DIGITAL TRANSFORMATION AND FIRM PERFORMANCE IN INNOVATIVE SMEs: THE MEDIATING ROLE OF BUSINESS MODEL INNOVATION

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ABSTRACT

This study investigates the consequences of digital transformation (DT) over performance in the case of innovative Small and Medium-sized Enterprises (SMEs). SMEs represent a heterogeneous kind of company in terms of capabilities. By focusing on their innovative character as a boundary condition, we increase our understanding of this relationship. We further research the mediating role of business model innovation (BMI) in the relationship between DT and performance. A sample of 434 innovative Spanish SMEs is used to test the research model through Partial Least Squares Structural Equation Modelling (PLS-SEM). We find that BMI partially mediates the positive relationship between DT and performance. This finding extends our understanding of BMI as an alignment tool and a blueprint for innovative SMEs channeling their investments in DT towards the improvement of performance. Finally, we put forward managerial implications and propose future avenues of research.

Keywords: *Digital transformation, Business model innovation, Firm performance, Innovative SMEs.*

1. INTRODUCTION

The emergence of new digital technologies -such as artificial intelligence (AI), the Internet of Things (IoT), big data analytics, or 3D-printing among others- has an immense impact on how companies transform themselves and compete in the market (Candi & Beltagui, 2019; Urbinati, Bogers, Chiesa & Frattini, 2019; Clarysse, He & Tucci, 2022). These technologies are instrumental for firms to enhance their digital transformation (Oduro, De Nisco & Mainolfi, 2023). Digital Transformation (DT) is a process that has been conceptualized in three phases -digitization, digitalization, and digital transformation-. Each of these phases implies a step further in the use of digital technologies, generating deeper and broader strategic imperatives for firms as well as an increasing transformation potential (Verhoef et al., 2021). *Digitization* refers to the conversion of analog information into digital configurations (Yoo, Henfridsson & Lyytinen, 2010) and, despite having significant cost-saving effects for companies, its effect on value creation activities is reduced (Verhoef et al., 2021). *Digitalization*, on the other hand, consists of the adoption, or the increased use of digital technologies by a firm to optimize business operations or increase customer value (Ritter & Pedersen, 2020), which has some potential to enhance a firm's value creation. By contrast, *digital transformation* is a company-wide phenomenon with a vast range of firm implications (Verhoef et al., 2021). In this regard, DT refers to "a fundamental change process enabled by the innovative use of digital technologies, accompanied by the strategic leverage of key resources and capabilities, with the aim of radically improving a firm and redefining its value proposition to its stakeholders" (Gong & Ribiere, 2021; p.12).

DT allows firms to capitalize on the advantages associated with emerging technologies to gain a competitive advantage (Matt, Hess & Benlian, 2015; Warner & Wäger, 2019). In particular, DT enables firms to offer smarter, faster, and more connected products (Porter & Heppelmann, 2014), facilitates innovation and entrepreneurship (Nambisan, 2017), and contributes to organizational ambidexterity (Vial, 2019). However, like other transformational processes, DT can also be associated with negative outcomes. For instance, employee resistance can emerge in the process of DT (Lucas Jr & Goh, 2009; Tabrizi, Lam, Girard & Irvin, 2019), inertia can act as a barrier if top managers strive for a more agile and innovative firm but without losing managerial control (Ibarra, 2019), or even DT may produce erosion of the firm's performance due to the investments required (Tijan, Jovic, Aksentijevic & Pucihar, 2021). Thus, DT has an uneven impact on firms' performance, with some firms able to reap the benefits of DT in their activities and processes (Sebastian et al., 2017), while others struggle to do so

(Tabrizi et al., 2019). A particular and compelling case is Small and Medium-sized Enterprises (SMEs), where the limitations to undertaking DT are higher due to their pervasive resource scarcity (Li, Su, Zhang & Mao, 2017; Goerzing & Bauernhansl, 2018), behavioral characteristics (Cenamor, Parida & Wincent, 2019), and lack of commitment to developing a DT strategy (Llopis-Albert, Rubio & Valero, 2021).

Nevertheless, we concur with Eller, Alford, Kallmünzer, and Peters (2020) that not all SMEs are equally ready to undertake a process of DT, as the strategic imperatives in terms of digital resources control and the needed organizational changes (Verhoef et al., 2021) could be an insurmountable obstacle for some of them. For this reason, we focus on innovative SMEs, those that are committed to change and carry out R&D and technological development activities (Flor & Oltra, 2004; Alegre and Pasamar, 2018; OECD, 2018). Innovative SMEs are critical for the sustainable economic development of any country (Abdullahi-Abubakar, Hand, Smallbone & Saridakis, 2019). They are more flexible, tend to respond faster to environmental changes (Sawers, Pretorius & Oerlemans, 2008), and are highly committed to learning, which is essential for benefiting from new and transformational processes (Rhee, Park & Lee, 2010). In addition, compared to the less innovative ones, innovative SMEs have superior technological competencies (Hervás-Oliver, Boronat-Moll & Sempere-Ripoll, 2016), which puts them in a better position for DT. Hence, responding to recent calls for a better theoretical and empirical understanding of the relationship between DT and performance (Eller et al., 2020; Verhoef et al., 2021), we focus on the innovative character of SMEs as a boundary condition to investigate this relationship.

As mentioned above, DT is not the sheer application of digital technologies to optimize the firm's internal processes but is a fundamental change process that has the aim of redefining the firm's value proposition (Gong & Ribiere, 2022). Due to this transformational dimension, DT has been conceptually connected to the concept of business model innovation (Bowman, Nijou, & de Reuver, 2019; Vial, 2019). Although several definitions of business model have been proposed, we adopt the most widely accepted definition established by Teece (2010; p.191), which depicts it as "the design or architecture of the value creation, delivery and capture mechanisms employed". In this definition, the alignment and coherence between the dimensions of a business model are key to providing the company with a clear path to profits (Teece, 2018). Relatedly, business model innovation (BMI) involves the "designed, novel, nontrivial changes to the key elements of a firm's business model and/or the architecture linking these elements" (Foss & Saebi, 2017; p.201). Despite the conceptual connection between DT

and BMI, there is limited evidence about their relationship and their role in explaining innovative SMEs' performance. With this in mind, our research objectives are: (1) to examine the effects of DT and BMI on innovative SMEs' performance and (2) to analyze the mediating role of BMI in the connection between DT and innovative SMEs' performance.

Firms may possess strategic digital resources such as data, algorithms, or specific software that can be leveraged to achieve superior performance and enjoy a competitive advantage over rivals (Giustiziero, Kretschmer, Somaya & Wu, 2022; Helfat et al., 2023). However, a firm having (digital) resources but lacking specific capabilities to reconfigure them to meet changing customers' needs and to adapt to fast-paced environments, has little chance to achieve superior performance (Teece, 2007; Schilke, Hu & Helfat, 2018). In line with previous studies (Teece, 2018; Ferreras-Méndez et al., 2021), we conceive BMI as a dynamic capability facilitating changes in value creation, value delivery, and value capture. Following this theoretical reasoning, we argue that (1) DT provides new ways of doing business which can stimulate BMI, and (2) BMI enables the firm to adapt and change its business model(s) in different ways that facilitate effectively profiting from the implementation and use of new digital resources.

