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Exploring the role of international R&D activities in the impact of technological and marketing capabilities on SMEs' performance

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ABSTRACT

One of the main challenges for small and medium enterprises (SMEs) is how to leverage their R&D activities in the international markets but current literature offers mixed evidence and inconclusive models in this regard. This paper addresses this gap by exploring the role of international R&D activities in the impact of SMEs' technological and marketing capabilities on their performance. The authors use in-depth interviews with five Italian SMEs recognized as particularly innovative firms in their own sectors (retail intelligence, business training, shoes, food, and sportswear) to identify the factors driving the success and performance of their international R&D efforts. Findings show that SMEs' technological and marketing capabilities have dominant and positive effects on their performance in the international markets. Besides extending the literature on the internationalization of R&D by SMEs, these findings highlight the major challenges and opportunities for the managers of internationally active SMEs.

1. Introduction

The role of research & development (R&D) in small and medium enterprises (SMEs) is a well-known topic in management literature (e.g., Lewandowska, Szymura-Tyc, & Golebiowski, 2016; Chaudhary & Batra, 2018; etc.). R&D is a business process that covers all activities that involve planning and development of new products or packaging, improving current products or solving problems with the current way of doing business, understanding the needs and behaviors of the consumers in the existing markets and developing new markets. International R&D activities are an important part of any business network and these may consist of formal R&D departments in a firm, formal cross-functional teams among different firms within the business network, or non-formal teams and business networks in acquiring new market knowledge and penetration, certificates, production standards, etc. (Cedrola, Battaglia, & Quaranta, 2016).

In this context, there is growing evidence that SMEs in particular depend on effective R&D for the diffusion of their innovations, to reduce R&D costs (Santoro, Ferraris, Giacosa, & Giovando, 2018; Martinez-Conesa, Soto-Acosta, & Carayannis, 2017), and to develop and grow their businesses in international markets (Autio, Sapienza, & Almeida, 2000; Del Giudice & Maggioni, 2014; Del Giudice, Della Peruta, & Maggioni, 2015). As more and more SMEs try to expand into international markets, one of the main challenges for their international expansion is how to expand their R&D operations and effectively diffuse R&D costs from the domestic to the international markets (cf., Chiao, Yang, & Yu, 2006; Santoro et al., 2018). Specifically, Durst and Edvardsson (2012) argue that SMEs are lacking resources to use their knowledge stock in the full scale. For example, business practice in Italy shows that small food producers (such as organic farmers, fair trader movement, functional food producers, etc.) typically have no formal R&D departments. However, these firms are able to export their goods or set up business activities in the international market through specialized NGOs and/or external consultants because they can obtain knowledge about the standards and procedures (i.e. R&D) to meet production certification requirements. These business procedures typically require close work with a third-party certification organization that is able to provide various commercial certificates and import permissions for different international markets. There are several organizations and market levels that enable successful internationalization of R&D by SMEs, consisting of manufacturers, suppliers, vendors, consultants, third-party certification firms, retailers, distributors and

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wholesaler, that need to exchange knowledge with each other and effectively creates the non-formal R&D team. In fact, SMEs need to adapt not only to local but also to international production standards and requirements (Davcik & Sharma, 2015)).

Current research on SMEs' mostly focuses on the antecedents that drive their market performance. For example, the literature often discusses marketing capabilities such as advertising intensity (Chiao et al., 2006; Garcıa, Avella, and Fernandez (2012)), marketing innovation (Lewandowska et al., 2016), brand value (Sharma, Davcik, & Pillai, 2016), and sharing the resources of other actors at various stages of the value chain (Brito & Roseira, 2005). However, the exact roles of these capabilities are not very clear as these may perform as exogenous variables (Autio et al., 2000; Chiao et al., 2006; Ren, Eisingerich, & Tsai, 2015b; Lewandowska et al., 2016; Sharma et al., 2016), moderating and/or mediating effects (Ren et al., 2015b), and even as simply control variables (Garcıa et al., 2012). Scholars have also studied the role of policy designs in incentivizing international R&D collaborations for SMEs (Hottentrott & Lopes-Bento, 2014), the impact of industry average R&D investments on the value of the assets of a firm (Ito & Pucik, 1993), knowledge intensity on sales growth (Autio et al., 2000), R&D intensity on firm performance (Chiao et al., 2006; Garcıa et al., 2012); Ren, Eisingerich, & Tsai, 2015a), and the moderating effect of knowledge absorptive capacity on firm performance (Chaudhary & Batra, 2018;).

Notwithstanding the invaluable contribution of all these studies, there are still numerous and conflicting models due to the lack of a strong conceptual framework in the literature. As a result, the relationships among SMEs' international R&D activities, dynamic capabilities and performance are still not well understood, despite their importance for the managerial practices in SMEs operating in international markets in the increasingly global marketplace. The authors address this important research gap by arguing that a better understanding of the drivers of success and performance of SMEs' international R&D efforts requires a comprehensive and exploratory approach. Thus, the main research objective in this paper is to explore how SMEs leverage their international R&D activities on firm performance, employing marketing and technological capabilities. This paper uses a qualitative research method consisting of in-depth interviews with five Italian SMEs to explore and better understand this phenomenon.

To summarize, this paper makes two specific contributions to the literature. First, by extending the narrow scholarly foundations of SMEs R&D processes and its underlying drivers in international markets, it helps resolve the inconclusive or marginally supported hypotheses reported in past research. Second, this paper clarifies the role and significance of internal dynamic (e.g., technological and marketing) capabilities in the mechanism that drives the success of SMEs international R&D activities. In doing so, this research aim is to shed light on potential synergistic activities of technological and marketing capabilities, and their effects on SMEs' R&D performance in the international markets. This paper begins with a literature review of factors driving SME success in R&D internationalization, followed by a description of the sample and interview procedure, the findings and conclusions.

