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Innovation success in an emerging economy: A comparison of R&D-oriented companies in Turkey

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Abstract

Knowledge and innovation capacities are unevenly distributed on a global scale, with national or regional settings playing a crucial role when it comes to the production and usage of knowledge. In particular, emerging economies are less equipped with relevant institutions and resources, meaning that firms residing in such contexts are likewise dealing with lacking innovation capabilities. However, achieving innovation is highly relevant for the economic development of firms and regions. Therefore, we aim to identify key factors for innovation strategies in a differentiated corporate landscape that might affect innovation success. Survey data from the innovative segment of 225 manufacturing firms in Istanbul is used in a two-step methodological approach. We apply dimension reduction through principal component analysis and use the resulting components in logistic regression analysis to estimate their effects on firms' innovation success. The results reveal not only important findings about factors for the innovation success of firms, but also highly relevant insights about firms' innovation strategies. The usage of internal and external R&D resources varies with firm type. In addition, we find that external R&D resources determine firms' internationalization strategies. Hereof, we suggest policy implications for distinct firm types to support diverse innovation strategies and consequently innovation success.

1 | INTRODUCTION

To compete in a technology-driven world, achieving innovation is becoming a central factor to thrive economically. For firms in emerging economies (EEs) with their rising labor costs, corporate success thus increasingly depends on innovation abilities. However, the geographies of innovation demonstrate an uneven distribution of knowledge and innovation capacity among countries and regions. Knowledge is often produced, used, accumulated, and enhanced in certain places (Dicken, 2011). Therefore, the national or regional setting plays a crucial role when it comes to respective capacities of knowledge production and learning (Cooke et al., 1997). In particular, EEs are rather less equipped with relevant resources and institutions. There is not only a variation in educational levels, but also in public and private spending for research and development (R&D) as well as scientific personnel. For instance, the G20 countries accounted for 92% of global R&D spending and 87% of all global researchers in 2013 (UNESCO, 2015). Consequently, domestic firms within EEs are likewise dealing with limited resources and lacking innovation capabilities due to relatively less developed scientific environments (Ozturk, 2018).

Nevertheless, in a globalizing world economy, EEs are interesting destinations for foreign direct investments (FDIs) from multinational enterprises (MNEs), based on business strategies such as asset- or market-seeking (Dunning, 1998, 2000). Major MNEs from advanced markets, operating in an EE setting, serve as role models for domestic firms to undergo a catching up process, and consequently obtain access to competitive markets. Hence, the literature on domestic latecomer firms in EEs focuses on technology followership as the primary strategy for business development (Hobday, 1995; Hobday et al., 2004; Mathews, 2006b). Nevertheless, it is unclear whether these spillover-related approaches (Blomström & Kokko, 1998; Görg & Greenaway, 2004) are contributing to successful innovation in any EE context. In addition, a more differentiated view about the domestic and foreign company population in EEs is necessary to identify the distinct factors affecting firms' innovation strategies and innovation success.

For this study, the EE of Turkey and the city of Istanbul in particular were selected. Turkey has been one of the leading economic centers connecting Southeastern Europe and the Middle East for many years (Tatoğlu & Demirbag, 2008), and is currently in a transformation stage from an emerging to an industrialized economy. The country and especially Istanbul have attracted an increasing amount of FDIs from countries around the world (Ayden et al., 2018), including growing numbers of MNEs engaging in R&D activities (Karabag et al., 2011). Moreover, the nation is constantly transforming its economic structure toward an innovation-related environment by implementing mechanisms in education and direct support measures for innovation activities of its domestic firms (Bakirci, 2018; Yildirim, 2017). Therefore, the 11th development plan of Turkey provides several policy measures to strengthen the R&D capabilities of Turkish manufacturing, providing a support structure to accelerate innovation outputs (Presidency of The Republic of Turkey, 2019). Nevertheless, Turkey is still in the bottom half of OECD countries regarding competences and capacities to innovate as well as required interactions and skills for innovation (OECD, 2016). Therefore, the question arises concerning key factors for innovation success, such as internal and external R&D resources, that might positively affect firms' innovation strategies. The results deliver a differentiated pattern of factors affecting innovation success in an EE context that is heavily influenced by economic globalization.

To answer this question, this study analyzes survey data from the innovative segment of manufacturing firms in Istanbul. With the help of principal component analysis (PCA), three principal components of various R&D resources are identified for further analysis: internal resources, external technological knowledge, and external market knowledge. With the use of logistic regression, the impact of the respective components on the innovation success of firms are modeled. To capture the results for a differentiated corporate landscape within the EE setting of Turkey, three firm types are compared: domestic Turkish firms (DTFs), Turkish MNEs (TMNEs), and advanced market multinational enterprises (AMNEs).

This paper is organized as follows. First, the theoretic framework of this study is presented. Second, hypotheses are developed with underlying theories regarding internal and external factors for innovation success in EEs as well as innovation strategies of different firm types. Third, survey sampling and data collection, measurement of variables and data analysis are outlined. Hereafter, PCA is used to identify principal components of the R&D resources and binary logistic regression analysis is used to test the hypotheses. Finally, results are discussed and theoretical as well as policy implications are drawn.