Based on data from a recent survey of 434 innovative Spanish SMEs, we propose and test our research model using PLS-SEM. Our study contributes to the existing literature on DT and BMI in SMEs in several ways. First, we offer scholars new insights into the effect of DT on BMI, contributing to a deeper understanding of BMI drivers in the context of innovative SMEs. Second, in response to recent calls (Clauss, Abebe, Tangpong, & Hock, 2021; Ferreras-Méndez, Olmos Peñuela, Salas-Vallina & Alegre, 2021), we seek to deepen our knowledge of the role of BMI as a mediating mechanism in helping innovative SMEs translate DT into SME performance (Al-Debei & Avison, 2010). Third, by focusing on innovative SMEs, we move away from a homogeneous treatment of this kind of company and offer new theoretical knowledge. This is in line with Verhoef et al. (2021) who called for further examination of the role of DT in firm performance in the context of SMEs. In summary, our study provides theoretical and empirical contributions and raises critical questions to stimulate further research on DT and BMI in SMEs.

2. THEORY AND HYPOTHESES

2.1 Digital transformation and innovative SMEs' performance

DT can exert a positive influence on almost any organizational routine or firm's business activity (Karimi & Walter, 2015; Warner & Wäger, 2019). However, there is reason to believe that the strength of such influence and its effect over performance varies across firms. There is

evidence suggesting that firms fail to meet their ambitions when embarking on a process of DT (Schallmo, Williams & Boardman, 2017; Vial, 2019). More precisely, DT needs to adopt processes and practices to help the firm effectively compete in an increasingly digital world since it entails a high commitment of different resources (e.g., financial resources, skilled personnel) (Gong & Ribiere, 2021) and the need to overcome organizational inertia and the resistance to change among employees (Lucas Jr & Goh, 2009; Singh & Hess, 2017). Therefore, given the costs of such investments in new digital technologies (Urbinati et al., 2019; Ceipek, Hautz, Petruzzelli, De Massis & Matzler, 2021) and the efforts required to develop a strong digital culture (Vial, 2019), innovative SMEs need to deploy these practices efficiently and effectively for these investments to pay off in terms of firm performance (Goerzing & Bauernhansl, 2018). We point to three different mechanisms by which DT is positively related to innovative SMEs' performance.

First, digital transformation enables firms to deploy routines that improve data retrieving and processing (Warner & Wäger, 2019). For instance, by using new digital technologies, more and more firms are increasingly collecting and analyzing large amounts of internal and external data to make better informed strategic decisions, to sense external environmental changes, or to anticipate customers' demands (Volberda, Khanagha, Baden-Fuller, Mihalache & Birkinshaw, 2021). This provides firms with the possibility to capitalize on the power of data to enhance firm performance. Moreover, by digitalizing everything that can be digitalized within the firm (Nasiri, Ukko, Saunila & Rantala, 2020), firms may develop and strengthen their digital agility (Verhoef et al., 2021) to capture profits from those new market trends (Berman, 2012).

Second, DT enables to design more efficient digital customer interface (Matt et al., 2015) and enhances better customer interaction and collaboration (Berman, 2012), even to the extent of incorporating customers as co-creators of value (Lenka, Parida & Wincent, 2017), thus, promoting customer engagement (Coreynen, Matthyssens & Van Bockhaven, 2017), a more continuous exchange of information (Müller, Buliga & Voigt, 2018), and a higher willingness to purchase a specific product or brand from a specific SME (Matarazzo, Penco, Profumo & Quaglia, 2021). In this regard, DT enables firms to design an innovative digital customer experience (Schallmo et al., 2017), through which firms may improve customers' loyalty (Férnandez-Rovira, Ávarez-Valdés, Molleví-Bortolo & Nicolas-Sans, 2021), thereby improving firm performance.

Finally, DT can provide firms with the opportunity to create stronger synergies between the different business processes and to improve operational efficiency (Nasiri et al., 2020). For instance, DT allows for less costly transit of material goods (Li et al., 2017) and better flows of information within the firms (Frank, Mendes, Ayala & Ghezzi, 2019), which in turn should reduce the costs (Pagani, 2013) turning innovative SMEs firms into more profitable. Thus, based on the above arguments, we propose the following hypothesis:

Hypothesis 1: *Digital transformation is positively related to innovative SMEs' performance.*

2.2 Digital transformation and business model innovation

DT has become a crucial enabler for innovation (Urbinati et al., 2019), and one of the main forces behind the interest in BMI. DT can influence the entire firm's business model and has implications for both incumbent firms and new startups (Bärenfänger & Otto, 2015). In the particular context of SMEs, as highlighted by Bouwman, Heikkilä and de Reuver (2019), DT is increasingly transforming how SMEs change the core elements of their business models. In a qualitative study on industrial businesses, Ghosh, Hughes, Hodgkinson and Hughes (2022) propose different mechanisms through which DT might drive BMI: e.g., the experimentation with different value creation and delivery models as well as with new ways of capturing value. While there are theoretical arguments to suggest a positive relationship between DT and BMI in the case of SMEs (Vial, 2019; Gong & Ribiere, 2022), the empirical evidence is still scarce and fragmented (Christofi, Khan, Zahoor, Hadjielias & Tarba, 2023; Ciacci & Penco, 2023).

More specifically, current literature highlights that DT enables innovative SMEs to experiment with the value creation dimension of their business models (Vial, 2019) for instance, through new product development (Sorescu, 2017). DT represents a useful opportunity for organizations to develop and launch new products as a new value proposition (Warner & Wäger, 2019) since firms can use new digital technologies (e.g., IoT) to offer smart, connected, and customized products (Porter & Heppelmann, 2014; Hanelt, Bohnsack, Marz & Antunes-Marante, 2021). This creates value by allowing customers to monitor the product's performance or anticipate maintenance (Coreynen et al., 2017). Additionally, DT offers innovative SMEs the possibility to collect and analyze large-sized, real-time, and diverse data to offer new services (Frank et al., 2019). Through the use of digital analytics skills firms can enhance digital servitization (Tronvoll, Sklyar, Sörhammar & Kowalkowski, 2020) and move from being a product-centric firm to a service-centric firm (Coreynen et al., 2017). Therefore, DT has broader implications for firms as they can increase the portfolio of products and services offered

(Lanzolla, et al., 2020), as well as combine products and services, facilitating the introduction of a new firm's value proposition (Yoo et al., 2010; Lansiti & Lakhani, 2014), what may lead to creating more value through BMI (Vial, 2019).