2. Literature review and conceptual development

The literature on SMEs and performance issues covers various research topics (e.g., brand management, product development, sales, and channel management, etc.), industry sectors (e.g., foods, tourism), types of businesses (e.g., entrepreneurship, family business, etc.), and diverse theoretical perspectives (e.g., dynamic capabilities perspective, knowledge-based theory, etc.). However, due to the heterogeneity in the nature of their businesses, it is less known how various business drivers affect SMEs performance in the international environment. The additional challenges for this stream of the research, in comparison to the more common national or single market research, include data unavailability, difficulties in making reliable and valid cross-sector and cross-market analyzes, and cross-cultural differences that may bias international investigations.

Past research explores many drivers of SME performance in international markets. For instance, Ito and Pucik (1993) show that the asset value of a firm, leadership in the industry and industry average R&D have positive effects on the firm's export activities but the industry average R&D matters for large but not for small firms. Similarly, Autio et al. (2000) find positive effects of firm age at market entry, knowledge intensity (a proxy for R&D spending), and imitability on international sales growth, while accounting for legal protection (against imitation), growth orientation and firm age. Chiao et al. (2006) extend this research by exploring the impact of internationalization, R&D intensity, and advertising intensity on the return on sales in newly-industrialized economies. Subsequently, Garcıa et al. (2012) assert the importance of technological capabilities (R&D intensity) and marketing capabilities (advertising intensity and being regular exporter) on employee productivity. Sharma et al. (2016) investigates the effects of R&D expenditure and brand equity on the market share performance of diverse market players; such as retailers, SMEs, and Multinational companies (MNCs). More recently, Ren et al. (2015a, b) explore the influence of R &D capability, R&D intensity, sales and patent activity on innovation performance; while Lewandowska et al. (2016) investigate the impact of a product, process, and marketing innovation on sales intensity. Based on the above literature, the authors identify three dimensions of success for international R&D activities. The first dimension is *firm performance*, which is typically analyzed through the increase in sales, innovation performance, productivity, premium price, market share, etc. The recent study from Coluccia, Dabic, Del Giudice, Fontana, and Solimene (2020) uses the R&D elasticity as an innovation disclosure indicator in the context of the non-financial disclosures measures. The second dimension is the *technological capabilities* of a firm through the R &D / innovation capabilities, management processes, knowledge transfer, and similar. Current literature uses different terms interchangeably to describe the technological capacities of the firm to obtain the market advantage; including technological capabilities (Garcıa et al., 2012; Sadeghi & Biancone, 2018; Battaglia, Neirotti, & Paolucci, 2018), R&D (Ren et al., 2015b), stakeholder co-creation processes and innovation performance (Markovic & Bagherzadeh, 2018), production standards as innovation types (Davcik & Grigoriou, 2020), presence of foreign technocrats on firm innovations (Zhang, Sharma, Xu, & Zhan, 2020) and innovation capabilities (Guo, Guo, & Jiang, 2016; Lewandowska et al., 2016). For ease of discussion, this paper uses technological capabilities as an overarching term to cover technical, R& D, innovative activities and processes. The third dimension is *marketing capabilities* that are typically discussed in the literature through the advertising intensity (Chiao et al., 2006), brand imitability (Autio et al., 2000; Garcıa et al., 2012), value creation (Ren et al., 2015b), brand equity (Sharma et al., 2016), marketing innovation (Lewandowska et al., 2016), and similar. Table 1 summarizes the exemplars, research gaps and main findings of these dimensions, which are described in more detail in the following sub-sections.

2.1. Performance

The research on internationalization and R&D effectiveness in the SME context typically focus on the performance of export (international sales), factor productivity, a firm innovation performance, and similar. Scholars recently studied the effects of government supported R&D programs on firm innovation outputs, such as the number of patents, new product sales performance, export, and similar (Guo et al., 2016). The first stream of the research asserts the importance of sales activities such as international sales growth (Autio et al., 2000), return on sales (Chiao et al., 2006), sales intensity (Lewandowska et al., 2016), export performance (Ito & Pucik, 1993; Rua, França, & Ortiz, 2018), etc. The second research stream has focused on a firm's innovation performance (Ren et al., 2015a, b; Guo et al., 2016; Scuotto, Santoro, Bresciani, &

Table 1
Literature review – dimensions of SMEs R&D activities.

