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Dynamic Capabilities, Internationalization and Growth of Small- and Medium-Sized Enterprises: The Roles of Research and Development Intensity and Collaborative Intensity

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Abstract

Small- and medium-sized enterprises (SMEs) can benefit from internationalization. However, there is little evidence of the extent of the benefit and its dependence on both research and development (R&D) intensity and collaborative intensity. Drawing on data of 262 SMEs, this study illuminates why some SMEs benefit more from internationalization than others, thereby illustrating an advanced application of partial least squares structural equation modeling by demonstrating conditional mediation analysis with two interdependent exogenous moderators (i.e., testing a second-stage three-way conditional mediation). Our findings substantiate that an SME's dynamic capabilities affect its degree of internationalization and indirectly its growth, and suggest a positive marginal growth impact of internationalization provided that an SME's R&D and collaborative intensities are proportional; when they are disproportional (i.e., one is "greater" than the other), SMEs do not experience positive marginal growth.

Keywords Dynamic capabilities · Internationalization · Growth · SME · R&D intensity · Collaborative intensity · PLS-SEM · Conditional mediation

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1 Introduction

The inherent complexities of conducting international business (e.g., Buckley & Casson, 2001; Eden & Nielsen, 2020) complicate developing understanding about whether and how internationalization helps large or small- and medium-sized firms (SMEs) improve their performance (e.g., Hennart, 2011; Lu & Beamish, 2001; Majocchi & Zucchella, 2003; Nguyen & Kim, 2020; Ribau et al., 2018). Some studies have suggested that a firm's research and development (R&D) intensity (e.g., Booltink & Saka-Helmhout, 2018; Ren et al., 2015) or collaborative effort (e.g., Swoboda et al., 2011) affect the extent to which internationalization translates into better performance (Mukherjee et al., 2021). However, it is unclear whether and how the performance effect of internationalization depends simultaneously on both a firm's R&D and collaborative intensities. This study addresses this issue with a particular focus on SMEs and their export intensity as a measure of their internationalization. We focus on exporting because it plays a crucial role in the internationalization of SMEs (Kuivalainen et al., 2012; Leonidou et al., 2010; Love & Roper, 2015; Mansion & Bausch, 2020; O'Farrell et al., 1998; Westhead et al., 2002) and their growth (D'Souza & McDougall, 1989). With this focus, the study addresses two research questions: what shapes an SME's internationalization and conditions its growth, and specifically what roles do R&D and collaborative intensities play in furthering this growth?

The dynamic capabilities (DCs) perspective substantiates internationalization and its performance implications, with recent studies emphasizing the importance of SMEs' DCs in exporting (Efrat et al., 2018; Monteiro et al., 2017, 2019; Villar et al., 2014). DCs are a critical feature that explains firms' performance differentials: "dynamic capabilities undergird the 'future' of any … [firm], because…they undergird competitive advantage" (Teece, 2014, p. 23). Essentially, a firm's DCs determine the degree to which it internationalizes and how it does so in a manner such that its performance improves. Therefore, our conceptualization assumes that DCs, at the corporate level, shape an SME's internationalization, which, in turn, affects its growth. Furthermore, and consistent with DCs reasoning, we argue that an SME's growth increases with its degree of internationalization as it engages in more external collaborations (e.g., Swoboda et al., 2011) and invests more in R&D (Booltink & Saka-Helmhout, 2018; Nunes et al., 2012). Both R&D and collaboration efforts are manifestations of DCs (e.g., Eisenhardt & Martin, 2000; Helfat, 1997) but operate at the business level enabling better local leverage of an SME's resources in one or more foreign markets when exporting.

Drawing on data from 262 SMEs, we apply partial least squares structural equation modeling (PLS-SEM) to assess our theoretical arguments. We use conditional mediation analysis and demonstrate an advanced application of PLS-SEM, which illustrates a conditional mediation analysis with two exogenous moderators that interact in moderating the growth impact of internationalization (i.e., assessing a second-stage three-way conditional mediation).

This study contributes to the international management literature by applying the DC perspective in explaining how an SME internationalizes and achieves

growth. Our findings confirm that, in the first instance, an SME's corporate-level DCs affect its degree of internationalization and indirectly its growth. While a positive relationship is shown between internationalization and growth, our findings provide further clarification and suggest that the marginal effect of an SME's degree of internationalization on its growth is positive if the combinations of its R&D and collaborative intensities are balanced (or proportional); when they are imbalanced (i.e., one is *greater* than the other), then an SME does not experience a positive marginal growth impact. Hence, DCs that operate at the business level, manifested in R&D intensity and collaborative intensity, enable an SME to better leverage its resources in one or more foreign markets when exporting if they are employed in proportion.

We further contribute to understanding about the application of PLS-SEM in international management contexts and beyond. We apply conditional mediation analysis and demonstrate an advanced application of PLS-SEM with two moderators that interact in conditioning the growth impact of an SME's internationalization (i.e., assessing a second-stage three-way moderated mediation). Besides outlining our results using a well-established two-dimensional three-way plot, we illustrate the results of our second-stage three-way moderation analysis by outlining regions of significance of the marginal effect on the impact of a mediating predictor variable (i.e., internationalization) on a dependent outcome variable (i.e., growth) for simultaneously varying moderators. This illustration is not only relevant to international management scholars but also to strategy, marketing, HRM, and MIS ones to understand how relationships are simultaneously conditioned by two exogenous moderators. In doing so, we respond to Eden and Nielsen (2020, p. 1610) who stated that "complexity is the underlying cause of the unique methodological problems facing international business research" and to advance an approach to assess three-way interactions in PLS-SEM.

This paper first outlines the conceptual background and substantiates several hypotheses. It then describes our empirical methodology and results, followed by a discussion of our findings and conclusion along with the contributions to the international management literature before suggesting avenues for further research.

2 Background and Hypotheses

In our theorizing, we reason that resource leverage internationally enables SMEs to benefit from firm- and country-specific advantages, with the latter relating to both the SME's home and host countries. In turn, SMEs experience growth improvements from exploiting location-specific advantages[1] (Dunning, 2000). This leverage of resources, in turn, defines how an SME's internationalization affects its

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[1] When we refer to location-specific advantages, we assume the SME has certain advantages when operating in a certain location (e.g., host country) in which is benefits from a pattern of firm- and country-specific advantages, but do not assume that the same location-specific advantage cannot occur in other locations (e.g., countries).

growth. Because SMEs resort commonly to exporting in their internationalization efforts (Kuivalainen et al., 2012; Leonidou et al., 2010; Love & Roper, 2015; Mansion & Bausch, 2020; O'Farrell et al., 1998; Westhead et al., 2002) to foster growth (D'Souza & McDougall, 1989), we operationalize an SME's degree of internationalization as its exporting intensity. Then, we show the deployment of DCs allows an SME to leverage its resources internationally to sustain or grow over time. Although an SME's pattern of firm- and country-specific advantages - along with ensuing location - specific advantages - defines the growth implications of its internationalization, by determining a suitable degree of internationalization (i.e., portfolio of international markets), DCs specify how the SME attempts to leverage such a pattern and the embedded location-specific advantages. Furthermore, we argue that an SME's R&D and collaborative intensities condition the extent to which it can benefit from leveraging its resources internationally by facilitating leverage of location-specific advantages that draw on its firm- and home/host country-specific advantages. In the following sections, we explain these arguments in depth.

2.1 Dynamic Capabilities and Internationalization

Firms expand into international markets as a key growth strategy (Chang & Wang, 2007). In line, the DC perspective highlights a firm's functioning over time and its performance and growth. It explains how firms leverage their resources internationally to sustain or enhance their performance (Altintas et al., 2022; Luo, 2000; Swoboda & Olejnik, 2022; Teece, 2014). For this reason, DCs have received significant attention in the strategic management and international management literature (Arikan et al., 2022; Drnevich & Kriauciunas, 2011; Fainshmidt et al., 2016). Importantly, not only do Matysiak et al. (2018) reinforce that internationalized firms' DCs allow them to sustain or grow their performance over time, they further explain that current theorizing in international business on the performance implications of firm- and country-specific advantages provide the decision logics that underlie the reasoning embedded in DC deployment in firms, and as we argue also in SMEs.