Moreover, DT facilitates firms to deliver uninterruptedly their new value propositions to their customers in a cost-efficient manner (Markides, 2008; Karimi & Walter, 2015). Today, firms can adopt an open, collaborative approach with other firms to co-deliver value (Warner & Wäger, 2019). In particular, innovative SMEs find it easier to adapt and collaborate with suppliers and business partners due to their smaller size (Klein & Todesco, 2021). Also, innovative SMEs may benefit from DT by changing their processes of value delivery through the implementation of a decoupling or a disintermediation strategy of their actual value chain (Warner & Wäger, 2019). These strategies result in a more balanced power, responsibilities, and independence between the firms within a value chain (Autio, Nambisan, Thomas & Wright, 2018). DT also enables SMEs to implement changes in the distribution and sales channels (Vial, 2019). For example, by digitalizing everything that can be digitalized within the firm SMEs can adopt an omnichannel approach, since DT can contribute to enhancing e-commerce and e-payments (Costa-Climent & Haftor, 2021). In addition, DT may help a firm to exploit an entirely new market niche or a new customer segment (Matt et al., 2015; Verhoef et al., 2021). This is particularly important for innovative SMEs as it allows them to deliver value to a small part of the market that is often overlooked by larger firms, enhancing their ability to capture more value (Latifi, Nikou & Bouwman, 2021).

Nevertheless, there exists a potential threat for firms if the value created and delivered is disproportionately captured by others (Lanzolla et al., 2020). In other words, while BMI represents an effective way to create and deliver value, it may not automatically lead to a superior value capture (Desyllas & Sako, 2013), since firms may also need to innovate the value capture component of the business model (Teece & Linden, 2017). In this regard, innovative SMEs could take advantage of their internal data collected from customers to create new sources of revenue (Sorescu, 2017) such as new data-based services for their customers or external organizations. Moreover, DT fosters market segmentation and price personalization, which in turn is closely linked with an improvement in the firm's ability to capture value (Lanzolla et al., 2020). Accordingly, DT could help innovative SMEs to identify customer behavior patterns and align more quickly the price mechanism to capture more value. Hence, we propose the following hypothesis:

Hypothesis 2: *Digital transformation is positively related to business model innovation in innovative SMEs.*

2.3 Business model innovation and innovative SME performance

BMI has been highlighted in the literature as a key dynamic capability to respond better to external environmental changes and to create a competitive advantage (Wirtz, Pistoia, Ullrich & Gottel, 2016; Foss & Saebi, 2018; Heider, Gerken, van Dinther & Hülsbeck, 2021). Indeed, "superior technology and products, excellent people, and good governance and leadership are unlikely to produce sustainable profitability if the business model configuration is not properly adapted to the competitive environment" (Teece, 2010; p. 174). In a recent meta-analysis, White, Markin, Marshall, and Gupta (2022) find a generally positive relationship between BMI and performance, however contingent on some firm- and context-specific characteristics.

BMI represents a high-risk, time, and resource-consuming process that can also lead to negative outcomes (Sabaruddin, MacBryde & D'Ippolito, 2023). Unlike larger companies, SMEs suffer from specific limitations that might increase the likelihood of these negative outcomes (Codini, Abbate & Messeni, 2023). First, when designing new business models, SMEs may lack managerial capabilities or feel more tension when managing the trade-offs between the old and the new business model (Sabaruddin et al., 2023). Second, the implementation of the new business model is a challenge (Aspara, Hietanen, & Tikkanen, 2010; Kim & Min, 2015), as it requires access to skilled human resources and specialized knowledge that might not be available to all SMEs (Verhagen, de Reuver, & Bouwman, 2023).

Despite the potential threats for SMEs in general, we contend that innovative SMEs present particularities that allow them to capitalize on their BMI efforts, increasing their attractiveness to customers and, by extension, their performance. In this vein, Ferreras-Méndez and colleagues (2021) have recently found that BMI can boost new product development in SMEs. Similarly, Coreynen and colleagues (2017) suggest that by shifting from simply selling physical products to hybrid offerings, SMEs can create and deliver a new value proposition to their customers through BMI, opening the door to increase sales or market share. Also, BMI is critical for those SMEs that want to increase sales in foreign markets (Colovic, 2022). Moreover, BMI allows SMEs to use and reconfigure the firm's resources in new domains, which in turn can lead to an increase in overall profitability (Latifi et al., 2021; Codini et al., 2023). For instance, by connecting and establishing new links and partnerships with different suppliers and business partners (Zott & Amit, 2007), BMI may help these firms to reduce

inventory costs or improve the efficiency of their operations (Huang, Lai, Lin & Chen, 2013). Considering this, we propose the following hypothesis:

Hypothesis 3*. Business model innovation is positively related to innovative SMEs' performance.*

2.4 The mediating role of business model innovation

Al-Debei and Avison (2010) suggested the business model to be useful as a mediating construct between technology innovations and the company's strategic goals. However, while previous research on BMI has focused on its direct impact on different organizational outcomes (e.g., Latifi et al., 2021), relatively fewer studies have been conducted to examine BMI as an internal intermediary mechanism (Guo, Tang, Su & Katz, 2017; Ferreras-Méndez et al., 2021). In this regard, it is understood that both DT and BMI can contribute to organizational performance in SMEs (Bouwman et al., 2019). However, as noted by Volberda et al., (2021) an appropriate level of DT, channeled through the right business model, can enable a firm to deliver and capture more value than a digitally mature firm with an inappropriate business model. Therefore, firms face the challenge of building a supportive business model to obtain higher returns of DT. Hence, building on the BMI literature (Amit & Zott, 2001; Teece, 2010; Foss & Saebi, 2017), this study proposes that BMI plays a mediating role in the relationship between DT and firm performance. That is, we propose that BMI may help innovative SMEs to give sense and transform most of the efforts and financial investments related to DT into superior firm performance.

BMI can aid firms in exploiting the benefits offered by DT by translating the business opportunities discovered through the firm's digital processes into new sources of revenue (Bouwman et al., 2019). Among the functions of business models identified by Al Debei and Avison (2010) two are especially relevant to justify the mediating mechanism. First, business models are a conceptual tool that provides alignment between the strategic level and the associated business processes (creation, delivery, and capture of value). While the adoption of new digital technologies is a source of opportunities for discovery it does not guarantee their effective and efficient deployment unless the three dimensions of the firm's business model keep congruence. To that end, SMEs need to articulate their efforts in a coherent way through BMI. Second, a business model is a "translating method" or "blueprint" essential to capture value from investments in new digital technologies (Al Debei & Avison, 2010; p. 371). For instance, BMI might provide an adequate route through which a firm can deliver, and capture part of the value created through new product developments (Chesbrough, 2010). Similarly,

Teece (2018) highlighted that BMI provides a pathway through which a technological innovation can be transformed into a new stream of revenue. Furthermore, BMI can make the most of DT by promoting greater external coordination and enabling firms to allocate activities outside the firm's boundaries (Rogers, 2016), which in turn would increase the firm's profitability. Based on the above arguments, we propose that BMI acts as a mediator mechanism through which DT impacts on innovative SMEs' performance. Therefore:

> ***Hypothesis 4.*** *Business model innovation is a mediating variable in the positive relationship between digital transformation and innovative SMEs' performance.*

The research model and hypotheses are represented in Fig. 1.