Exemplars	Performance	Technological capabilities	Marketing capabilities	Research gaps	Main findings	Comments
Ito & Pucik, 1993	Export; Assets value of a firm	a leader in the industry; Industry average R&D (INDR)		– two firm-level measures of export performance: the absolute amount of export sales and their elasticity, and the relative share of exports in the total sales of a firm (export ratio)	– export sales are positively associated with R&D expenditures and the size of a firm, and also with the R&D intensity of the industry. – industry R&D is associated positively with exports for the aggregate sample, it is not significant for small firms after disaggregation. – investment in new capacity has a greater positive impact on exports than on domestic sale	Firm size matters; compare large vs. small firms; INDR matters for large, but not for small firms
Autio et al., 2000	Sales growth (international)	Age at entry; Knowledge intensity (a proxy for R&D spending);	Imitability	– the time lag between the founding of a firm and its initiation of international operations – the speed of a firm's subsequent international expansion	– a knowledge- and learning-based framework for SME to examine the effects of the age of a firm at first international sales, its knowledge intensity, and the imitability of its core technology on its subsequent international growth – the introduction of the concept of "learning advantages of newness" and a confirmation of the usefulness of knowledge-based and learning views for understanding international expansion issues	Legal protection (against imitation); growth orientation; firm age; Knowledge-based theory
Chiao et al., 2006	Performance (Return on sales); Internationalization (export sales/total sales);	R&D intensity (R&D expenditure/total sales);	advertising intensity (advertising expenditure/total sales)	– the effects of internationalization on SMEs performance – examination of other possible factors (e.g., intangible assets) on SMEs performance – academic literature mostly focused on large firms from developed countries	– there is a very little variance in the optimal levels of internationalization among industries and countries, – The competitiveness of Taiwanese SMEs is mainly built upon the basis of a highly refined manufacturing capability, rather than on marketing skills or innovative capabilities to produce differentiated products	Newly-industrialized economies
Garcıa et al., 2012	Productivity – (value added per employee and total factor productivity [TFP]); Export status; Regular exporters	technological capabilities (R&D intensity)	marketing capabilities; advertising intensity (advertising expenditure/total sales);	– Do exporters benefit from knowledge spillovers in international markets? – Unclear if the endowment of technological capabilities bears an influence on the ability of firms to learn by exporting	– Export status is positively related to firm productivity, particularly labor productivity (evidence of learning by exporting) – Firms that invest in R&D more than the average firm in their industry tend to experience higher increments in productivity after exporting than those others that invest less in R&D than the average firm in their industry	Firm size; inward FDI (industry-level and firm-level); industry structure
Ren, Eisenger & Tsai 2015a	Innovation performance (firm); Sales; Profit	R&D capability; R&D intensity		– the relationship between the search scope (exploration of new ideas and knowledge), R&D capability, and innovation performance is still inconclusive – Are firms from emerging markets more likely to benefit from greater innovation performance when they work with a selected few firms or a broader base of exchange partners (suppliers and customers)	– Search scope along the supply chain has a positive moderating effect on innovation performance as measured by the total number of patents – Positive effects of firm size and R&D investment on innovation.	firm size matters
Ren, Eisenger & Tsai 2015b	Innovation performance (firm); Internationalization	R&D capability (R&D investment); international patent activity (foreign patents)	marketing capability (value creation, market knowledge)	What is the specific role and interaction of marketing vs. R&D capability in the driving SMEs innovation performance during the process of internationalization	SMEs' marketing capability positively strengthens the effect of R&D investment on innovation performance as well as the effects of internationalization on innovation performance.	firm size matters
Sharma et al., 2016	Market share	R&D expenditure	Brand equity	What is the exact mechanism by which brand equity may affect market share in a	The study provides mixed evidence that R&D activities have a positive and negative effect on	The importance of product innovation varies for

(*continued on next page*)

Table 1 (*continued*)

Exemplars	Performance	Technological capabilities	Marketing capabilities	Research gaps	Main findings	Comments
Lewandowska et al., 2016	New product export intensity (sales)	Product and process innovation	marketing innovation	marketplace with several players (SMEs, retailers, multinational firms) – the research interest in exporting has primarily focused on innovation effects, leaving the effects of innovation cooperation underexplored. A very small number of studies examine the reverse causality: the influence of internationalization/export on innovation – studies that investigate the linkages between innovation, cooperation/networks, and export/internationalization are nascent	product innovation in a multibrand environment – The examination of complementarities between various types of innovation—product, process, and marketing innovations—proves the need for a more holistic view of innovation adopted in the search for its relationships with export performance – Different innovation cooperation modes may either boost the exports of new products or reduce their sales internationally.	different market players (retailers, SMEs, & MNCs) Innovation sets (product, process, and marketing innovation); Innovation cooperation models (domestic, foreign, and domestic & foreign)

Del Giudice, 2017). The third research stream focuses on financial performance outputs, such as R&D investment (Booltink & Saka-Helmhout, 2018; Battaglia et al., 2018), financial slack intensity (Sadeghi & Biancone, 2018), market share outputs (Sharma et al., 2016), intellectual capital and market value (Sardo & Serrasqueiro, 2017) and factor productivity (Garcıa et al., 2012).

Past research and anecdotal evidence suggest that product innovation mediates R&D expenditure on price premium and market share (Davcik & Sharma, 2015). Also, different levels of product innovation in a firm's brand portfolio may simultaneously or jointly affect brand performance indicators, such as brand equity and market share (Sharma et al., 2016). This is particularly important for SMEs in their R&D market diffusion and future performance expectations. SMEs must focus their business efforts on the most lucrative part of the market because they hardly can compete against resources, market dominance and brand positioning of multinational companies (MNC) and retailers. Sharma et al. (2016) provide empirical evidence that intra-firm competition for limited resources in the multi-brand firm will lead to the use of different R&D collaborations in brand development with also different expectations within the brand portfolio in various markets. It is less clear how single brand firms create their performance expectations across different markets.

2.2. Technological capabilities

The literature recognizes various technological capabilities that may improve SMEs R&D activities in the international market. For instance, the knowledge intensity is used as the proxy for R&D spending (Autio et al., 2000); and researchers often use R&D intensity (Chiao et al., 2006; Garcıa et al., 2012; Ren et al., 2015a; Booltink & Saka-Helmhout, 2018), knowledge absorptive capacity (Chaudhary & Batra, 2018;), R& D internationalization moderated by knowledge management (Ferraris, Giachino, Ciampi, & Couturier, 2020), and R&D capability (Ren et al., 2015a, b) as exogenous variables in modeling. In line with this research stream, Wang, Dou, Zhu, and Zhou (2015) show that innovation and technological capabilities are critical enablers in enhancing inter-firm collaboration and drivers of performance. For example, Sharma et al. (2016) assert the importance of the relationship between product innovation and brand performance.

The authors argue that one of the reasons for the mixed results presented in extant literature could be the differences in the focus and scope of the various studies. For example, one research stream underlines the importance of high performing brands in driving innovation (e.g., Beverland, Napoli, & Farrelly, 2010); another stream highlights the importance of product innovation in raising the brand value (e.g., Sriram, Balachander, & Kalwani, 2007); and the third research stream provides evidence that these phenomena interact one another on sales performance (e.g., Slotegraaf & Pauwels, 2008). In addition, there is a general consensus that R&D has positive effects on product innovation. However, the literature in strategic management suggests the opposite, i.e. multi-brand firms may disincentivize R&D activities for product innovation (e.g., Hitt, Hoskisson, & Kim, 1997) due to managers' financial accountability for the firm performance. Sharma et al. (2016) provide evidence of how this is a contextual issue, not a theoretical problem. These mixed findings may suggest that technical capabilities are dependent on: (i) firm's strategic orientation, and (ii) availability of resources to implement their R&D and market diffusion. This theoretical underpinning is particularly important for the effectiveness of SMEs' international R&D activities and performance.