Whereas DCs can be focused on corporate- or business-level strategic change (Wilden et al., 2016), extant literature rarely distinguishes between the two foci. Corporate-level DCs govern a firm's degree of vertical and/or horizontal integration and degree of related and/or unrelated diversification. In the context of an SME, these DCs therefore also determine its degree of internationalization to achieve the SME's overall growth objective. In this way, corporate-level DC deployment encapsulates the identification, evaluation, and strategic change of an SME's exporting mix. It concerns the SME's degree of market diversification in consideration of the domestic markets that it sells to and international markets that it exports to. Specifically, it determines whether and where to export to and whether to change the mix and/or emphasis that an SME places on exporting to maintain or grow exporting sales relative to domestic sales. Business-level DCs on the other hand support strategic change in individual product and/or country markets where an SME may leverage its resources by, for example, putting in place and implementing suitable, possibly country-specific, product configurations and/or marketing and sales capabilities

to foster revenue growth in these individual markets. Accordingly, our theorizing considers corporate-level DCs as predicting an SME's degree of internationalization, and corresponding with business-level DCs reasoning, R&D intensity and collaborative intensity as supporting means to implement corporate-level DCs consequences (i.e., an SME's degree of internationalization) through local reconfiguration activities (Hawass, 2010). Specifically, we argue that R&D enables exploring, seizing, and tailoring product and/or service offerings that better align with the requirements of certain export markets. Collaborations, on the other hand, support an SME in sensing, evaluating, and exploiting opportunities and threats in certain export markets. Therefore, as these DCs enable tailoring the SME's exporting activities in market-specific ways, they function at the business level rather than the corporate level.

Therefore, SMEs deploy DCs to change how they leverage resources (e.g., Arend, 2014; Randhawa et al., 2021). The use of DCs helps produce economies of scope and scale through internationalization (e.g., leveraging an SME's resources across an appropriate portfolio of international markets) (Teece, 1980). Accordingly, DCs help SMEs make effective decisions on whether to internationalize and to what degree, and how to leverage their resources effectively through exporting activities that are tailored to country-specific market conditions. They can be categorized into three types of capacities (e.g., Matysiak et al., 2018): sensing and seizing strategic situational awareness; through them, firms seek knowledge to discover opportunities and threats and make effective decisions. Reconfiguring concerns material changes to what the SME does to exploit opportunities (i.e., changes to its degree of internationalization).

First, sensing allows SMEs to identify internationalization gaps in their portfolio. Sensing occurs in searching for opportunities to leverage products in existing or new international markets, and analyzing market growth, to point out some specific sensing capacities. Knowledge about external changes and their implications derived from sensing and scanning the international environment may reveal opportunities for an SME to sell more products in already served international markets, to sell existing products in new international markets, or to do both. SMEs with well-developed sensing can comprehend (1) internationalization opportunities, (2) gaps in their portfolio of international markets, and (3) possible strategies (e.g., exporting) to address the gaps. Such SMEs should have a better understanding of potential firm- and home/host country-specific advantages that they could benefit from through exporting and, hence, ultimately engage in better internationalization (Prange & Verdier, 2011).

High-quality sensing supplies inputs for SMEs' decision-making on leveraging its resources in international markets. Thus, following sensing, seizing facilitates decision-making on assessments of location-specific advantages to harness the right international opportunities. In particular, location-specific commercial assessments and evaluations help an SME determine whether and, if so, how to exploit opportunities in international markets. This involves exploring internationalization options (i.e., different exporting strategies) revealed through sensing, evaluating, and comparing potential initiatives based on deep analysis and/or intuition. However, seizing does not include entering new international markets or launching additional

products in existing international markets. Thus, seizing draws on the outputs of sensing to specify whether and, if so, which firm- and home/host country-specific advantages to exploit in specific international markets; although leading to a strategic decision (short of implementation), the guidance should culminate in producing better growth through internationalization (Swoboda & Olejnik, 2016).

Finally, implementation concerns entry into new international markets or the launch of additional products in existing ones. Reconfiguration capacities allow SMEs to establish or refine their international portfolio and fill the internationalization gap by implementing the (exporting) strategy that emerges from seizing. Although the capacity to seize can specify how an SME could potentially exploit location-specific advantages based on the firm- and home/host country-specific advantages in international markets, this potential will need to be realized in the SME's degree of internationalization (Lu & Beamish, 2001). For instance, an SME may use standardized interfaces to enable suitable configurations of the components in its product architecture to assemble products that fit certain international market opportunities. Reconfiguring thus supports an SME's exporting by entering existing foreign markets with new products, new foreign markets with products, or both.

Therefore, the three types of capacities that underpin corporate-level DCs shape an SME's export intensity, and hence its degree of internationalization. We argue that SMEs that exercise these DCs should experience less organizational inertia (Suddaby et al., 2020) and thus become more internationalized such that they grow the proportion of revenue generated outside their home country, irrespective of whether this involves one or more foreign markets. Therefore, we reason that an SME's internationalization is determined by its DCs, and corporate-level ones specifically, because they allow the SME to establish a portfolio of international markets that provides the foundation to strategically benefit from firm- and home/host country-specific advantages through exploiting location-specific advantages when leveraging its resources through internationalization:

Hypothesis 1: *An SME's internationalization increases with its corporate-level dynamic capabilities.*

2.2 Internationalization and Performance

Firms that export into foreign markets harness location-specific advantages (Dunning, 2000) that integrate with the unique patterns of firm- and home/host country-specific advantages (Rugman & Verbeke, 2001). Thereby, firms take advantage of the resources developed in their home (or another host) markets (Bartlett & Goshal, 1989). In turn, these firms improve performance (Rugman et al., 2011). This reasoning echoes the tenets of the resource- and knowledge-based views of the firm (Barney, 1991; Kogut & Zander, 1993).

However, internationalization-associated institutional diversity and complexity result in a firm's liability of foreignness and challenge SMEs in achieving desired performance outcomes (e.g., Lu & Beamish, 2006; Richter, 2014). More so, management constraints limit firms (Pitelis & Verbeke, 2007), particularly SMEs (Ribau et al., 2018), in their internationalization efforts. The Uppsala model (Johanson &

Vahlne, 1977) highlighted that internationalizing firms first gain experience in their domestic markets before engaging in international markets into which they export. Therefore, an SME's liability of foreignness decreases as it gains more experience in leveraging its resources internationally to create and exploit location-specific advantages that harness firm- and country-specific advantages (Rugman et al., 2011). For instance, an SME can improve exporting performance through better adapting its product configurations and/or marketing and sales capabilities. Such improvements can occur as the SME exports more within a single foreign market where it learns to better leverage its resources, or as it exports across multiple foreign markets. Therefore, as an SME leverages its resources through exporting, a dynamic interaction process fosters continuous growth for the firm. This marginal increase in a firm's performance depends on the creative and dynamic interaction between its productive resources and international market opportunities (Penrose, 1960). That is, an SME can grow if it can better leverage its products in foreign markets. This interplay enables any firm, including SMEs, to exploit location-specific advantages by drawing on certain patterns of firm- and home/host country-specific advantages to improve performance. Accordingly, whereas corporate-level DCs determine an SME exporting mix and ensuing degree of internationalization, the extent to which the latter translates into growth rests on the actual exploitation of location-specific advantages which the SME's exporting strategies ought to leverage. We put forward the following base hypothesis:

> *Hypothesis 2*: *An SME's growth increases with its internationalization.*

Combining our hypotheses 1 and 2, we conjecture an indirect-only effect of an SME's (corporate-level) DCs on its growth. This reasoning follows common DC theorizing that the performance impact of DCs, in general, should not be theorized by linking them directly to the performance of the firm (e.g., Helfat et al., 2007), but rather by means of a two-step process that "first traces their impact on intermediate outcomes in the form of strategic change and then assesses the impact of such change on measures of firm performance, such as survival, growth, and financial performance" (Helfat & Martin, 2015, p. 1288).