Insert Figure 1 around here
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3. METHODOLOGY

3.1 Sample and data collection

To test our research hypotheses, we draw on a sample of innovative Spanish SMEs from the Directory of Innovative Spanish SMEs. The Innovative SME seal is a recognition provided by the Spanish Ministry of Science and Innovation to those SMEs committed to R&D and technological innovation. In line with the Oslo Manual (OECD, 2018) and with previous studies (Oltra & Flor, 2004; Alegre and Pasamar, 2018), the Spanish Ministry of Science and Innovation awards this Innovative SME seal when any of the following circumstances occur in the last three years: (1) having received public funding for innovation projects, (2) holding its own patent in exploitation or having got tax deductions derived from verifiable innovation activity, (3) holding official certifications on innovative activity by certifier organizations.

Using firms from this Directory enabled us to ensure uniformity in the criteria used to be considered an innovative Spanish SME, as the requirements were established by the Spanish Ministry of Science and Innovation. Additionally, we further restricted our target population to firms in this Directory that were still active when doing the survey. This was checked at the Orbis Database. We identified a target population of 2.717 firms whose Innovative SME seal expiry date was 2022 or later. From July to October 2022, we collected data from 442 firms through a survey. After removing cases with missing data, our final sample consisted of 434 firms, representing a 16% response rate. We used an online questionnaire based on existing and validated scales from the literature. The original questionnaire was prepared in English, then

translated into Spanish, and finally translated back into English to ensure that the translation process did not introduce any bias in the measures (Childow, Ghauri, Yeniyurt & Cavusgil, 2015). Before the final survey was administered, we conducted a pre-test with three managers of innovative SMEs and two academics to ensure the relevance and clarity of the survey. We targeted firms' owners or CEOs, thereby ensuring they would have good knowledge and be able to respond to items related to DT, BMI, and firm performance at a firm level (López-Nicolás & Meroño-Cerdán, 2011; Latifi et al., 2021). Table 1 offers descriptive information about the sample in terms of CEOs' and firms' characteristics.

Insert Table 1 around here

3.2. Variables

Digital transformation. We operationalize DT at the firm level following the construct recently developed by Nasiri et al., (2020) consisting of a Likert scale of five items ranging from 1 (totally in disagreement) to 7 (totally in agreement). Items are available in the Appendix II. Nasiri et al. (2020) measurement scale focuses on the main DT processes in the context of European SMEs and fits our DT conceptualization as well as our empirical research setting.

Business model innovation. We assess BMI using the construct recently developed by Latifi et al., (2021), conceived as a second-order reflective-formative construct formed by three elements – namely, value creation, value delivery, and value capture, and seven items. The responses for the items ranged from 1 to 7 (see Appendix II). It is a second-order reflective-formative construct because a change in one of the lower-order dimensions does not imply a change in any of the other ones (Spieth, Röth, Clauss & Klos, 2021). Latifi et al., (2021)'s measurement scale fits our BMI conceptualization and was originally used in the context of European SMEs that have engaged in BMI in the previous two years.

SME performance. Following Ferreras-Méndez, Newell, Fernández-Mesa, and Alegre (2015), SME performance was measured by a four-item scale in which respondents rated their firm's performance compared to competitors on a seven-point scale ranging from 1 to 7 (see Appendix II). According to Mc Dermott and Prajogo (2012), the use of subjective measures of firm performance is a completely valid proxy in SMEs. Ferreras-Méndez et al., (2015)'s used this measurement scale in the context of European high-tech SMEs.

Control variables. We used several control variables at the firm level to alleviate potential alternative explanations of the results. We included *firm size* as the logarithm of the total number of employees since larger firms are more likely to be more willing to invest in DT and BMI, and this may determine performance differences between firms. We controlled for *firm age*, measured as the logarithm of the number of years since the company was founded. Firms with more experience may enjoy the benefits of learning and be more efficient and thereby have superior performance (Brettel, Strese & Flatten, 2012). Finally, we also used the *industry sector* to which the firm belonged – namely, primary, manufacturing, and service industries.

3.3. Biases control

To test the quality of data, we carried out some analyses to test for potential biases. We checked late-response bias through an independent t-test by comparing the answers of early answers and late answers (Amstrong & Overton, 1977), and the results showed no significant differences between the groups. Thus, the late-response bias was not a major concern. Non-response bias was checked through an independent sample t-test by comparing the responding and non-responding firms regarding firm age, firm size, and revenues. We did not find any statistically significant difference between both groups. Hence, non-response bias was not a major problem in this study. Moreover, to ensure the reliability of CEOs' answers, we have crosschecked part of the data collected in our survey with secondary sources of information when possible.

Furthermore, we followed the suggestions of Podsakoff, MacKenzie, Lee, and Podsakoff (2003) to control and rule out that our results are affected by common method bias (CMB), since our study is based on data from a single informant. First, we pre-tested the survey to assess that all the items of the respective constructs were clearly understood by respondents. Second, we ensured anonymity and confidentiality to avoid the risk of socially desirable bias. Third, we offered a benchmarking report to all the participants of the survey in a way to increase their commitment and motivation. Fourth, we also subjected the data to Harman's one-factor test as a post-hoc statistical procedure. The results showed that a single factor accounted for 30,17 percent, which suggests no substantial CMB, since it is less than 50 percent of the variance. Finally, we followed the approach suggested by Lindell and Whitney (2001) to assess CMB. We used *CEO international experience* as our marker variable since this variable seems not to be theoretically associated with any of the critical variables of our conceptual model. The results showed a non-significant correlation between the marker variable and our variables of interest.

In addition, while controlling for the effect of the marker variable, the correlations between the variables of interest remained statistically significant. In sum, both procedural and statistical remedies seem to alleviate concerns about CMB in our study.

Lastly, to assess for potential endogeneity problems, we followed the Gaussian copula approach (Hult et al., 2018). The results showed that none of the Gaussian copulas' values are statistically significant ($p < 0.05$), which suggests that endogeneity should not be a major concern in our study.

4. ANALYSIS AND RESULTS

4.1. Data analysis

To test our research hypotheses, we used Partial Least Square-based Structural Equation Modelling (PLS-SEM) (Hair, Hult, Ringle & Sarstedt, 2016), using the software package SmartPLS 4. Following the guidelines from Hair, Risher, Sarstedt, and Ringle (2019), we performed a PLS-SEM analysis for several reasons. First, our interest lies in testing some theoretical assumptions from a prediction perspective. Second, our structural model includes reflective constructs, but also a second-order reflective-formative construct. Third, we required the latent variable scores to create the second-order formative construct measurement model of BMI. Finally, PLS-SEM can work very well with large samples such as in our case. We assessed and evaluated the measurement models and the structural model in two steps (Chin, 2010). In the first step, we evaluated the reliability and validity of both reflective and formative measurement models, respectively. In the second step, we evaluated the structural model by focusing on its explanatory and predictive power.

4.2. Measurement model evaluation

As BMI is conceived as a reflective-formative latent variable, this study employed the two-stage approach (Hair, et al., 2016; Becker, Klein & Wetzels, 2012). In the first stage, we estimated and assessed all the lower-order constructs measured by reflective items of the research model. This stage is needed to obtain the latent variables scores of the direct relationships between the lower-order constructs (Hair et al., 2016). It is important to consider that, in this stage, the formative higher-order construct (BMI) is not included in the analysis. In this regard, we proved the reliability and validity of the reflective first-order constructs of our research model, including the three lower-order constructs of BMI – namely, value creation, value delivery, and value capture.