An additional challenge for SMEs is the impact of IT activities on their performance in various markets (Scuotto et al., 2017). It is well documented in the business literature (Meso, Musa, Straub, & Mbarika, 2009; Del Giudice & Straub, 2011) that IT activities may have a strong influence on the creation of business culture and market growth. The success is strongly correlated with external support and favorability of the business environment as well as the diffusion of IT solutions. For

example, Guo et al. (2016) showed that policy shift from centralized to decentralized government support had considerably stronger effects on technological innovation outputs of SMEs. To summarize this discussion, there is still no consensus about the exact manner in which technological capabilities may influence SME performance. This paper addresses this important research gap.

2.3. Marketing capabilities

Past literature suggests that marketing capabilities represent research on the deployment of marketing resources (Angulo-Ruiz, Donthu, Prior, & Rialp, 2014; Davcik & Sharma, 2016). The scholars assert the importance of extricating the dynamic relationships among marketing resources, sales, and brand equity in showing how marketing capabilities affect firm performance (Mariadoss, Tansuhaj, & Mouri, 2011; Angulo-Ruiz et al., 2014; Davcik & Grigoriou, 2020). Kim, Shin, and Min (2016) show how marketing capabilities, through the mechanism of technological and marketing resources, may drive R&D activities of the manufacturing and service firms. Nath, Nachiappan, and Ramanathan (2010) study the relative impact of marketing and operational capabilities on the firm's financial performance to argue that firms are better off when they focus on narrow brand portfolio and diverse geographical markets. Mariadoss et al. (2011) assert the importance of using various types of marketing capabilities in the development of innovation-based sustainable strategies, which lead to a firm competitive advantage. Wang et al. (2015) study how three internal capabilities (innovation, information, and relational) affect marketing capabilities in enhancing inter-firm collaborations. The open question according to these authors, which is still unclear and not properly addressed in the literature, is how inter-firm collaboration may improve the dynamic marketing capabilities of an individual firm.

Past research identifies many constructs in this context that affect firm performance. For instance, marketing capabilities as a general construct is often used in the literature (Garcıa et al., 2012; Ren et al., 2015b; Kim et al., 2016; Nath et al., 2010), advertising intensity (Chiao et al., 2006; Garcıa et al., 2012), marketing innovation (Mariadoss et al., 2011; Lewandowska et al., 2016), imitability (Autio et al., 2000), etc. Sharma et al. (2016) suggest that the performance of marketing capabilities varies among retailers, SMEs and MNCs, and it depends on the use of a firm's resources, strategic orientation, and R&D in achieving the competitive advantage. In this context, knowledge is an essential tool to develop innovation and internal capabilities to foster and integrate the different sources of dispersed firm knowledge for international R&D activities (Ferraris, Santoro, & Dezi, 2017; Del Giudice et al., 2015; Santoro et al., 2018).

3. Research methodology

3.1. Research design and setting

This study uses a qualitative approach to understand the challenges and opportunities faced by SMEs in their international markets, by interviewing SMEs that are recognized as particularly innovative firms in their own sectors. Five SMEs were selected from different industry sectors (retail intelligence, business training, shoes, food, and sportswear). These SMEs are relevant for this research because of their brand heterogeneity, high level of innovativeness and internationally recognized exposure. The authors use semi-structured interviews to develop specific propositions and use interview transcripts and cross-case tables to support the analysis of the content around the three main themes of this research: performances, technology capabilities, and marketing capabilities. The interviewees have a wide range of educational and business backgrounds, roles in their respective SMEs that belong to different sectors. The authors present the key findings starting with the characteristics of the R&D in the five SMEs, followed by the possible relationships among their international R&D activities, collaborative innovation, and firm performance as well as their technological and marketing capabilities.

The authors also used secondary data about the five Italian SMEs and their international operations. First, the authors analyzed company corporate reports and brochures provided by these firms. Next, they accessed the corporate websites and social networks to collect information about the R&D activities of these firms. This was followed by in-depth and semi-structured interviews using open-ended questions with owners or decision-makers in these five SMEs. For this purpose, a protocol guide was used. All the data collected from the different sources were triangulated to provide a better response to the research questions. Corroboration evidence from different sources sheds light on the research topic and provides a robust interpretation of research findings (Denzin & Lincoln, 2011).

3.2. Sample and procedure

The sample includes three micro/small and two medium SMEs from different sectors: retail intelligence/data analytics (SME_1), business training (SME_2), shoes (SME_3), food (SME_4), and sportswear (SME_5). These five firms were selected using the "emphasis of variation criteria" and adopting the driver of "intensity" (Patton, 2002), in this vein, the authors interviewed firms that are recognized as particularly innovative in their own sectors. These SMEs are relevant for this research because of their brand/market heterogeneity, innovativeness, and distinguished presence in the international markets. The interviews took place in October 2018. This study uses diverse profiles of interviewees because of the comparison between different applications of R&D activities and team cooperation as well as to allow the robust interpretation of findings (cf. Creswell, 2007). This helps the authors to present quotations from SME owners and managers about how they perceive the impact of international R&D activities and dynamic capabilities on their business performance.

Table 2 shows the in-depth interview guide. This protocol guide addresses topics of the importance of sales performance in international markets for an SME firm, tools or services used in managing R&D activities, the application of technological capabilities, how firms use their marketing capabilities, and the self-statement on the R&D annual spending. The authors also conducted a pre-test to develop and finalize the guide by interviewing two senior scholars from the management field who are experts in qualitative research and in-depth interview methodology. After their comments, the authors made some minor changes and wording adaptations. All interviews were conducted in the Italian language, recorded on-site, transcribed and translated in the English language. All the retrieved data and information were critically and individually examined by the authors and then a research report was written. The language nuances were controlled by three scholars fluent in the Italian and English languages. Table 3 shows the sample and firm profiles.