> *Hypothesis 3*: *An SME's corporate-level dynamic capabilities increase its growth through internationalization.*

2.3 The Roles of Collaborative Intensity and R&D Intensity in Internationalization

As outlined, an SME's DCs that function at the corporate level determine its degree of internationalization and indirectly its growth. In leaning on prior DC literature that views R&D and collaborative efforts as manifestations of DCs (e.g., Eisenhardt & Martin, 2000; Helfat, 1997), we complement our theorizing by applying business-level DC reasoning and explain that R&D intensity and collaborative intensity are supporting means for the implementation of corporate-level DC consequences (i.e., supporting revenue growth subject to an SME's degree of internationalization). To reiterate, whereas corporate-level DCs determine an SME exporting mix and ensuing degree of internationalization, the extent to which the latter translates

into growth rests on the actual exploitation of location-specific advantages which the SME's exporting strategies ought to leverage. Hence, by reinforcing local reconfiguration efforts, these two business-level DC manifestations facilitate better local leverage of an SME's resources in one or more foreign markets when exporting.

Against this backdrop, we argue that, in exploiting location-specific advantages through exporting, R&D intensity specifically improves growth associated with the SME's firm-specific advantage, and collaborative intensity particularly yields greater growth due to home/host country-specific advantage. Collaborative intensity is externally focused, and it supports the SME in exploiting home- and/or host country-specific advantages, whereas R&D intensity is largely internally focused and can improve the leverage of the SME's firm-specific advantage.

2.3.1 Collaborative Intensity

Access to potential country-specific advantages can be challenging. All firms may not have free and full access to these advantages (Hennart, 2009, 2012); therefore, some advantages can be leveraged only through collaborations with other firms. For instance, local institutions may offer local firms preferential access to country-specific advantages (Aggarwal & Agmon, 1990), so SMEs may find it challenging to develop and benefit from the potential location-specific advantages in the host country. As local firms are better adept in maneuvering local institutional conditions (Cuervo-Cazurra & Genc, 2008; Morck et al., 2008), SMEs can collaborate with local firms to decrease their liabilities of foreignness and gain the required access to these host country-specific advantages (Brouthers et al., 2015). That is, SMEs' abilities to explore threats and opportunities in certain export markets likely are constrained. By recognizing the business-level DC nature of collaborative efforts, we can clarify how, collaborations support SMEs in sensing, evaluating, and exploiting opportunities and threats in certain export markets. This, in turn, should strengthen SMEs' capabilities to improve their export performance in a given foreign market; ultimately translating into greater growth for the SME.

Studies have shown that SMEs collaborate to access resources when internationalizing (e.g., Manolopoulos et al., 2018; Schmitt, 2018), which further improves their performance (Hoffmann & Schlosser, 2001; Lu & Beamish, 2006; Nakos & Brouthers, 2008; Swoboda et al., 2011). Likewise, exporting performance has been shown to improve through collaborations (Zahoor et al., 2020). Collaboration strengthens as firms become more embedded in dense networks and collaborate with a larger range of partners (e.g., Hoffmann, 2005). In turn, these firms invest in identifying suitable partners and fostering existing collaborations to access resources (e.g., Draulans et al., 2003). Therefore, in distinguishing between the potential value of country-specific advantages and their realized value (Madhok & Tallman, 1998), as SMEs collaborate more intensively, they should be better able to create and exploit location-specific advantages through leveraging their firm-specific and realized country-specific advantages:

> *Hypothesis 4a*: *An SME's collaborative intensity positively moderates the relationship between its internationalization and growth.*

2.3.2 R&D Intensity

Our theorizing incorporates the business-level conceptualization of DCs and draws on Rugman's (1981) reasoning that SMEs possess idiosyncratic sets of firm-specific advantages to gain a competitive edge in their markets. Similar to the resource-based view of the firm (e.g., Barney, 1991), the firm-specific advantage that SMEs exploit is based on specialized, inimitable, difficult-to-access resources. Rugman et al. (2011, p. 760) highlighted that "[firm-specific advantages] arise from upstream research and development (R&D) expenditures that lead to new products or production processes." Hence, because R&D intensity can improve an SME's firm-specific advantage, we deduce that the effect of internationalization on performance in its exporting activities improves as it exhibits greater R&D intensity. By stressing the business-level DC nature of R&D, we can explain how it enables exploring, seizing, and tailoring product and/or service offerings that better align with the requirements of certain export markets. That is, greater R&D intensity enables SMEs to better configure their product offerings to suit the foreign market they target such that they should improve export sales in that market.

Whereas the overall relationship between R&D intensity and firm performance remains somewhat unclear (Li & Atuahene-Gima, 2001), we reason that the impact is not direct but rather indirect. Some studies portray a positive impact of R&D on performance for high-tech SMEs (Nunes et al., 2012; Ren et al., 2015; Stam & Wennberg, 2009), yet the same is not the case for non-high-tech SMEs, for which Nunes et al. (2012) found a negative linear relationship between R&D intensity and growth. Then, in an international context, Zhang et al. (2007) found that R&D intensity is positively related to performance in export market-focused international joint ventures. Contrary to Nunes et al. (2012), Booltink and Saka-Helmhout (2018) revealed an inverted U-shaped relationship between R&D intensity and firm performance among non-high-tech SMEs and found that as these SMEs become more internationalized, their R&D investment has a greater impact on the performance. Hence, R&D-intensive SMEs should be better able to create and also exploit location-specific advantages by leveraging their improved firm- and country-specific advantages (Lee & Marvel, 2009):

Hypothesis 4b: An SME's R&D intensity positively moderates the relationship between its internationalization and growth.

2.3.3 The Interplay of Collaborative Intensity and R&D Intensity in Internationalization

Although R&D intensity has a primary impact on the development of an SME's firm-specific advantage and collaborative intensity on realizing country-specific advantages, there are spillover effects as well. SMEs with greater R&D intensity and, hence, a likely greater firm-specific advantage, are more attractive partners for local firms in the host country (Borch & Solesvik, 2016; De Mattos et al., 2013) and affect the SME's ability to partner with local firms and access host country-specific
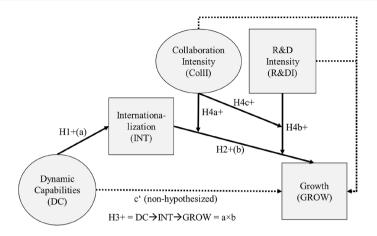
Fig. 1 Research model

advantages. Accordingly, the realization of country-specific advantages may also depend on the SME's R&D intensity. Similarly, collaborations may support an SME's R&D efforts such that its collaborative intensity also influences its firm-specific advantage. Indeed, SMEs engage in international collaborations to foster their R&D efforts (Dickson et al., 2006; Lee et al., 2012; Narula, 2004). Therefore, we reason that the extent to which an SME's collaborative and R&D intensities improve the growth impact of its internationalization is intertwined and mutually reinforcing:

> *Hypothesis 4c*: *An SME's collaborative and R&D intensity mutually moderate the relationship between its internationalization and growth - there is a positive three-way interaction.*

Figure 1 illustrates our conceptual research model.

3 Methodology

3.1 Sample

We identify SMEs from the Bureau van Dijk's commercial Amadeus database that contains information on 21 million firms across Europe. First, we exclusively focus on SMEs as defined by the European Commission 2003/361 (i.e., only firms with < 250 employees and either annual sales ≤ €50 million or an annual balance sheet ≤ €43 million). With just 88% of all active 3.19 million firms meeting these criteria (vs. 99% across European economies), there might be an omission bias due to data unavailability for some SMEs. Second, we restrict our population to manufacturers and providers of electronic and other electrical equipment (US-SIC Code 36), inviting representatives of 9,198 (delivered: 9,165) SMEs from 42 countries to participate in an online survey in 2015, yielding 1,294 responses (14% response rate) after two rounds of reminders. We focus on SMEs from these

high-tech industries as they operate in dynamic environments within which they commonly engage in R&D (Nunes et al., 2012), external collaborations (Ferreras-Méndez et al., 2019; Lee et al., 2012), and international activities (Ribau et al., 2018). Third, we exclude all SMEs with missing information on the following objective model variables: R&D intensity, internationalization (measured using data on export intensity), and growth (measured using sales growth that requires data on annual sales for the next fiscal year). These restrictions yield a final sample of 262 SMEs from 34 countries (c.f. Table 9 in the appendix for country distribution). To overcome the potential sample selection bias from nonresponse and data unavailability (e.g., +9.9% German firms due to home country bias), we model and control for the selection process by calculating an inverse Mills ratio from the SMEs' sizes, ages, and countries of origin (with the latter serving as valid exclusion criterion; Certo et al., 2016).