Subsequently, in the second stage, conducting a second analysis, we used the latent variables scores of the lower-order constructs obtained in the first stage as indicators for the higher-order construct (Hair et al., 2016). That is, we used the first-order construct scores of value creation, value delivery, and value capture, obtained in the first stage, as formative indicators to obtain the second-order construct of BMI to complete the measurement model.

Table 2 shows the mean values, standard deviations, and the correlations between the variables used in this empirical analysis.

Insert Table 2 around here

4.2.1. Reflective measurement model assessment

We used five criteria to assess the reflective measures of the research model: content validity, construct dimensionality, composite reliability, average variance extracted (AVE), and discriminant validity (Hair et al., 2016). Content validity was found to be adequate because the measurement items came from a review of the existing literature and were clearly understood by the pre-test participants. All indicators showing construct dimensionality, composite reliability, AVE, and discriminant validity reached satisfactory thresholds (see Table A1, A2, and A3 in Appendix I).

4.2.2. Formative measurement model assessment

We used two criteria to assess the formative measurement construct of BMI: the indicator of multicollinearity using the Variance Inflation Factor (VIF) measure, and assessing the statistical significance and relevance of the outer weights (Hair et al., 2016). First, we assessed potential multicollinearity between the lower-order constructs. To assess the level of multicollinearity, we checked the VIF values. In this regard, every indicator of the formative measurement model had to be below the conservative threshold value of 3 (Hair et al., 2019). In our case, the VIF values ranged from 1.366 to 1.447. Therefore, as the highest individual VIF value was 1.447, no indicator appeared to be redundant. Thus, multicollinearity did not seem to be a problem in our study. Second, using bootstrapping with 5,000 bootstrap samples, we also calculated the T-statistics, p-values, and outer weights to assess the suitability of the formative indicators of the second-order BMI construct. Table 3 shows that the outer weights of value creation and value capture are statistically significant. In this regard, even though the outer weight of value delivery is not significant, its outer loading is well over the acceptable

level of 0.5 proposed by Hair et al. (2016) and is statistically significant. In addition, the business model literature has identified value delivery as an important element of BMI (e.g., Teece, 2010, 2018; Latifi et al., 2021).

Insert Table 3 around here

4.3. Structural model evaluation

We estimated two models. In Model 1 we checked the direct relationship between DT and firm performance. In Model 2, we checked the mediating role of BMI on the relationship between DT and firm performance, along with the other hypotheses proposed. To examine the structural model, we used the following four criteria: the level of the R^2 values, the predictive relevance through the Q^2 values, the f^2 effect sizes values, and the significance of the path coefficients (Hair et al., 2016). Table 4 shows the values of the coefficient of determination (R^2) of each endogenous latent variable introduced in Model 2. R^2 is a measure of the model's explanatory power (Cohen, 1988). On the one hand, the model explains 24.1 percent of the variance of firm performance and, on the other hand, 26.1 percent of the variance of BMI. Hence, both values are superior to the minimum value of 10% established by Falk and Miller (1992). That is, our results show that there is coherence between the latent variables of the model and the data.

Furthermore, to assess the predictive relevance of the proposed Model 2, we used the Stone-Geisser Q^2 statistic (Hair et al., 2016). The Q^2 value was obtained by applying the blindfolding procedure. In this regard, when the value of this statistic is superior to zero for a certain endogenous latent variable, its explanatory variable displays predictive relevance. Table 4 shows values of the Q^2 Statistic greater than zero for both firm performance and BMI. Hence, the predictive relevance of the proposed model is confirmed.

Insert Table 4 around here

Using bootstrapping, with 5.000 bootstrap samples, we obtained the path coefficients and their respective significance levels for both models: the direct effect model (Model 1) and the mediated model (Model 2). Table 5 presents the values of both models.

The results in Model 1 support Hypothesis 1 (H1) as DT shows a positive and significant effect on firm performance. On the other hand, the results in Model 2 support Hypothesis 2 (H2), as DT shows a positive and significant effect on BMI. Moreover, Hypothesis 3 (H3) is supported, as BMI exhibited a positive and significant effect on firm performance. Therefore, we find empirical support for all the direct hypotheses proposed in the present study as the connection shows positive and high significance at the $p \leq 0.001$ level. We also examined the Cohen's f^2 values (Cohen, 1988). According to Hair et al. (2016) values higher than 0.02, 0.15, and 0.35 represent small, medium, and large f^2 effect sizes, respectively. Therefore, the associations proposed in H1 and H2 depict a small f^2 effect size. However, it is interesting to highlight the large f^2 effect size that shows the relationship between DT and BMI (H3). Thus, the f^2 effect size values provide further support to our hypotheses, in line with the results obtained when we evaluated the hypothesis through the path coefficients.

Finally, we used the mediation analysis procedure recommended by Preacher and Hayes (2008) to examine Hypothesis 4 (H4), which proposes that BMI mediates the relationship between DT and firm performance. In Model 1, BMI was excluded to check whether there was a significant direct association between DT and firm performance. As we mentioned before, the results confirmed a positive and significant relationship between DT and firm performance. Next, in Model 2, we included the proposed mediator. In this regard, the difference between the total effect and the direct effect in the DT and firm performance relationship is the indirect effect through the mediation variable, which has a value of 0.135 and a bias-corrected bootstrap confidence interval of 0.068 and 0.203. Hence, considering that the indirect effect is positive and significant and that the bias-corrected bootstrap confidence interval did not include zero, Hypothesis 4 (H4) is also supported. Table 6 shows the results of the mediation analysis.

Insert Table 5 around here

Insert Table 6 around here

Control variables

The analysis also reveals that firm size is the only control variable that has a positive and significant association with SME performance. Interestingly, we did not find a significant effect of firm age on SME performance. In this sense, the average age of the firms in our sample

was 17 years. Considering this, the insignificant connection between firm age and firm performance may be explained by the fact that in this new digital era, SMEs should not only draw on existing firm resources and capabilities but also establish new skills, processes, and a new mindset to ensure a positive and holistic attitude towards experimentation and innovation initiatives, and thereby achieve a better firm performance. Finally, the results also revealed that there was not a significant relationship between any of the industry sectors included as variables of control.

5. DISCUSSION

This study was motivated by two complementary research objectives about the role of DT and BMI in the specific context of innovative SMEs. Our findings provide new insights into the valuable role of DT and BMI in innovative SMEs' performance and the effect of DT on BMI. Moreover, they reveal BMI as a solid mechanism through which DT impacts on innovative SMEs' performance.