4. Key findings and propositions

4.1. Role of R&D in SMEs

4.1.1. Interdependence between R&D and the international R&D activities formalization

The main aim of this study is to understand the nature of SMEs

Table 2
In-depth interview guide with topics covered.

✓ The important pieces of sales performance in international markets
✓ Tools or services in managing R&D activities as a part of a business network
✓ The application of technological capabilities as a part of a business network
✓ The use of marketing capabilities as a part of a business network
✓ The self-statement on the R&D annual spending.

Table 3
Sample and companies profile.

Company name	Interviewed profile	Sector	Size (employees)	Description
SME_1	Owner / Entrepreneur	Retail intelligence / data analytic B2B	25	– SME_1 is a high-tech company that operates internationally in retail intelligence and communication technology sector. – Marketing specialist, IT, creatives and technical engineers constitute the research group from which new solutions for turn-key analysis and communication are born, developed for each specific need, designed and implemented, creating the best technology and interactivity, the most effective emotional impact and the most efficient simplification of content management. – − 80% of turnover is abroad.
SME_2	Owner / Entrepreneur	Business training B2B	35	– SME_2 has been founded in 2001. In its business focus is e-learning or creation of multimedia solutions for employee training and education of large companies and multinationals. – The products consist of a catalog of multimedia contents where the client companies can choose which one to purchase and which can be inserted in their training programs, as they are or reworked, according to specific company knowledge; classic class face-to-face training with various methods and technologies. – SME_2 is a small company that has doubled its turnover in the last five years, with many changes in the organizational processes to be implemented to grow from a small to a medium company. – The percentage of the foreign market is 1%, but the intention is to achieve significant growth already in the next 12 months. – Investment in R&D is around 5%.
SME_3	Owner / Entrepreneur	Fashion industry – shoemaker Customer is a trade B2C	40	– SME_3 is a footwear company based in Montegranaro, Italy. It was founded in 1955 during the years of the boom in the shoe production in the city and, like many other realities of the territory in those years, quality and craftsmanship were the hallmarks and keys to SME_3 success, that brought this small laboratory to be and established reality in the Italian scene. – SME_3 is a high-quality product company, which owns two brands. Its customers comprise small and medium-size retailers that sell footwear and apparel in Italy, Russia, Germany, and other middle European countries. The company has doubled its revenue over the last five years by changing its marketing channels.
SME_4	Owner / Entrepreneur (CEO)	Food – rice producers	140	SME_4 is one of the oldest Italian rice factories, founded in 1856 with a plant in Genoa (Italy) and another that was opened simultaneously in Argentina to face the demand of the South American market. The “XYZ” brand was born in the 40 s and became synonymous with excellence. The mission of SME_4 is to spread the culture of rice and risotto in the world, with continuous brand innovations that adapt to the needs of modern and international consumers. Currently, the management is focused on the issues of sustainability in the production of rice. – 40% of turnover is abroad – Investment in R&D is 2% of revenues The new products are developed in collaboration with other firms located in Italy and Europe. SME_4 also collaborate with research institutes for obtaining new seeds, and with an association to reach a sustainable production and SGF certification.
SME_5	2 co-CEOs – Brand Manager in Sportswear & Licensing	Swimwear – sportswear	340	SME_5 is the second largest swimwear brand in the world, as well as an undisputed groundbreaker in the field of innovative materials and products for professional swimming races. In the period between 1991 and today, SME_5 has undergone five major changes in its ownership and management structures. – 82% of turnover is abroad – Investment in R&D is 2.6% of revenues – Product innovation is crucial and developed in a broad network of external consultants, ranging from designers to innovation centers to universities for competition swimwear and internally for the regular products and sportswear – New styles and products are developed in collaboration with famous athletes SME_5 covers international markets according to three different business models: a) direct to consumers, through direct e-shop; b) wholesale, trying to gain more space in the POS of retailers; c) distributors, strengthening the cooperation and supporting them in finding out any possible tool to increase market penetration.

formal structures and decision-making processes in their international R &D activities. This is important because it is unclear in the literature on how firm size (Large vs. SME), R&D intensity (expenditure) and marketing capabilities affect R&D performance outcomes. The findings from this study show that R&D activities in interviewed SMEs are not always formalized or recognized as a new R&D process. The absence of the international R&D activities formalization in the organization can reduce the perceived role of this group, and sometimes the activities and impact are not very clear to the firm itself. An additional issue is knowledge transfer among R&D teams and its effects on the innovation process (Huang, Ma, Sheng, & Dou, 2017). In general, family businesses and micro-small companies have no particular procedures, organizational or technological tools that support collaborative activities, knowledge transfer or knowledge sharing. The project integration of the team members is managed with the personal interaction and in many cases guided or followed directly by the entrepreneur. As highlighted in several interviews, many of the international R&D activities are not related to technical issues but depend upon other activities such as access to external funding, lack of knowledge on production standards, and lack of human resources.

SME_2: "*In general, we are very much impeded on R&D, in my opinion, by a lack of structured planning: time and resources for innovation are not budgeted, so we have innovations that cannot see the light because we do not have time….. Although it may seem inefficient and "messy", then every year we have one or two new projects."*

SME_1: "*….happened (not planned), thanks to a couple of key people that have intensified the relationships, created new links, made them operational by some means."*

4.1.2. Country-of-origin as the differentiator

Consumer-centric firms are applying various strategies to enhance international sales growth. For instance, free trade agreements may positively utilize the perceived effect of cultural and geographical distance (Kingshott, Sharma, Hosie, & Davcik, 2019). The firms operating in industries where the country of origin effect is a high and positive focus on the culture of the country of production (country of origin of the brand, cultural heritage, etc.) may foster sales activities in the international markets (Cedrola & Battaglia, 2013). For example, when SME_4 introduces its brands abroad*: "… sell(s) rice as risotto, with a recipe saying to prepare it, a consumer has to use Italian rice".* Moreover, the firm has collaborations with famous chefs and journalists writing in journals focused on food and cooking, creating a real network of experts and ambassadors of the brand.

