar as well as unrelated contexts. It would be worthwhile undertaking complementary qualitative research to examine the reason for the non-direct relationship between digitalisation and internationalisation. Digitalisation, sustainability and channel integration are complex concepts that have become urgent in the companies' agendas following the pandemic of COVID-19; however, the pandemic has also caused financial difficulties to SMEs. Future research should look into the changing investment priorities of firms to increase international performance.

As well, future research should investigate the role of the degree of internationalisation, since our novel findings suggests that it could act as a catalyst for sustainable practices that positively impact international performance. Given the differences identified when the SMEs in the sample were segmented according to their level of internationalisation, we recommend future quantitative research take samples large enough to allow for efficient multi-group analysis; these studies should attempt to measure the degree of internationalisation not only based on the percentage of international sales but also on the number of countries to which firms sell.

Additionally, future research could rely on quantitative objective data that could produce interesting results on its own or combined with survey data. While this would likely mean sacrificing the presence of SMEs in the sample since public databases usually refer to larger companies, it could, for example, allow researchers to uncover changes in profitability or other relevant financial metrics due to higher digital investments.

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Annex 1

International performance	Zou *et al.* (1998)	Int1	Our export activity has been very profitable
		Int2	Our export activity has generated a high volume of sales
		Int3	Our export activity has achieved rapid growth
		Int4	Our export activity has improved our global competitiveness
		Int5	Our export activity has strengthened our strategic position
		Int6	Our export activity has significantly increased our global market share
		Int7	The performance of our export activity has been very satisfactory
		Int8	Our export activity has been very successful
		Int9	Our export activity has fully met our expectations
Sustainability	Denicolai *et al.* (2021a)	Sus1	Waste and emissions management
		Sus2	Recycling of waste materials
		Sus3	Procurement of raw materials and renewable/sustainable sources
		Sus4	Optimisation of energy consumption
		Sus5	Sustainable product and packaging design with longer life cycle
		Sus6	Optimisation of transport and distribution
		Sus7	"On demand" production (on request, to make orders and storage more efficient)
		Sus8	Sharing/leasing of products/services
Digitalisation	Lee (2020)	Dig1	We use ICT for facilitating technical knowledge creation
		Dig2	We use ICT for facilitating market knowledge creation
		Dig3	We use ICT for communication (e.g. inter-departments, suppliers, customers, channel members, etc.)
		Dig4	We use ICT for marketing and promotion purposes
		Dig5	We are moving towards automation or digitalisation of processes

(continued)

Table A1.
Scales

			Channel Integration	Song *et al.* (2019)	Cha1	Level of information integration with intermediaries and/or 3PLs

Channel Integration | Song *et al.* (2019)

Cha1 Level of information integration with intermediaries and/or 3PLs

Cha2 Level of logistical and marketing process integration with intermediaries and/or 3PLs

Cha3 Level of organisation integration with intermediaries and/or 3PLs

Cha4 Level of information integration amongst offline and online channels

Cha5 Level of logistical and marketing process integration amongst offline and online channels

Cha6 Level of organisation integration amongst offline and online channels

Table A1.

Annex 2

Factors	Items	Loadings > 0.7	AVE > 0.5	Cronbach's alpha >0.70	Composite reliability > 0.70
International performance	Int1	0.873	0.835	0.975	0.978
	Int2	0.928			
	Int3	0.885			
	Int4	0.900			
	Int5	0.929			
	Int6	0.923			
	Int7	0.944			
	Int8	0.952			
	Int9	0.886			
Sustainability	Sus1	0.763	0.566	0.809	0.866
	Sus2	0.746			
	Sus3	0.842			
	Sus5	0.752			
	Sus7	0.644			
Digitalisation	Dig1	0.847	0.724	0.905	0.929
	Dig2	0.868			
	Dig3	0.825			
	Dig4	0.862			
	Dig5	0.852			
Channel integration	Cha1	0.950	0.900	0.978	0.982
	Cha2	0.943			
	Cha3	0.927			
	Cha4	0.947			
	Cha5	0.960			
	Cha6	0.966			

Cross loadings Item	Int	Sus.	Dig.	Cha.
Int1	*0.873*	0.005	0.218	0.314
Int2	*0.928*	0.065	0.288	0.357

Table A2.
Reliability and validity

(*continued*)

Cross loadings Item	Int	Sus.	Dig.	Cha.
Int3	*0.885*	0.067	0.275	0.355
Int4	*0.900*	0.023	0.210	0.268
Int5	*0.929*	0.091	0.274	0.339
Int6	*0.923*	0.054	0.181	0.310
Int7	*0.944*	0.062	0.152	0.332
Int8	*0.952*	0.092	0.161	0.315
Int9	*0.886*	0.064	0.120	0.292
Sus1	0.070	*0.763*	0.149	0.042
Sus2	0.052	*0.746*	0.152	−0.024
Sus3	0.056	*0.842*	0.162	−0.057
Sus5	0.008	*0.752*	0.218	0.095
Sus7	0.076	*0.644*	0.099	0.040
Dig1	0.239	0.207	*0.847*	0.498
Dig2	0.186	0.193	*0.868*	0.409
Dig3	0.112	0.136	*0.825*	0.430
Dig4	0.201	0.148	*0.862*	0.514
Dig5	0.237	0.215	*0.852*	0.400
Cha1	0.357	0.017	0.489	*0.950*
Cha2	0.353	0.031	0.467	*0.943*
Cha3	0.354	−0.003	0.436	*0.927*
Cha4	0.303	0.038	0.549	*0.947*
Cha5	0.338	−0.012	0.541	*0.960*
Cha6	0.312	0.031	0.545	*0.966*

Note(s): Values in italic are the loadings of the indicators in the factors they measure

Discriminant validity

Discriminant validity: Forner–Larcker criteria

	Cha.	Dig.	Int.	Sus.
Cha.	0.949			
Dig.	0.534	0.851		
Int.	0.353	0.233	0.914	
Sus.	0.018	0.212	0.065	0.752

Discriminant validity: HTMT

	Cha.	Dig.	Int.	Sus.
Cha.				
Dig.	0.561			
Int.	0.360	0.239		
Sus.	0.077	0.241	0.085	

Table A2.

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