The sample characteristics in our study are as follows: average (median) SME size is 63 (39) employees, established in 1984 (1991), past fiscal year's export intensity is 42.7% (37.5%), R&D intensity 17.8% (10.0%), return on equity (ROE) 23.1% (18.0%), and sales volume €9.7 million (€5 million). SMEs experienced an average (median) sales growth of 20.2% (15.0%) in the next fiscal year. 71.8% of key informants were male, 35% were the owner or CEO, and had an average tenure of 7.2 years.

3.2 Measures

This study draws on multi-item measurement models and objective single-item measures (see Table 1 for all item characteristics). The SMEs' internationalization, growth, and R&D intensity measures are obtained from objective data; their (corporate-level) DCs and collaborative intensity measures are based on survey data.

We use export intensity (INT; in % of an SME's last fiscal year's annual sales) as an objective proxy for an SME's internationalization (Freixanet et al., 2018). Our dependent measure of growth (GROW) is based on an SME's sales growth, indicating an SME's sales in the next fiscal year relative to the last fiscal year (i.e., growth = [sales in t_1 – sales in t_0]/sales in t_0; Hult et al., 2008). We measure R&D intensity (R&DI) as the ratio of R&D expenses to SME's previous financial year's annual sales (Lee & Marvel, 2009). Owing to its considerable positive skew (mean = 17.8%, median = 10.0%, skewness S = 2.05; S > |2.0|; West et al., 1995), we add a constant of +1 and apply the natural logarithm to yield more desirable psychometric properties of ln R&DI (S = −0.379).

The survey items to measure (corporate-level) DCs and collaborative intensity draw on prior studies and are adapted based on the insights generated through a workshop with regional SME managers. Development of the measurement model for DCs follows the guidelines for constructing indexes based on formative indicators, namely, criteria of content specification, indicator specification, indicator collinearity, and external validity (Diamantopoulos & Winklhofer, 2001). First, we reviewed alternative operationalizations of DCs (e.g., Helfat et al., 2007; Lin et al., 2008; Pavlou & El Sawy, 2011). Most studies on DCs agree on three essential

Table 1 Measurement model assessment

Constructs and Items	Mean	SD	Kurtosis	Skewness	Loading (weight)	p-value	CA/CR	ρ_A	AVE	FL
Dynamic Capabilities (DC) (leaning on Pavlou & El Sawy, 2011; Wilden et al., 2013)	0.000	1.002	−0.179	−0.291	–	–	n/a	1.000	n/a	n/a
Sensing1: We constantly search for new product ideas	3.985	0.996	0.325	−0.909	(0.289)	0.035	–	–	–	–
Sensing2: We analyze the rationales of market growth in depth	3.425	1.009	−0.633	−0.233	(0.383)	0.017	–	–	–	–
Seizing1: We usually explore more than one alternative option	3.773	0.972	−0.485	−0.492	(0.271)	0.045	–	–	–	–
Seizing2: We decide our actions by gut feeling	2.572	1.082	−0.791	0.193	(0.267)	0.081	–	–	–	–
Transf1: Our standardized interfaces allow functional and physical interactions between core components	3.165	1.163	−0.641	−0.341	(0.378)	0.035	–	–	–	–
Transf2: Interfaces allow quick configuration of core components in the product architecture	3.022	1.204	−0.837	−0.117	(0.282)	0.069	–	–	–	–
Internationalization (INT): exports in %	42.741	30.190	−1.127	0.385	SI	SI	SI	SI	SI	0.284
Growth (GROW): sales growth in %	20.184	19.116	6.834	2.426	SI	SI	SI	SI	SI	0.376
Collaborative Intensity (CollI) (leaning on Kandemir et al., 2006):	0.000	1.002	−0.746	−0.062	–	–	0.919/0.921	0.924	0.746	0.475
CollI1: We invest substantially in order to find suitable partners	2.748	1.219	−1.020	0.124	0.831	0.000	–	–	–	–
CollI2: We are embedded in a dense network of collaboration	2.870	1.154	−0.937	0.001	0.797	0.000	–	–	–	–
CollI3: We invest substantially in order to intensively cultivate our existing collaborations	2.802	1.111	−0.895	−0.020	0.898	0.000	–	–	–	–
CollI4: We have a whole portfolio of different collaborations and collaboration partners	2.931	1.028	−0.677	−0.180	0.922	0.000	–	–	–	–
R&D Intensity (R&DI): Ln R&D intensity in %	2.436	1.071	−0.097	−0.379	SI	SI	SI	SI	SI	0.350
Firm Profitability: ROE in %	23.076	20.255	3.661	1.795	SI	SI	SI	SI	SI	0.376
Firm Size: Ln firm size in employees	3.520	1.227	−0.688	−0.301	SI	SI	SI	SI	SI	0.357
Firm Age: Ln firm age in years	2.979	0.896	−0.274	−0.134	SI	SI	SI	SI	SI	0.357
Firm Patents: Ln number of Patents in past 5 years	0.362	0.739	2.222	4.507	SI	SI	SI	SI	SI	0.231
Sample Selection Control: Inverse Mills ratio	19.991	7.499	1.446	0.647	SI	SI	SI	SI	SI	0.204

SD standard deviation; *CA* Cronbach's alpha; *CR* composite reliability; ρ_A construct reliability; *FL* Fornell–Larcker; *AVE* average variance extracted; *FL* Fornell–Larcker; *SI* single item

capacities that comprise DCs: (1) sensing concerns an SME's capacity to scan for and sense opportunities, (2) seizing captures an SME's capacity to evaluate existing and emerging opportunities, and (3) reconfiguring encapsulates an SME's capacity to recombine resources and ordinary capabilities (Teece, 2007; Wilden et al., 2013). This operationalization with these three capacities completely aligns with the theorizing upon which this study rests. Second, based on inputs provided by SME managers at the workshop, we use two formative items for each of the three DC capacities and construct a formative DC index (Table 1). These three DC capacities are not interchangeable, do not have the same content, and build on significantly different process categories (Wilden et al., 2013). None of our final six formative items exhibits excessive collinearity (VIF < 1.654).

There are numerous studies on firm-level collaborations, but a measurement model related to an SME's collaborative intensity is not readily available. Based on the feedback from SME managers involved in collaborative ventures and considering earlier studies on alliance management portfolio capabilities of SMEs (O'Dwyer & Gilmore, 2018; Sakhdari et al., 2020), we adapted a measurement model closely related to alliance orientation (Kandemir et al., 2006). This one-dimensional construct consists of four reflective five-point Likert-type items (anchored at 1 = not at all and 5 = fully applicable). Exploratory factor analysis supports the necessary condition of unidimensionality for the measurement model we use for an SME's collaborative intensity (hereafter, CollI).

Both latent measurement models meet all standard thresholds for evaluating reflective and formative models (Hair et al., 2022). Besides, bias-corrected and accelerated (BCa) confidence intervals of the heterotrait-monotrait (HTMT) criterion for testing the discriminant validity (Henseler et al., 2015) of model-implied variables do not include the conservative threshold value of 0.85, with the highest 95% estimate of HTMT being 0.495 between ROE and SME's growth. We support the formative and reflective modes of measurement for DCs and CollI based on a confirmatory tetrad analysis in PLS-SEM (CTA-PLS; Gudergan et al., 2008; Hair et al., 2018). The 95% bca confidence intervals with Bonferroni-adjusted p values test the null hypothesis of the reflective and alternative hypothesis of the formative mode (see Table 2).