SME_3: "*… a shoe in another shop was sold and got extra-extra-reasserted because perhaps there is the shop owner or the properly educated shop assistant that explain to the customer the reasons behind that product – because it is made in Italy."*

4.1.3. Measurement of R&D performance and international R&D activities

Performance measurement has different levels of complexity between micro-, small-, and medium-sized firms because the outputs of R &D for SMEs are not always necessarily new brands, new markets or processes. These outputs can be continuous market improvement and performance of existing brands and business processes (Damanpour & Gopalakrishnan, 2001). The interviews in this study suggest that product innovation can jointly affect brand performance indicators, such as brand equity and market share.

SME_5: "*Through our international research & development network we were the first to introduce carbon fiber into our sector. This innovation has led to increases in market share (we are the leaders in Europe) and an increase in the value attributed to our brand. Currently, the value of the brand is greater than the size of the company and its global market share*."

International R&D activities involve different people, levels of decision making and functional areas: marketing, sales, operation, R&D, procurement, etc. Moreover, the personal characteristics and leadership skills of the entrepreneur that may directly manage the business process in many cases. SME_2: "*Very often it is the owner who says "we have to do this" and then things go faster".* Based on this discussion, the size of SMEs may positively affect their R&D performance. Accordingly, the authors offer their first proposition, as follows:

P1. SMEs R&D performance is positively affected by international R &D activities.

4.2. Role of innovation

4.2.1. Innovation process

The authors found evidence of innovation as a basic part of the DNA of all the five firms interviewed. It is normal to be innovative for the whole of these firms and not only for their R&D departments. New ideas and solutions can flow from different departments and not only from the innovation group or senior management. Many participants expressed the opinion that innovation must be an attitude for the whole firm and involve many different areas.

The co-CEO of SME_5 (medium-size enterprise) states: "*Innovation does not mean that we must always invent something new, such as a product, a sales technique, or a business process that was never seen before. For a company like ours, to be innovative means to continuously improve the things we do every day. For us, being innovative means repeating to ourselves that every single thing that we do today can be done even better tomorrow: product, packaging, commercial strategy, commercial terms, our supply chain, and our factories. You can always improve, but the question is - how? By considering what our customers would want".*

In addition, SME_4 successes can be largely attributed to the innovation process in terms of organizational structure, production, logistics, distribution, and IT management. "*We cover international markets according to three different business models: a) direct to consumers, through our direct e-shop; b) wholesale, by trying to gain more space in the POS of retailers; c) with distributors, strengthening the cooperation and supporting them in finding out any possible tool to increase market penetration.*"

SME_2: "*The international network is connected to this …. one of the things we have done to put them together in this "think tank" named Alfa, the result of the imagination of three or four people who then involved others where they do nothing but create moments of meeting in which information of that type is also shared."*

4.2.2. Innovative organization

The ability of SMEs to make an impact during the innovation process is linked to an intrinsic capability to continuously innovate, the quality of the employees involved (they have an open mindset), and the environment in which the companies are included or have been built (marketing relational capabilities). For instance, SME_2: "*the international network is fundamental to innovate and have stimuli and cues out of the box: indirectly I need them for the international market but directly I need them to innovate, full stop. What I want from them is an innovation".* Similarly, SME_1: "*…anyone who have received some kind of stimulus from an international fair, from articles read or from customer feedback, can have an innovation idea…… continuous exchange of ideas between people as there is widespread knowledge of what needs to be improved throughout the firm ….."*

The medium-size firms tend to have more formalized teams. For example, SME_5: "*Product innovation is crucial for us, and developed in a broad network of external consultants, including designers, innovation centers, universities for the development of competitive swimwear*". Similarly, SME_4: "*The new products are developed in collaboration with other firms located in Italy and Europe (mostly suppliers). We also collaborate with research institutes to obtain new seeds and an (agricultural) association to reach a sustainable production and SGF certification*".

Based on the above discussion, the authors offer their second proposition, as follows:

P2. Collaborative innovation positively affects SMEs R&D performance.

4.3. SMEs dynamic capabilities

4.3.1. Role of technological capabilities

It is commonly accepted that technological capabilities may improve R&D processes in SME's. However, SMEs typically face a lack of technological resources and investment opportunities. These challenges can stimulate SMEs to seek collaboration opportunities with other players in the market. For example, SME_5 was only able to invest in IT and advanced production processes. Management systems were updated following most of the company re-organizations, with a progressive harmonization of applications. The product development and supply chain management systems have been merged through the implementation of US software, while planning and forecasting management systems rely on Finnish software. SME_5 proliferate their production according to technical and production demands. They own a plant for the production of patented products (high-performing products) for advanced production processes. For regular products (price sensitive products), SME_5 has a network of local producers in Asia.