Prior research suggests that DT contributes to firms' competitiveness (Nasiri et al., 2020), especially for innovative SMEs, since their technological competencies, learning commitment, and flexibility situate them in a better position (Eller et al., 2020). Yet, there is scarce and fragmented evidence of the influence of DT over innovation and performance in this kind of firm. Thus, following our literature review, we identify the mechanisms through which DT enables firms to respond to the changes in the competitive environments and to explain their performance differences. Our findings show that DT can significantly enhance innovative SMEs' performance despite the risks and costs associated with such a process. More specifically, DT facilitates innovative SMEs to achieve superior performance benefits by allowing them to improve their operational efficiency, customer engagement, and revenues. Thus, our study underscores the importance of DT to ensure the profitability of innovative SMEs despite that DT is a much more complex process than firms usually assume.

In addition, we contribute to the growing literature on the role of DT for BMI (e.g., Bouwman et al., 2019; Matarazzo et al., 2021) by theorizing and showing that the extent to which innovative SMEs digitally transform themselves is related to their innovation activities and promotes BMI. Extant literature has not been clear enough in the conceptual separation of these two constructs (Vial, 2019; Gong & Ribiere, 2022). Additionally, the empirical evidence of this relationship is limited and partial (Ciacci & Penco, 2024). Our study demonstrates a positive relationship between DT and BMI in the context of innovative SMEs. Considering how the advancements of new digital technologies can impact and transform business models is

particularly important in the case of innovative SMEs (Verhoef et al., 2021). One reason for this positive impact is that many products and services have become commoditized, and the unique opportunity to create value for customers is by delivering digital offerings in innovative ways through BMI (Volberda et al., 2021). Another reason is that DT enables firms to re-design the value capture dimension of the business model by adding new revenue streams or a new pricing mechanism (Berman, 2012). For example, a firm can extend its traditional portfolio of products and offer new digital services through DT.

Furthermore, we find that BMI is a critical internal driving factor that improves firms' performance in the context of innovative SMEs. Our results are in line with studies that found that BMI has a positive and significant influence on firm performance (e.g., Cucculelli & Bettinelli, 2015; Latifi et al., 2021). BMI can be considered a distinct dynamic capability that firms need to develop to select and recombine strategic resources (Mezger, 2014), but also to adjust ordinary capabilities to address changes in the business or technological environment through the re-design of the value creation, value delivery, and value capture mechanisms that the firm employs (Teece, 2018). Hence, our findings suggest that by redesigning the innovative SMEs' heterogeneous resources and capabilities associated with the activities for creating, delivering, and capturing value, BMI enables them to gain an idiosyncratic competitive advantage in terms of differentiation and innovation, fostering their performance.

Finally, we offer new insights into how BMI mediates the relationship between DT and innovative SME performance. While the mediating function of business models was conceptually introduced years ago (Al-Debei & Avison, 2010), most literature has focused on understanding the direct effect of either DT or BMI on performance, but without unraveling other effects that provide a more nuanced view of the business model concept. Our study offers empirical evidence regarding the positive mediating effect of BMI on the DT-SME performance relationship. This allows us to identify BMI as a fundamental and valuable mechanism contributing to the heterogeneity in performance in innovative SMEs. The finding extends our understanding of BMI as an alignment tool and a blueprint for innovative SMEs channeling their investments in DT towards the improvement of performance.

5.1. Theoretical contributions

More specifically, our study puts forward three contributions. First, our study contributes to the DT and BMI literature (e.g., Schallmo et al., 2017; Bouwman et al., 2019), as we suggest that DT can positively and significantly impact on BMI. Initiating a process of

DT can be risky and may not always lead to successful innovation (Vial, 2019). As previously stated, DT is considered a resource-intensive process, as firms are required to build mechanisms for searching the latest market or technological developments, which can require considerable resources and be time-consuming (Bouwman et al., 2019). This may be an important barrier to overcome for SMEs. Nevertheless, our findings show that, despite the scope of DT varying between firms and DT being considered unique in each firm, innovative SMEs can use DT to undertake changes in any of the dimensions that form a business model. Thus, our results suggest that business models could be innovated by leveraging DT to introduce a new value proposition, refreshing the firm's portfolio of products or services, establishing new collaborative approaches with suppliers or third parties, reconfiguring key business activities, by implementing a new mechanism of pricing, and by creating new sources of revenues.

Second, our study theoretically argues and empirically tests the mediating role of BMI in the relationship between DT and innovative SMEs' performance, thereby advancing our understanding of BMI as a significant mediator mechanism and a relevant antecedent of innovative SMEs' competitiveness. In this regard, our study contributes to the call of Clauss et al. (2021) who noted the need to widen our vision of BMI as an intermediary strategic mechanism. Despite the difficulty of innovating the business model (Chesbrough, 2010; Sabaruddin et al., 2023), doing it can have a catalyst effect for innovative SMEs, giving sense to their DT efforts, and helping them to improve their performance. Innovating the business model is fundamental to making the most of DT. However, innovative SMEs must consider that the performance of BMI depends both on its correct design *and* implementation (Verhagen et al., 2023). In this line, Brink and Holmén (2009) highlighted that a firm's competitiveness can deteriorate because of BMI when the firm does not possess the capabilities needed to implement a new business model. As a result, the implementation of a new business model can be delayed or failed. In addition, the lack of resources may limit the implementation of a new business model (Teece, 2010). Moreover, if top managers in charge of implementing BMI lack the needed managerial capabilities (Teece, 2018) then the firm will not be able to translate strategic objectives related to BMI into specific tasks and functions. Furthermore, if BMI is considered a radical change compared to what is considered normal in the industry where the firm competes, the challenges associated to the implementation of the new business model can lead the firm to deal with a superior level of complexity and uncertainty (Sabaruddin et al., 2023). Thus, as Verhagen et al (2023) pointed out firms should approach BMI as a dynamic process where it is critical to focus not only on designing a new business model but also on how

to implement the business model designed into specific operations and processes at different organizational levels.

Third, the empirical studies on the direct effect of DT on firm performance in the specific context of SMEs are scarce and offer mixed evidence. Recent studies (Eller et al., 2020; Verhoef et al., 2021) have called for more empirical studies since DT involves different costs and benefits, thereby giving rise to different impacts on firm performance. SMEs are far from being a homogeneous group, and the typical limitations related to their size might not play the same role for all of them. Our study extends the limited empirical research on the DT of SMEs (Eller et al., 2020), and addresses this literature gap by focusing on a specific group of SMEs, the more innovative ones. The innovative profile of SMEs represents a highly relevant boundary condition for a better comprehension of DT and BMI outcomes, as these companies are used to uncertain and risky processes, are more flexible, and have significant technological competencies. We contribute to extending current knowledge of the DT literature by highlighting the mechanisms through which DT enhances the performance of innovative SMEs and validating these theoretical expectations (Vial, 2019). Therefore, although some SMEs are struggling with the process of DT (OECD, 2021), our results suggest that DT plays a prominent role in explaining inter-firm differences in the context of innovative SMEs. This is because DT can help firms design stronger processes and structures to meet customers' needs through the new digital technologies, support business operations with digitalization when possible, and simultaneously, operate more efficiently.

5.2. Managerial contributions

Our study has also several managerial implications for decision-makers in SMEs. First, innovative SME managers should pay close attention to the consistent development of practices and routines associated with digital technologies that allow for radically improving the value proposition. For instance, gathering and analyzing vast amounts of data from a wide range of sources, including social media or e-commerce transactions, would likely enable SMEs to sense new business opportunities that emerge from the changes in the customers' needs.