3.3 Analytical Approach

We use the SmartPLS 3 software to estimate our model (Ringle et al., 2015). In the following, we report the main results for the consistent PLS algorithm (Dijkstra & Henseler, 2015) with 10,000 bootstraps using the percentile method, as recommended by Sarstedt et al. (Sarstedt et al., 2021). We test higher-order interactions using the recommended two-stage approach for reflective and formative measurement models (Hair et al., 2022). To test our postulated latent three-way interaction of a second-stage conditional mediation effect (Edwards & Lambert, 2007; Hayes, 2018), we precalculated a two-way manifest-manifest interaction between INT and

Table 2 Results from confirmatory tetrad analysis (CTA-PLS)

Model-implied Non-redundant Vanishing Tetrad	Original Sample Estimate (Oτ)	Sample Mean Estimate (Mτ)	Standard Deviation (σ)	p values	Bias	CI low	CI up	Bonferroni adj. α	z(1 − α)	CI low adj	CI up adj
τ_{Coll}, 1234	− 0.163	− 0.165	0.072	0.024	− 0.002	− 0.304	− 0.020	0.025	2.258	− 0.324	0.001
τ_{Coll}, 1243	0.009	0.010	0.036	0.790	0.000	− 0.061	0.079	0.025	2.258	− 0.071	0.090
τ_{DCs}, 2345	0.053	0.053	0.031	0.089	0.000	− 0.008	0.115	0.006	2.774	− 0.034	0.141
τ_{DCs}, 2354	0.083	0.082	0.038	0.029	− 0.001	0.009	0.159	0.006	2.774	− 0.022	0.190
τ_{DCs}, 2346	0.028	0.028	0.032	0.369	0.000	− 0.034	0.090	0.006	2.774	− 0.059	0.116
τ_{DCs}, 2463	0.023	0.022	0.024	0.340	0.000	− 0.024	0.070	0.006	2.774	− 0.043	0.090
τ_{DCs}, 2341	0.012	0.012	0.028	0.658	0.000	− 0.042	0.067	0.006	2.774	− 0.065	0.090
τ_{DCs}, 2356	0.259	0.257	0.059	0.000	− 0.002	0.146	0.376	0.006	2.774	0.098	0.424
τ_{DCs}, 2361	− 0.026	− 0.026	0.034	0.443	0.000	− 0.091	0.040	0.006	2.774	− 0.119	0.068
τ_{DCs}, 2451	0.017	0.017	0.024	0.488	0.000	− 0.031	0.065	0.006	2.774	− 0.051	0.085
τ_{DCs}, 2416	− 0.016	− 0.016	0.025	0.524	0.000	− 0.066	0.033	0.006	2.774	− 0.087	0.054

The null hypothesis H_0: $\tau = 0$ and a t value above or below a critical value for the conventional α-level supports the rejection of the null hypothesis. CTA-PLS does not reject H_0 for collaborative intensity and, thus, supports the reflective measurement model specification. The Bonferroni-adjusted 95% bca confidence interval (CI) for the tetrad τ_{DC}, 2356 of DCs excludes zero [0.098; 0.424], even for the less restrictive 90% CI [0.113; 0.410], and therefore rejects the reflective measurement model specification

Table 3 Test of overall model fit

Saturated Model			
Criteria	Value	HI95	HI99
SRMR	0.032	0.038	0.042
d_{ULS}	0.218	0.310	0.365
d_G	0.167	0.154	0.219
Estimated Model			
Criteria	Value	HI95	HI99
SRMR	0.041	0.040	0.044
d_{ULS}	0.357	0.342	0.401
d_G	0.184	0.171	0.255

10,000 bootstraps; *SRMR* standardized root mean square residuals; d_{ULS} unweighted least squares discrepancy; d_G geodesic discrepancy

ln R&DI, thereby avoiding attenuation bias in case of imperfect reliabilities (Boyd et al., 2005). The section on robustness provides further insights.

We include a series of control variables to reduce the likelihood of omitted causes and endogenous results. SME demographics strongly influence an SME's internationalization and sales growth (Miesenbock, 1988). Hence, we control for an SME's age by including the natural logarithm of years since founding and its size by considering the natural logarithm of employees in the last fiscal year. To avoid the confounding effects of an SME's growth versus profitability objectives (Lu & Beamish, 2006), we control for an SME's past firm performance by including its ROE (in %). Since new product launches can boost SMEs' growth, we screened the European Patent Office (https://worldwide.espacenet.com/) for all firms in our sample and included the log-number of patents in the past five years into our models (Agostini et al., 2015). Because industry effects may also explain the growth differentials (Majocchi et al., 2005), we binary control for the largest subgroup of electronic components and accessories (i.e., SIC = 367). In dealing with nonrandom sampling, we calculate the inverse Mills ratio as an additional control (Certo et al., 2016).

3.4 Results

First, we assessed the global model fit of the estimated model shown in Fig. 1, including a non-hypothesized relationship (c') and various interactions for a (conditional) mediation analysis (Hayes, 2018). Table 3 summarizes three global goodness-of-fit measures: the standardized root mean squared residual (SRMR), the unweighted least squares discrepancy (d_{ULS}), and the geodesic discrepancy (d_G), including their bootstrap-based 95% (HI95) and 99% (HI99) percentiles. Our estimated model cannot be rejected since none of the estimated fit statistics exceeds the HI99 (Dijkstra & Henseler, 2015).

Table 4 Bivariate correlation matrix

Measures	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
(1) Growth (GROW)	1.000														
(2) Internationalization (INT)	**0.284**	1.000													
(3) Dynamic Capabilities (DC)	**0.165**	**0.188**	1.000												
(4) INT×ColII	0.022	0.063	0.050	0.746											
(5) INT×ln R&DI	0.081	−0.047	−0.042	**0.190**	1.000										
(6) ColII×ln R&DI	0.136	−0.073	−0.024	**0.394**	**0.354**	0.746									
(7) INT×ColII×ln R&DI	**0.352**	**0.183**	0.060	0.024	0.169	−0.141	0.746								
(8) Collaborative Intensity (ColII)	**0.163**	**0.268**	**0.475**	−0.124	−0.067	−0.074	0.135	0.746							
(9) R&D Intensity (R&DI)	**0.256**	**0.269**	**0.209**	−0.075	−0.084	0.002	**0.350**	**0.226**	1.000						
(10) ROE	**0.376**	0.075	**0.161**	0.063	0.103	0.102	**0.291**	**0.187**	**0.199**	1.000					
(11) Ln Firm Age	**−0.262**	−0.098	**−0.202**	0.007	−0.008	0.049	0.002	−0.104	**−0.244**	−0.132	1.000				
(12) Ln Firm Size	0.022	0.015	−0.126	−0.066	−0.026	0.071	0.042	0.040	−0.061	0.040	**0.357**	1.000			
(13) Ln Patents	0.131	0.076	0.091	0.011	0.045	0.054	0.081	0.018	0.054	0.076	**0.126**	**0.231**	1.000		
(14) Industry (binary)	0.008	**0.171**	−0.056	−0.029	−0.048	0.003	−0.035	−0.008	0.052	**0.205**	−0.056	0.001	0.075	1.000	
(15) Inverse Mills Ratio	0.000	0.019	0.095	−0.022	0.003	−0.040	−0.002	−0.024	0.086	−0.026	**−0.204**	−0.114	0.048	−0.023	1.000

$N = 262$ SMEs; bold correlations are significant at $p \leq 0.05$ (i.e., 95% bca CI from 10,000 bootstraps exclude zero); diagonal shows average variance extracted

Table 4 shows all bivariate correlations, including all postulated interaction terms, as recommended by Haans et al. (2016). Table 5 summarizes the estimations for the structural path model, including effect sizes and variance inflation factors.