Another example is SME_4 who invested in laboratories for new seeds and new product research. However, their production capacities are limited and they collaborate with other firms in Italy and abroad to meet consumers' demand. According to SME_4: "*For example, for the risotto ready in two minutes, we have a pilot plant. For the production, we work with two contractors (one in France and one in the UK). Regarding the rice milk or other products that we have just launched on the market, the idea of a new product started with us, but we also use the contractor for the realization of the idea… These companies have a fully equipped plant; basically, we are going to use this plant because it would not make sense every time to build a plant…*"

SME_4 also collaborates with international food associations to develop the sustainability protocols to be implemented by the farms where they buy raw materials. For example, "*First of all we had to develop the sustainability protocol for a farmer, then we got certified by Friends of the Earth. We have developed the protocol together with them (we have been collaborating for 10 years). We have farmers with whom we work closely, and we have observed the usual activities and identified what should have been done. Friends of the Earth has brought a list of requests adapted to rice production. Then, at some point, we felt that we need to have everything certified by a third-party organization. SGF controls how the protocol is applied in the field.*" Similarly, SME_2: "*You have to study augmented reality because that's the future. Based on the time a customer can dedicate to it, we gave him virtual reality and for three months he is independent in experimenting with that product.*"

These findings are in-line with Sharma et al. (2016) that assert the importance of the relationship between product innovation and brand performance. For instance, SME_5 is taking advantage of a network formed with external institutions, including University of Reims (France), University of Bologna (Italy), University of Liège (France), University of Berlin (Germany), Polytechnic of Milan (Italy) and an English innovation agency Innovia that brings together scientists from various research areas), current and former athletes and champions sponsored, went beyond pure stylistic adaptations and conceived truly original ideas, patents, and break-through products. The results of their innovation increased in the mind of customers the value of the brand that is perceived as a leader in innovative products for swimming competitions (racing swimsuits). As stated by the co-CEO of the firm "The value of the brand is bigger than the value and dimension of the firm". Accordingly,

P3. The technological capabilities of SME's positively affect their R&D performance.

4.3.2. Role of marketing intelligence

The interviews show a close link between R&D activities and marketing from two different perspectives: market information and knowledge acquiring. In the description of the development process of a new product, the key figures of marketing and in general the function of marketing and sales, are always involved in the different stages of the process. The crucial business activity for SMEs is to obtain information about market rules and performance to enhance sales activities. The analysis of the five firms shows that comprehensive market analysis is the typical strategy of medium firms, whereas micro and small firms tend to know the market leveraging on marketing and relational capabilities only. For instance, SME_4 works with Nielsen and Eurisko to collect specific market information: "*We mainly have data from Nielsen, both retail and consumer for Italy and abroad; then we have market research, focus groups, indices on the use of our products abroad and in Italy. Then we analyze the targets for consumption styles and data based on Eurisko's food styles".*

In addition, a recurring aspect in the companies examined is the skills put in place by key figures in marketing or sales to understand market and technological trends (information). Market knowledge acquisition can be generated within a firm or acquired from outside a firm (Durst & Edvardsson, 2012). The SMEs have developed a strong market sensing capacity while not carrying out formal activities of market research or research on new technologies. This market sensing capability can be oriented both to trying to understand what the consumption trends can be in specific international markets that can then be transferred to new or restyled products. For other types of business, this market sensing capacity is geared towards understanding what technologies can be used in their products or services for the future. These particular capabilities are related to the "search scope" of R&D - an exploration of new ideas and knowledge (Ren et al., 2015a; Segarra-Ciprés & Bou-Llusar, 2018).

SME_1: "*The key to the success we have had so far has been not much producing something and then putting it on the market, but rather, going on the market, keeping our ears open, intercepting questions and then making our skills available to respond."*

SME_3: "*research on market trends and brands … it is logical, we normally do not shoot blindly. From this info then they personalize the idea according to the tastes of the representative, his customers, but also according to the tastes of the company…..Another source regarding the market trend is the world of suppliers."*

SME_3: "*Representatives or agents give us feedback directions on an area. Last year, for example, we had an agent who expressed his preference for shoes with a particular wash"* (the wash is the processing phase).

SME_2 "*…very simply participating in moments of sharing, culture, and information on the subject, talking with potential customers and trying to understand what their questions were; doing a lot of research online, reading, studying …"*

Marketing intelligence is also used to collect information for the adoption of new technologies: SME_2: "*with a Venezuelan guy who had come to work here, who had dedicated himself to experiments on virtual reality that we could also test ourselves, obviously without achieving perfect quality."*

In some cases, the international partner has a role in the development of new technologies: SME_1: "… *our Chinese colleague is based in Wanzu, which is very close to Shenzhen. The latter is one of the most advanced technological centers in China, so its connections with the technological and production side are strong enough; so when we need to look for hardware, we refer to him and then he puts us in touch with the right people, and this happens in the software part as well.*" In other cases, marketing intelligence is used to support the development of new markets and to obtain international product certifications. For example, SME_2: "*We went to a fair and we identified a company that could take care of all aspects of marketing …… the people who are dealing with marketing abroad are completely different from the people who deal with marketing in Italy, in fact, we have acquired skills directly from abroad and there is nothing of our know-how."*

P4. Marketing intelligence of SMEs positively affects their R&D performance

4.3.3. Role of marketing capabilities

Marketing capabilities depend on a firm's strategic orientation and availability of resources to implement its R&D and market diffusion. The absence of a clear market strategy and lack of financial resources necessary for the development of a clear path negatively impact overall firm performance and its ability to develop new and successful products. For example, SME_3: "*…to say that sneakers go (in the future) is like standing in front of the beaches (Adriatic sea) and say "look, there is Albania." I already know that Albania is on the other side of the sea, but you must tell me how to go to Albania because at this moment there is a storm going on. Obviously, it is not at all easy to have, but a small company like ours couldn't ever afford internal staff who can give us these answers (market research information)… I do not know if (I would buy) by (technical) capacity or by the economic aspect.*"

In addition, the ability to adapt and successfully answer the clients' needs is important. SME_2: "*…with a client who tells us "change this" some changes are made very quickly, while other changes more slowly, also because we receive a lot of feedback from customers. When we look at this market (the UK), we try to make it clear that we are new in the game and we welcome their feedback and we will improve our services quickly.*"

In the consumer goods market, developing a strong brand and adaptability of marketing capabilities plays a crucial role in business survival. SME_3: "*…You can no longer live only with a product or ability to communicate with the customer because you became a friend. Today, you should mainly live with marketing and these types of roles are missing in (small) companies like ours. In this regard, we are trying to get our shoes bought, not because they are necessarily beautiful, but we want them to be sold because they are called "ZZZZ" or "YYYY". This process is a very steep climb for us.*"