Second, most of SME managers are reluctant to invest in adopting and implementing emerging technologies in their business processes because there is still a lot of ambiguity and uncertainty about the operationalization of DT (OECD, 2021). However, drawing on our empirical evidence regarding the positive association between DT and innovative SMEs' performance, managers should take caution against overreacting and abandoning DT efforts. In

particular, SME managers are recommended to develop initiatives to digitalize their business and their organizational processes, as well as to create synergies between the emerging technologies and the business operations so that their DT efforts could be more fruitful in terms of performance. Therefore, we suggest SME decision-makers initiate and foster their DT journey.

Third, SME decision-makers should fully understand the benefits and limitations of DT in each component of their business model. We suggest SMEs institutionalize regular experimentation of their business models, as BMI can make firms more attractive to customers and increase their chances of increasing SME performance. Agile and scrum approaches related to BMI may be a rapid and almost inexpensive enabler for continuous experimentation in SMEs (Bouwman, Heikkilä, Heikkilä, Leopold & Haaker, 2018; Bocken & Snihur, 2020). Moreover, inter-functional coordination between the three dimensions is another initial key point for innovation. Hence, SME managers need to define their business partners (e.g., suppliers, start-ups) for sharing responsibilities and collaborating in the firms' business activities.

Finally, considering the supportive and relevant role played by BMI as a mediator mechanism in the DT-SME performance relationship, SME managers need to consider an optimum resource trade-off balance between DT and BMI to align the innovations. The dilemma of investing in implementing new digital technologies is that in the short term, it could lead to inefficiencies. Simultaneously, investing in building a new value proposition is also associated with costs, since it could cannibalize existing products or services. However, explicitly designing a new business model and investing time and effort in its implementation should compensate SMEs, helping them to overcome some of the barriers associated with their lower level of resources.

5.3. Limitations and further research

Lastly, it is important to underscore that our results have some limitations, which in turn create opportunities for further research. First, our focus on innovative SMEs from a single country (Spain) may introduce a cultural or regional bias. Future research could explore competitive differences between industries or countries to corroborate our results. In addition, we recognize the risk of addressing firms from a single directory, as it could introduce sampling bias, since firms listed in the Directory of Innovative Spanish SMEs may not represent the entire population of innovative SMEs in Spain. Additionally, while focusing on the innovative ones allows us to understand the performance consequences of complex processes such as DT and

BMI, it limits our understanding of what is the effect of DT and BMI in other SMEs. Are other (non-innovative or less innovative) SMEs benefiting from DT and the implementation of emerging technologies in the business processes in the same way? Are less complex processes like digitization precluding innovations in their business models? These represent interesting future research avenues.

Second, we collected cross-section perceptual data among CEOs and owners of innovative SMEs, applying previously validated scales from recent studies on European SMEs. Despite that managerial perceptions deviate minimally from objective measures of performance (Kyriakopoulos, 2011), and that the used scales come from similar contexts, future studies could combine perceptual data with objective measures of performance with a time lag to understand the impact of DT on organizational performance. Additionally, current literature reviews conceptualize DT as a highly complex concept (Vial, 2019). This represents an invitation for future studies to develop more detailed and complete measurement scales capturing more thoroughly the different dimensions and nuances of DT. Relatedly, even though a letter was sent to our respondents explaining the objectives of the research project, and our constructs' discriminant validity analyses were satisfactory, there is still a potential risk of conceptual confusion between the concepts of digital transformation and business model innovation. Future studies using more evolved measurements for DT and BMI could overcome this limitation.

Third, in this study, we have focused on BMI as an intermediate mechanism between DT and SME performance. Future research is needed to grasp the full potential of DT on performance. Thus, analyzing how other internal firm factors (e.g., firm size, TMT) or external market factors (e.g., competition intensity, technology intensity) may mediate or moderate the relationship between DT and SME performance is certainly an exciting opportunity to advance our knowledge in this area. Finally, our measures have been all defined at the firm level. However, previous research has stressed the role of managerial capabilities on DT (Li et al., 2017) and BMI (Teece, 2018). Therefore, a potentially fruitful research avenue could be examining the association between variables from a multilevel perspective. For instance, a growing research area can be examining if and how dynamic managerial capabilities (individual level) enable firms to initiate their DT initiatives (firm level).

6. CONCLUSION

A firm's competitive environment is characterized by ambiguity and complexity due to the increasing use of new digital technologies, which in turn demands that firms engage with DT to promote strategic change. In this study, we investigate the relationships between DT, BMI, and firm performance with a particular concern with the mediation effect of BMI under the specific boundary condition of innovative SMEs. On the other hand, we develop a more comprehensive understanding of BMI as a mediating variable that explains innovative SMEs' performance differences.

Moreover, another important theoretical contribution of this research lies in the envision of DT as an antecedent of BMI responding to the gap in the literature. Furthermore, our findings reveal that DT exerts a positive effect on SME performance via BMI. Therefore, if firms focus too much on DT itself and underestimate the importance of innovating the business model, due to insufficient resources or capabilities, then firms might not be able to achieve a superior performance. Concerning the managerial findings of this study, our results suggest that top managers of SMEs should actively seek new ways of creating, delivering, and capturing value to ensure a BMI that promotes to the maximum the positive effects of DT on SME performance. Hence, by considering the insights from this study into their innovation strategies, not only innovative SMEs but also more traditional SMEs may set themselves apart from the competition.

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Fig. 1. Research model and hypotheses.

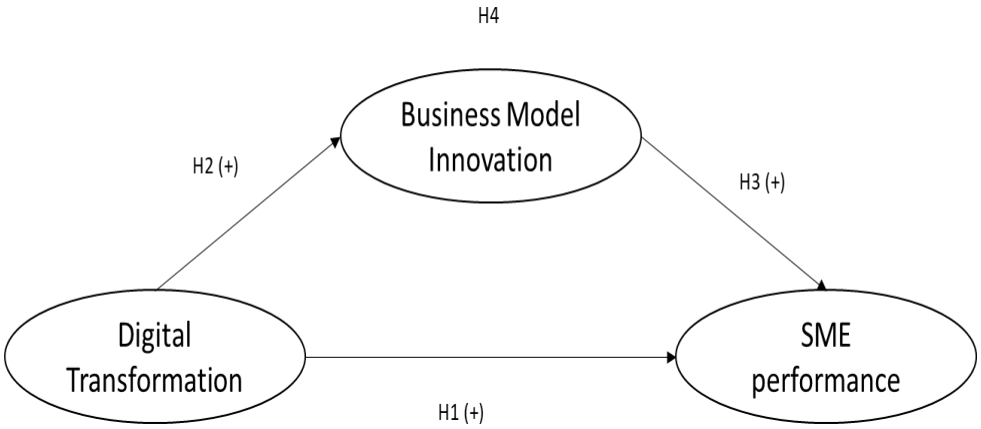

Table 1. Sample descriptive statistics

Items	Categories	Quantity	Percentage
CEO gender	Male	377	86,9%
	Female	57	13,1%
CEO age	20-40	61	14,1%
	41-60	322	74,2%
	61-80	51	11,8%
Firm size	Micro firms (<10)	130	29.9%
	Small firms (10–49)	222	51.1%
	Medium firms (50-250)	82	19.0%
Firm age	<5 years	50	11.5%
	5–10 years	147	33.9%
	11–20 years	109	25.1%
	>20 years	128	29.5%
Industry sectors	Primary	12	2.8%
	Manufacturing	86	19.8%
	Services	336	77,4%

Table 2. Means, standard deviations, and correlations among variables.