The bootstrapping results for Hypothesis 1 show that the corporate-level DCs construct significantly affects INT (H1: $\beta = 0.183$, $p = 0.004$, $f^2 = 0.033$), supporting our first hypothesis. Although the bivariate correlation between DCs and GROW is positive and significant ($r = 0.165$, $p < 0.05$), the conditional main effect (c') of DCs on GROW is insignificant ($\beta = 0.016$, $p > 0.10$ before and $\beta = 0.002$, $p > 0.10$ after inclusion of the indirect path DCs→INT→GROW and $\beta = 0.024$, $p > 0.10$ after inclusion of all postulated 2nd lag interaction effects). However, INT affects GROW significantly (H2: $\beta = 0.230$, $p < 0.001$, $f^2 = 0.063$ before and $\beta = 0.225$, $p < 0.001$, $f^2 = 0.064$ after interactive extensions), constituting an indirect-only effect (H3: $\beta = 0.041$, $p = 0.016$; Zhao et al., 2010). Next, we tested our higher-order inter-actions. Both contingencies (i.e., R&DI and CollI) failed to significantly moderate the relationship between INT and GROW in isolation, thus rejecting our H4a for CollI ($\beta = -0.102$, $p > 0.10$) and H4b for R&DI ($\beta = -0.054$, $p > 0.10$). Notably, there is a positive stand-alone moderation effect between CollI and R&DI ($\beta = 0.125$, $p < 0.050$, $f^2 = 0.021$) that remains robust after including all postulated interactions ($\beta = 0.228$, $p = 0.002$, $f^2 = 0.054$). Moreover, CollI and R&DI jointly interact with INT's effect on GROW (H4c: $\beta = 0.278$, $p = 0.001$, $f^2 = 0.084$), supporting our sec-ond-stage conditional mediation effect (Edwards & Lambert, 2007). Specifically, there is a second-stage three-way moderated indirect-only effect (Hayes, 2018). The overall model explains about one-third of GROW ($R^2 = 0.355$, $p < 0.001$). Table 6 summarizes the conditional mediation analysis by direct, indirect, and total effects for different values of both moderators ($+/–1$ SD). Only proportional levels of the two moderators yield positively significant indirect-only effects (Hayes, 2018; Zhao et al., 2010).

Figure 2 illustrates our second-stage three-way moderation by regions of signifi-cance of INT's marginal effect d(INT) on GROW for two simultaneously varying moderators:

$$\frac{d(\text{GROW})}{d(\text{INT})} = 0.225^{***} + -0.102 \times \text{CollI} + -0.054 \times \text{R\&DI} + 0.278^{**} \times \text{CollI} \times \text{R\&DI}.$$

(1)

The lower and upper bounds of INT's marginal effect at the top of Fig. 2 are non-linear because of the combined standard error increasing at the edges of the x-axis (i.e., levels of zCollI) and z-axis (i.e., levels of zln R&DI). Positive ('+') and nega-tive significance ('–') emerge from the positive lower bounds and negative upper bounds, respectively, of the 90% confidence intervals. Figure 2 (bottom left panel) combines all information. Here, INT's marginal effect is insignificant ('n.s.') if the 90% confidence interval (CI) includes zero. The center of the profile with zCollI@0 and zR&DI@0 represents the average positively significant marginal effect of INT on GROW. Moreover, all proportional combinations of CollI and R&DI allow SMEs to increase their GROW by marginal increases of their INT, suggesting a balanc-ing act between internal R&DI and external CollI where both act in tandem. The

Table 5 Structural model estimations

Outcome, Paths & Hypothesis	ß	p value	PBCI	Sig?	f²	VIF
INT ($R^2=0.075$; $R^2_{adj}=0.050$)						
H1(+): DC→INT	0.183	0.004	[0.066; 0.295]	Yes	**0.033**	1.105
ROE→INT	–0.007	0.922	[–0.147; 0.127]	No	0.000	1.104
Ln Age→INT	–0.080	0.250	[–0.216; 0.054]	No	0.005	1.250
Ln Size→INT	0.057	0.419	[–0.084; 0.191]	No	0.003	1.219
Industry→INT	0.176	0.004	[0.056; 0.295]	Yes	**0.031**	1.064
Ln Patents→INT	0.044	0.482	[–0.077; 0.171]	No	0.002	1.098
Mills Ratio→INT	–0.007	0.918	[–0.137; 0.124]	No	0.000	1.061
GROW ($R^2=0.355$; $R^2_{adj}=0.319$)						
H2(+): INT→GROW	0.225	0.000	[0.122; 0.316]	Yes	**0.064**	1.224
(c') DC→GROW	0.024	0.738	[–0.126; 0.163]	No	0.001	1.441
H3(+): DC→INT→GROW	0.041	0.016	[0.012; 0.074]	Yes	n/a	n/a
CollI→GROW	–0.019	0.813	[–0.167; 0.142]	No	0.000	1.459
R&DI→GROW	–0.022	0.754	[–0.160; 0.116]	No	0.001	1.399
H4a(+): CollI×INT→GROW	–0.102	0.131	[–0.257; 0.042]	No	0.012	1.291
H4b(+): R&DI×INT→GROW	–0.054	0.193	[–0.155; 0.050]	No	0.004	1.280
R&DI×CollI→GROW	0.228	0.002	[0.096; 0.391]	Yes	**0.054**	1.490
H4c(+): INT×R&DI×CollI→GROW	0.278	0.001	[0.144; 0.444]	Yes	**0.084**	1.440
ROE→GROW	0.246	0.001	[0.094; 0.381]	Yes	**0.074**	1.263
Ln Age→GROW	–0.263	0.000	[–0.397; –0.144]	Yes	**0.081**	1.319
Ln Size→GROW	0.042	0.531	[–0.093; 0.171]	No	0.002	1.258
Industry→GROW	–0.098	0.064	[–0.201; 0.005]	No	0.013	1.126
Ln Patents→GROW	0.095	0.244	[–0.053; 0.265]	No	0.013	1.114
Mills Ratio→GROW	–0.047	0.442	[–0.162; 0.075]	No	0.003	1.070

INT internationalization; *GROW* growth; *DC* dynamic capabilities; *CollI* collaboration intensity; *R&DI* research & development intensity; *adj* adjusted; *sig* significant; *VIF* variance inflation factor; *n/a* not available; *PBCI* percentile bootstrap confidence interval; bootstrapping based on N=10,000 re-samples; postulated relationships tested using 95% one-tailed and controls using 95% two-tailed tests; meaningful effect sizes are bold (for direct effects: "small" = $f^2 > 0.020$, "medium" = $f^2 > 0.15$ and "large" = $f^2 > 0.35$; and for moderated effects: "small" = $f^2 > 0.005$, "medium" = $f^2 > 0.01$ and "large" = $f^2 > 0.025$; Hair et al. (2022)

INT-attributed growth potential becomes insignificant if high R&DI coincides with low CollI, indicating an external barrier to SMEs' growth. A greater threat to an SME's growth is an internal R&DI barrier ($<–0.7 \triangleq <4.0\%$) in conjunction with high CollI ($>+1$ SD). The well-established traditional two-dimensional three-way plot at the bottom right of Fig. 2 allows similar observations. However, these plots solely focus on the mean values of a dependent variable, not accounting for the sample size considerations implicit to standard errors. With Likert-typed scales commonly used in PLS-SEM, the absolute mean values become less important than more informative regions of significance.

Table 6 Conditional mediation analysis

Models	c (total): DC→GROW		c' (direct): DC→GROW		Configuration ColI (Mod1)	R&DI (Mod2)	H3: a×b (indirect): DC→INT→GROW	PBCI (indirect)	Sig?	VAF
1. No Interactions	ß=0.044	[−0.106; 0.186]	ß=0.002	[−0.143; 0.138]	mean	mean	ß=0.042	[0.012; 0.075]	Yes	95%
2. Indirect-only	ß=0.042	[0.008; 0.084]	excluded		mean	mean	ß=0.042	[0.013; 0.076]	Yes	n/a
3. ModMed-model (equivalent to model *No. 18* in PROCESS; Hayes, 2018)					balanced					
	ß=0.066	[−0.087; 0.207]	ß=0.024	[−0.126; 0.163]	mean	mean	ß=0.041	[0.011; 0.074]	Yes	62%
	ß=0.080	[−0.080; 0.246]	ß=0.024	[−0.126; 0.163]	+1 SD	+1 SD	ß=0.064	[0.013; 0.130]	Yes	79%
	ß=0.136	[−0.034; 0.316]	ß=0.024	[−0.126; 0.163]	−1 SD	−1 SD	ß=0.119	[0.038; 0.215]	Yes	88%
					unbalanced					
	ß=−0.005	[−0.149; 0.146]	ß=0.024	[−0.126; 0.163]	+1 SD	−1 SD	ß=−0.021	[−0.070; 0.013]	No	comp
	ß=0.014	[−0.148; 0.187]	ß=0.024	[−0.126; 0.163]	−1 SD	+1 SD	ß=−0.002	[−0.063; 0.055]	No	comp