Two B2B firms (SME_1 and SME_2) understand what marketing capabilities they need to develop a future product, and how to identify partners who can support the development of that particular service or product as the part of international R&D activities. In other words, investing in product development could depend on the willingness of a key customer to carry out a specific project. For example, SME_1: "*….once Mr. X told me: It's useless for you to come up with ideas and then try to sell them, go and see what customers want, go home and develop it according to your skills."* Similarly, SME_2: "*At this point (after the search), we had a customer with a specific need that we thought we could meet by developing just that type of product that I had in mind. The customer made an initial investment with the first version of the product developed."* Moreover, SME_2: (on development) "*…maybe I carry it slowly and then the commercial sells it before it is ready and must be finished in a hurry … these are the dynamics behind innovation.*"

P5. Marketing capabilities of SMEs positively affect their R&D performance

5. Discussion and future research

The literature on international R&D activities operationalizes numerous variables in assessing SMEs market performance and uses a great number of conceptual frameworks; very often with conflicting assumptions and results (Garcıa et al., 2012; Ren et al., 2015b; Lewandowska et al., 2016; Davcik & Sharma, 2016; etc.). The current business research literature, as described in section 2 (Literature review), is bound by partial conceptual approaches, strictly quantitative models, and marginally supported hypotheses. The authors address this research gap by exploring the interrelationships among three dimensions of SMEs R&D activities – performance, technological and marketing capabilities. This paper articulates key challenges for international R&D activities by conducting comprehensive and exploratory research on the role of SMEs' R&D drivers of success and performance in the international market. In doing so, the authors begin with an exhaustive literature review to better understand the research and managerial gaps among three dimensions of SMEs international R&D activities (namely, firm performance, technological and marketing capabilities), have developed the in-depth interview, and have interviewed five leading Italian SMEs with extensive international experience and R&D activities.

The literature (Chiao et al., 2006; Ren et al., 2015a, b; Lewandowska et al., 2016) suggests that technological capabilities have an important role in SMEs success. However, the current academic findings are dominantly based on partial modeling application, on the use of a limited number of variables, and data-driven approach. This study contributes to the literature by extending that limited view applying the in-depth qualitative analysis and showing how technological and marketing capabilities may drive SMEs R&D diffusion and performance outcomes success in the international environment. Specifically, the authors discover many important themes for managers in SMEs such as the tools they use in managing R&D activities and how they use technology to improve their market outcomes.

For instance, SME_4 has developed a broad international cooperation network with international food associations in the last decade. Their goal was to develop the technological standards, production and sustainability protocols to be implemented by the farmers from which they buy raw materials. "*First of all, we had to develop the sustainability protocol for a farmer, and then we got certified by Friends of the Earth. We have developed the protocol together with them (…). We have farmers with whom we work closely, and we have observed the usual activities and identified what should have been done. Friends of the Earth has brought a list of requests adapted to rice production. Then, at some point, we felt that we need to have everything certified by a third-party organization. SGF controls how the protocol is actually applied in the field.*"

The second contribution of this study is clarifying synergistic activities of technological and marketing capabilities, and their effects on IRDT performance in the international market; such as the use of marketing intelligence, size of SMEs, managerial approach, and use of different marketing strategies in R&D diffusion. For instance, the exploratory evidence reported in this paper suggests that marketing intelligence has an important role for SME managers in gathering market information and acquiring the new knowledge for a firm. This theme arises as an important topic for interviewees, and not only within the marketing domain and the use of marketing capabilities and gathering relevant market information, but it is also important within the technological domain and process of knowledge acquiring. For instance, SME_1: "*… our Chinese colleague is based in Wanzu, (…), so its connections with the technological and production side are strong enough; so when we need to look for hardware, we refer to him and then he puts us in touch with the right people, and this happens in the software part as well*".

The performance measurement has different levels of complexity among micro-, small-, and medium-sized firms. The results of this study suggest that the size of the SME and management approach matters in the decision making process. For instance, SME_4 (a medium-size SME) base its decision making on obtaining the market information from Nielsen: "*We mainly have data from Nielsen, both retail and consumer for Italy and abroad; then we have market research, focus groups, indices on the use of our products abroad and in Italy".* On the contrary, SME_2 (a small size SME): "*Very often it is the owner who says "we have to do this" and then things go faster".* This finding is in line with Durst and Edvardsson (2012) assertion that small firms typically have free-floating and non-bureaucratic management style. The business literature (Ito & Pucik, 1993; Sharma et al., 2016, etc.) focuses on the performance problems in SMEs and large firms, such as retailers or multinational firms. It is beyond the scope of this study to further study the performance and leadership nuances among micro-, small-, and medium-sized firms. However, future research may address these issues in view of their importance for academia and business practice.

Marketing capabilities are an important resource of competitive advantage for SMEs in the international arena. This paper adds to the literature by examining how the use and application of different strategies affect R&D diffusion. Our findings suggest that R&D diffusion depends on SMEs size, market adaptability and available resources for

marketing support activities. For instance, SME_3: "*Obviously, it is not at all easy to have, but a small company like ours couldn't ever afford internal staff who can give us these answers (market research information)…I do not know if (I would buy) by (technical) capacity or by the economic aspect.*". As per SME_1: " *It's useless for you to come up with ideas and then try to sell them, go and see what customers want, go home and develop it according to your skills.*"

Future research may also pay more attention to marketing intelligence and how knowledge acquiring and (new) market information affect SMEs abilities to improve R&D activities in the international market. It is beyond the scope of this research to study how market information and knowledge acquiring may have different roles for micro-, small-, and medium-sized firms and their ability to implement new knowledge in R&D diffusion. In addition, future research may focus on definitional and conceptual issues about internal dynamic capabilities and their underlying mechanisms, such as marketing intelligence, managerial approach, size of SMEs, etc. that drive the success of SMEs' international R&D activities. Such efforts may lead to a more comprehensive conceptual framework consisting of relevant constructs and models that could be empirically tested.

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