Variables	Mean	SD	1	2	3	4	5	6	7	8	9
1. Digital transformation	4.95	1.32	1.000								
2. Business model innovation	5.16	1.18	0,472**	1.000							
3. SME performance	5.19	1.15	0,349**	0,369**	1.000						
4. Firm size	33.64	41.52	-0,017	0,053	0,146**	1.000					
5. Firm age	16.97	15.92	-0,074	-0,017	0,080	0,311**	1.000				
6. Industry (Primary)	0.03	0.171	-0,061	-0,057	-0,044	0,061	0,162**	1.000			
7. Industry (Manufacturing)	0.21	0.404	-0,157**	-0,057	0,024	0,182**	0,263**	-0,089	1.000		
8. Industry (Service)	0.76	0.425	0,174**	0,077	-0,005	-0,197**	-0,315**	-0,317**	-0,916**	1.000	
9. CEO international experience (Marker variable)	2.50	5.148	0.074	0.085	-0.060	-0.062	-0.073	-0.051	-0.082	0.098*	1.000

Note: *p ≤ 0.05; **p ≤ 0.01; SD: Standard Deviation

Table 3. Second-order formative construct results

Second-order construct	First-order constructs	VIF	Outer Weight	T-Statistics	Outer loading	T-Statistics
Business model innovation	Value creation	1.447	0.467***	4.772	0.816***	14.019
	Value delivery	1.393	0.163	1.602	0.637***	8.612
	Value capture	1.366	0.589***	6.302	0.874***	19.977

Note: ***p≤ 0.001

Table 4. Inner model assessment indicators

Factor	R^2	R^2 *adjusted*	Q^2
SME performance	0.241	0.231	0.109
Business model innovation	0.261	0.259	0.248

Table 5. PLS analysis results

Path	Model 1		Model 2					
	Total effect	T-Statistics	Total effect	T-Statistics	Direct effect	T-Statistics	f2	Hypothesis
DT ➔ SMEP	0.346***	6.860	0.345***	6.751	0.210***	3.666	0.042	H1: Supported
DT ➔ BMI			0.511***	12.338	0.511***	12.338	0.353	H2: Supported
BMI ➔ SMEP			0.264***	4.523	0.264***	4.523	0.067	H3: Supported
Control variables								
Firm size ➔ SMEP	0.243***	6.860	0.212***	4.677	0.212***	4.677	0.045	
Firm age ➔ SMEP	0.016	0.326	0.030	0.609	0.030	0.609	0.001	
Industry (Primary) ➔ SMEP	-0.234	0.911	-0.185	0.745	-0.185	0.745	0.001	
Industry (Manufacturing) ➔ SMEP	0.045	0.367	0.059	0.495	0.059	0.495	0.001	

Note: ***p≤ 0.001; T-Statistics for n = 5000 subsamples DT: Digital transformation; BMI: Business model innovation; SMEP: SME performance

Table 6. Mediation analysis results

Path	Indirect effect	T-Statistics	BCa Confidence interval		Hypothesis
			Lower (2.5%)	Upper (97.5%)	
DT ➔ BMI ➔ SMEP	0.135***	3.933	0.068	0.203	H4: Supported

Note: ***p≤ 0.001 DT: Digital transformation; BMI: Business model innovation; SMEP: SME performance

Appendix I

Table A1. First-order reflective constructs results

	Factor loading	SD	T-Statistics	CR	AVE
Digital transformation				0.909	0.669
DT01	0.732***	0.036	20.186		
DT02	0.719***	0.035	20.830		
DT03	0.880***	0.012	73.537		
DT04	0.890***	0.012	77.177		
DT05	0.853***	0.020	43.130		
Value creation				0.788	0.650
VCRE01	0.798***	0.028	28.624		
VCRE02	0.814***	0.025	32.947		
Value delivery				0.815	0.602
VDEL01	0.859***	0.017	50.767		
VDEL02	0.849***	0.017	50.504		
VDEL03	0.589***	0.047	12.667		
Value capture				0.845	0.732
VCAP01	0.873***	0.013	65.230		
VCAP02	0.837***	0.021	40.749		
SME performance				0.891	0.675
SMEP01	0.654***	0.049	13.279		
SMEP02	0.873***	0.014	61.824		
SMEP03	0.888***	0.014	62.715		
SMEP04	0.849***	0.026	32.720		

Note: *p ≤ 0.05; **p ≤ 0.01; ***p≤ 0.001; T-Statistics for n= 5.000 subsamples. SD: Standard Deviation. α: Cronbach's Alpha. CR: Composite Reliability. AVE: Average Variance Extracted.

Table A2. Discriminant validity analysis

First-order constructs	1	2	3	4	5
1. Digital transformation	(0.818)				
2. Value creation	0.435	(0.806)			
3. Value delivery	0.315	0.477	(0.776)		
4. Value capture	0.435	0.461	0.427	(0.855)	
5. SME performance	0.356	0.298	0.265	0.359	(0.822)

Note: Diagonal elements are the square root of the AVEs (in parenthesis); off-diagonal elements are the square correlations among constructs in the inner mode.

Table A3. Heterotrait-Monotrait analysis

First-order constructs	1	2	3	4
1. Digital transformation				
2. Value creation	0.670			
3. Value delivery	0.408	0.875		
4. Value capture	0.578	0.851	0.676	
5. SME performance	0.409	0.479	0.349	0.491

Appendix II

Questionnaire items for digital transformation (Nasiri et al., 2020)

Please indicate your level of agreement with the following statements about your firm.

1. In our company, we aim to digitalize everything that can be digitalized.
2. In our company, we collect massive amounts of data from different sources.
3. In our company, we aim to create stronger networking between the different business processes with digital technologies.
4. In our company, we aim to enhance an efficient customer interface with digitality.
5. In our company, we aim at achieving information exchange with digitality.

Questionnaire items for business model innovation (Latifi et al., 2021)

Please indicate your level of agreement with the following statements about your firm.

Value creation

1. We have introduced new products as a new value proposition.
2. We have introduced new services as a new value proposition.

Value delivery

3. We have started to collaborate with new business partners.
4. We have shared new responsibilities with business partners.
5. We have focused on a completely new market segment.

Value capture

6. We have created new revenue streams.
7. We have introduced a new pricing mechanism.

Questionnaire items for SME performance (Ferreras-Méndez et al., 2015).

Please state your firm performance compared to that of your competitors with regard to the following items.

1. Customer loyalty.
2. Sales growth.
3. Profitability.
4. Return on investment.