VAF = variance accounted for; *n/a* not available; comp = competitive indirect effect with sign changes, see Zhao et al. (2010); PBCI = percentile bootstrap confidence interval; bootstrapping based on N = 10,000 re-samples; H3 tested using 95% one-tailed, direct & total effects using 95% two-tailed tests
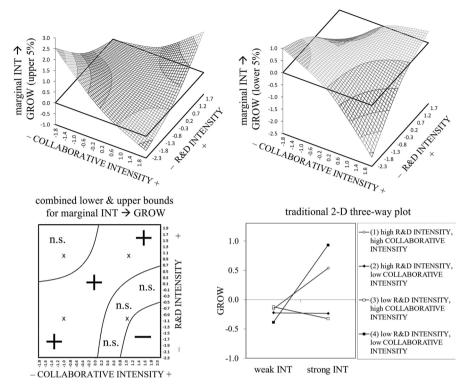
Fig. 2 3D and 2D plots of a three-way interaction

3.5 Robustness Tests

In following recommendations by Sarstedt et al. (2020), we conducted a series of robustness checks of our findings. First, we used a time-lagged objective-dependent measure to reduce common method bias and issues due to reverse causality, causing potentially endogenous results. Methodologically, we applied the Gaussian copula approach to the variable scores of DCs, INT, CollI, and R&DI. Although none of the added copulas yields significance, they lead to severe variance inflation (VIFs > 10) primarily due to "too normal" endogenous regressors (Papies et al., 2017, p. 612). Nevertheless, even after including all copulas, our postulated main H4c remained significant, confirming that the interactions are robust to different sources of biases (Siemsen et al., 2010). Second, we controlled for the quadratic effects of our core variables to relax the implicit linearity assumption. In practice, relationships are often monotonic rather than linear (Ganzach, 1998). The added quadratic parameters do not yield significance (all four $p > 0.935$, all $f^2 < 0.006$, highest VIF = 3.874), and all postulated relationships remained robust.

Table 7 Fit indices and relative segment sizes for the one- to four-segments solutions

Criteria	Number of Segments			
	1	2	3	4
AIC$_3$	1422.601	1292.218	1215.000	**1175.404**
AIC$_4$	1445.601	1339.218	1286.000	**1270.404**
BIC	1481.673	1412.930	**1397.352**	1419.396
CAIC	1504.673	**1459.930**	1468.352	1514.396
EN	n/a	0.677	0.880	**0.916**
Segment 1%	100%	81.2%	77.4%	71.3%
Segment 2%		*18.8%*	*14.4%*	*11.6%*
Segment 3%			*8.2%*	*9.8%*
Segment 4%				*7.3%*

AIC Akaike's information criterion (modified versions with factor 3; 4); *BIC* Bayesian information criterion; *CAIC* consistent AIC; *EN* entropy; *n/a* not available; bold numbers indicate the best number of segments per criterion; italic numbers indicate segment sizes with insufficient power levels for identifying all medium effect sizes

Third, we assessed unobserved heterogeneity and applied the FIMIX-PLS algorithm with the standard settings to our data. The results of an a priori power analysis suggest a minimum segment size of 101 to uncover all medium effect sizes at a power level of 80%, restricting a meaningful extraction to a maximum of three segments, given our sample size. In Table 7, we present the results of one- to four-segment solutions. Consideration of several fit indices suggests different optimal numbers of segments. AIC$_3$ and CAIC, as well as AIC$_4$ and BIC, favor different solutions, revealing an inconsistent pattern (Sarstedt et al., 2011, 2016). Notably, only the first segment was of a meaningful size throughout all solutions, suggesting the absence of meaningful alternative segments (all < 19%) and, consequently, no severe threat of unobserved heterogeneity.

Fourth, we checked for alternative model specifications: (1) we switched the measurement mode for CollI to a formative one because the first tetrad from CTA-PLS is close to rejecting the reflective mode. Nevertheless, the results remained robust. Therefore, there are no artifacts of the measurement mode. (2) We also conducted estimations ignoring R&DI's natural skew and discarded the log-transformation. Again, the results remained robust. (3) We then extended the second-stage three-way conditional mediation to a total effect three-way moderation by adding contingency-interactions at the first stage and the direct effect of DCs (Hayes, 2018). None of the extensions reached significance, and the postulated relationships remained robust. (4) Regarding the narrow corridor of GROW through increased INT for proportional CollI and R&DI, we tested potential evolutionary paths in SMEs' internationalization (Dabić et al., 2020). Firm age might be a proxy of business experience and greater internationalization. To test the sensitivity of the identified corridor to SMEs' age, we added four additional age interactions to our final model. None of these extensions

Table 8 PLSpredict analysis

Prediction of Growth (GROW)	PLS-SEM	LM	Δ PLS-SEM – LM
RMSE	0.670	0.678	– 0.008
MAE	0.446	0.451	– 0.005
MAPE	573.813	624.309	– 50.496
$Q^2_{predict}$	0.174	0.154	0.020

RMSE root mean squared error; *MAE* mean absolute error; *MAPE* mean absolute percentage error; *LM* linear regression model; $PLS_{predict}$ analysis based on k = 10 folds and r = 10 repetitions; both RMSE and MAE favor PLS-SEM, but due to PLS-SEM's error distribution being somewhat skewed (S = 1.780, K = 5.721), MAE is more reliable for correct model selection (Shmueli et al., 2019)

yielded significance, and all postulated relationships remained robust. Therefore, we conclude that our identified "growth-through-internationalization-corridor" is independent of SMEs' age and can be applied as a universal growth strategy.

Finally, Table 8 summarizes the predictive power of our estimated full model (PLS-SEM) versus a naïve linear regression model (LM) following Shmueli et al. (2019). Our PLS-SEM model predicting growth yields superior prediction, with a positive Q^2 and lower RMSE and MAE statistics as compared to the LM benchmark.

4 Discussion and Conclusions

4.1 Theoretical Implications

This paper contributes to several literature streams. The paper advances international management understanding about the growth effects of SME internationalization. It emerges that SMEs can benefit from the location-specific advantage(s) that they create and exploit. This rests on a nuanced balancing act that is based on an SME blending its firm-specific advantages with realized country-specific advantages by engaging in R&D and external collaborations at the corresponding levels of intensity. In other words, the synergistic value residing in patterns of firm-and country-specific advantages depends on the analogous efforts to strengthen resources underpinning both advantages. Therefore, investment in either R&D or collaborations does not increase the extent to which SMEs experience greater growth from internationalization. Our findings suggest that greater investment in R&D than collaborations, vice versa, creates an unbalanced set of firm-specific and realized country-specific advantages and has no discernible improvement in growth. This finding is consistent with existing international management literature that states that internationalizing firms seek

to attain optimal configurations of firm- and country-specific advantages (e.g., Rugman & Verbeke, 2003) to benefit from location-specific advantages that are based on an optimal balance of leveraging firm- and country-specific advantages (Bartlett & Goshal, 1989; Rugman & Hodgetts, 2001). Furthermore, our finding that SMEs must balance their R&D and collaborative intensities to improve growth from internationalization corresponds with Girod and Rugman (2005, p. 343): "Growth [of internationalizing firms is] balanced between internalized and partnership strategies." Overall, this study provides theoretical and empirical evidence to substantiate that the growth impact of an SME's internationalization depends on the interplay of both its R&D and collaborative intensities. In the particular context of operationalizing an SME's degree of internationalization by its export intensity and its performance by its revenue growth, we reason that the more sophisticated, differentiated an SME's exporting activity, the more it benefits from engaging in and simultaneously leveraging both R&D and collaborative efforts to grow overall revenues. In contrast, when the exporting activity is rather generic, it would not engage much in either but still see revenue growth as a function of it being more internationalized. These reinforcing roles of the SME's R&D and collaborative intensities at corresponding levels condition the growth effect of its exporting activity irrespective of whether it exports into one or few foreign markets compared to many foreign markets.

This paper also contributes to the DC and SME literature. First, it responds to calls for further research on DCs in the international management literature, as Li et al. (2019), echoing among others Lessard et al. (2016), emphasized the need for additional empirical research to understand DCs used in international environments. In distinguishing corporate-level DCs from manifestations of business-level DCs (i.e., R&D and collaborative efforts), we offer a more nuanced understanding of DCs in internationalizing SMEs. Our empirical findings show that (corporate-level) DCs foster internationalization and that, rather than directly affecting growth, these DCs have an indirect effect on growth through internationalization. This finding is consistent with studies that suggest that DCs shape a firm's international activities to sustain or enhance its performance (Li-Ying et al., 2016; Luo, 2000; Teece, 2014). Additionally, our findings substantiate the indirect growth effect of DCs mediated through internationalization. While the general strategy literature stresses that the performance of DCs should not be conceptualized by linking them directly to the firm's performance (e.g., Helfat et al., 2007), but rather indirectly in that "first traces their impact on intermediate outcomes in the form of strategic change and then assesses the impact of such change on measures of firm performance, such as survival, growth …" (Helfat & Martin, 2015, p. 1288), empirical evidence in international management is scarce. Furthermore, by empirically assessing R&D and collaboration efforts as manifestations of DCs (e.g., Eisenhardt & Martin, 2000; Helfat, 1997), we account for business-level DCs reasoning in our explanation of the roles that R&D intensity and collaborative intensity play in implementing corporate-level DC outcomes. Our results confirm that corporate-level DCs affect an SME's degree of

internationalization but only indirectly growth; an indirect impact that is conditioned by the SME's business-level DCs in the form of its R&D and collaborative intensities. Second, while there is a growing body of SME literature that aims to clarify SME internationalization (e.g., Ribau et al., 2018) and the performance impacts of their investment in R&D and external collaborations (e.g., Ferreras-Méndez et al., 2019; Lee et al., 2012; Nunes et al., 2012), an established body of knowledge is yet to emerge. Our findings add to the SME literature by highlighting that high-tech SMEs benefit from internationalization and even experience greater growth improvements when they invest analogously in R&D and collaborations. Thereby, this paper further clarifies the works of Lee and Marvel (2009) and Nunes et al. (2012).

4.2 Methodological Implications

Although mediation (Nitzl et al., 2016; Sarstedt, Hair, et al., 2020) and moderation analyses (Becker et al., 2018) in PLS-SEM are used in international management research, it does not apply to conditional mediation analysis that draws on both. Whereas researchers commonly adopt Hayes' (2018) PROCESS-macro for SPSS or SAS as a complement when conducting their PLS-SEM analysis, Cheah et al. (2021) and Sarstedt, Hair, et al. (2020) advocate simultaneous estimations. Furthermore, most international management studies consider only a single exogenous moderator in conditional mediation analysis.

This paper demonstrates an advanced application of PLS-SEM, which concerns a conditional mediation analysis with two exogenous moderators that interact in conditioning the growth impact of an SME's internationalization (i.e., assessing a second-stage three-way moderated mediation). This addresses the explicit call for research in PLS-SEM on conditional mediation analysis "in which two exogenous moderators (rather than one) simultaneously condition either the first-stage or second-stage of the mediated relationship" (Cheah et al., 2021). In addition to describing our results using a well-established two-dimensional three-way plot, we illuminate the results of our second-stage three-way moderation analysis by outlining the regions of significance of the marginal effect on the impact of a mediating predictor variable (i.e., internationalization in this paper) on a dependent outcome variable (i.e., firm growth in this paper) for two simultaneously varying moderators. This illustration should help international management researchers - but also those in other business disciplines such as strategic management, marketing, management accounting, etc. - better empirically assess how marginal second-stage effects are simultaneously conditioned by two exogenous moderators (e.g., exploration vs. exploitation, competition vs. collaboration, autonomy vs. control). By providing these methodological advances, we reply to Eden and Nielsen (2020, p. 1610) who emphasize that "complexity is the underlying cause of the unique methodological problems facing international business research" and outline an approach to assess three-way interactions in PLS-SEM.

4.3 Practical Implications

The implications for SME management are lucid: First, notwithstanding resource constraints, SMEs benefit from internationalization and, hence, should not shy away from doing so. To do so effectively, management should deploy DC to systematically explore, initiate, and exploit opportunities in international markets. Without deploying DC, SME internationalization will occur by chance and likely be a mix of international activities that may or may not enhance revenue growth. Furthermore, investment decisions concerning R&D and external collaborations ought to strive toward corresponding levels of investment into these two sets of activities so that they are in balance. Balanced investments into R&D and external collaborations will help achieve greater growth from internationalizing the SME (Fink et al., 2008; Zahoor et al., 2020).

4.4 Implications for Further Research

This paper can be extended to produce a more nuanced understanding of the growth implications of SME internationalization conditional on the SME's R&D and collaborative intensity. Although our robustness tests already account for the possibility of nonlinear relationships, we encourage further analyses to deal more systematically with such. Applying a necessity logic to the model could be an interesting future research route (Richter & Hauff, 2022; Richter et al., 2020). Among other insights, it may generate understanding about the threshold levels of R&D and/or collaborative intensity as potential bottlenecks (Klimas et al., 2021). Then, although our theorizing is general and applicable to any SME, our sample has focused on high-tech SMEs only. Therefore, assessing the generalizability of our findings for non-high-tech SMEs would be a worthwhile endeavor. In addition, while we draw on a general conceptualization and measurement for collaborative intensity, further studies could unpack this further to distinguish the type of collaborations prevailing and account for the mix of different collaborations (Garcia-Canal et al., 2002).

Similarly, we only focus on export intensity as a means of an SME's degree of internationalization. Although exports are the most prominent entry mode to foreign markets, SMEs can choose multiple paths to internationalization (e.g., joint venturing, acquiring an existing company, or establishing a wholly-owned greenfield investment from scratch; Kuivalainen et al., 2012; Lu & Beamish, 2001). Hence, examining multiple modes simultaneously could provide further nuanced insights. Likewise, R&D intensity could be studied more nuanced to distinguish between investments in home- and host-country R&D.

Appendix 1

See Table 9.

Table 9 European country distribution (SMEs in US-SIC 36)

Country	Population N	Population%	Sample N	Sample%
Germany	2800	30.55	106	40.46
Russia	1243	13.56	25	9.54
Great Britain	1057	11.53	20	7.63
France	548	5.98	13	4.96
Poland	434	4.74	11	4.20
Switzerland	433	4.72	10	3.82
Czech Rep	416	4.54	8	3.05
Turkey	163	1.78	6	2.29
Hungary	233	2.54	6	2.29
Austria	156	1.70	6	2.29
Bulgaria	149	1.63	5	1.91
Romania	147	1.60	4	1.53
Finland	108	1.18	3	1.15
Slovakia	106	1.16	3	1.15
Serbia	107	1.17	3	1.15
Ukraine	142	1.55	3	1.15
Portugal	145	1.58	3	1.15
Bosnia and Herzegovina	24	0.26	2	0.76
Italy	99	1.08	2	0.76
Belgium	71	0.77	2	0.76
Denmark	65	0.71	2	0.76
Estonia	56	0.61	2	0.76
Hungary	86	0.94	2	0.76
Norway	85	0.93	2	0.76
Slovenia	94	1.03	2	0.76
Spain	30	0.33	2	0.76
Lithuania	51	0.56	2	0.76
Netherlands	7	0.08	1	0.38
Liechtenstein	7	0.08	1	0.38
Latvia	23	0.25	1	0.38
Malta	7	0.08	1	0.38
Belarus	20	0.22	1	0.38
Greece	13	0.14	1	0.38
Macedonia	19	0.21	1	0.38
Albania	5	0.05	0	0.00
Iceland	4	0.04	0	0.00
Sweden	3	0.03	0	0.00
Cyprus	2	0.02	0	0.00

Table 9 (continued)

Country	Population N	Population%	Sample N	Sample%
Monaco	2	0.02	0	0.00
Luxembourg	2	0.02	0	0.00
Ireland	2	0.02	0	0.00
Kosovo	1	0.01	0	0.00
Overall	9165	100	262	100

$\chi^2(41) = 37.19$, $p = .64$ (adjusted for expected cell frequencies less than 5)

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