2 | THEORETICAL FRAMEWORK AND HYPOTHESES DEVELOPMENT

2.1 | Emerging markets and internationalization strategies

Explaining the economic rise of poor or peripheral countries has attracted the interest of social scientists, economists, and economic geographers, at least starting with the development of the Asian Tiger economies in the last decades of the 20th century (Gulati, 1992; Lall, 1996). A number of key terms have since been applied that help to structure and understand this phenomenon. The perspectives of global value chains (GVCs) (Dicken, 2011; Gereffi, 1999) as well as latecomer firms and technological catching up (Mathews, 2006a) have proven most seminal in this context. They stress the fact that EEs and their firms initially start from a position of limited science and technology (S&T) or R&D resources and a weak institutional framework, restricting firms to low value-added activities. Therefore, the context of EEs creates difficulties for firms in such contexts to access external and advanced knowledge sources (Ozturk, 2018). Globalization thus provides opportunities for these firms to enter global production networks and to learn how to master higher value-added activities (Ernst & Kim, 2002; Hobday, 1995; Humphrey & Schmitz, 2002; Mathews, 2002). Involvement in GVCs becomes a crucial knowledge source for EE firms, particularly within knowledge-intensive or high-tech industries (Hu & Mathews, 2005). Therefore, FDIs—both inward and outward—create opportunities for EE firms to collaborate along value chains, to exchange goods and services, and to either benefit or suffer from spillover effects (Blomström & Kokko, 1998; Görg & Greenaway, 2004). However, to overcome locational disadvantages and benefit from these opportunities, internal capacities are crucial for domestic firms not just to recognize, but also to understand and thus utilize available knowledge sources. Hereinafter, latecomer firms are strategically able to access advanced knowledge through linkages to other firms, leverage of available resources, and subsequent learning (Mathews, 2002).

The position of Turkey and the regional economy of Istanbul can as be understood in the context of the international division of labor (Balassa, 1979; Fröbel et al., 1980). In a liberal trade regime, manufacturing employment builds up significantly in EEs such as Turkey, marking these countries' advantage in producing labor-intensive goods. The changes in the Turkish sector distribution during the last decades support this view. However, a further differentiation of labor-intensive production according to skill levels and technological sophistication helps to identify the relative strength of Istanbul's companies in the upper segment of labor-intensive goods. Nevertheless, since firm strategies not only respond to trade options and resources, but also take into regard the possibilities of carrying out more narrowly defined activities in particular value chains, the GVCs approach seems to offer more explanatory value for this study.

In the context of a globalized economy, companies seek to build a competitive position and concentrate on those activities that match their own capabilities. This contributes to different internationalization motives, that is, market-seeking or asset-seeking (Dunning, 1998, 2000), to the emergence of different types of firms, domestic or MNEs, and to different needs regarding the home and host regions. In this context it is widely accepted that AMNEs usually seek market access in EEs, and do not predominantly try to place R&D activities there, while EE MNEs' outward investments in industrialized countries or advanced markets may be targeted toward accessing technological knowledge (Ayden et al., 2018; Haasis & Liefner, 2019). In particular, those companies from EEs that actively pursue a strategy of technological upgrading may seek not only to exploit the limited technological capacities of their home base, but also to benefit from the technological capabilities that reside in other regions or with other firms (Mathews, 2006b).

2.2 | Innovation capacities in EEs

However, effective technological upgrading of firms critically depends on broader strategies at the domestic location that involve efforts and investments in organization, knowledge creation, and technological development at the firm level (Pavitt, 1990; Prahalad & Hamel, 1990), public investments in human capital, institutions, administration, and the S&T system at the regional and national levels (Cooke, 2001; Hu & Mathews, 2005; Lundvall, 2007), assistance for domestic firms to establish closer linkages with advanced global players and stronger embeddedness in GVCs (Gereffi et al., 2005; Giuliani et al., 2005; Humphrey & Schmitz, 2002), as well as direct political support for firms' innovation efforts (Szczygielski et al., 2017; Wang, 2018). Hu and Mathews (2005) identify public R&D funding as an important lever for latecomer economies to catch up with technological leaders, indicating that latecomer countries become more innovative when specializing on certain industries (Hu & Mathews, 2005).

While it is clear that innovation is to a large degree rooted in specific skills, resources, and capabilities at the firm level (Barney, 1991; Eisenhardt & Martin, 2000; Teece et al., 1997; Wernerfelt, 1984), innovation capabilities also involve knowledge from sources external to the firm (Chesbrough, 2003, 2010; Cohen & Levinthal, 1989, 1990; Teece, 1977; Teece et al., 1997). Here, firms' usage of external resources highly depends on access to collaboration partners and political support. In particular, collaboration facilitates not only interactive learning, knowledge sharing, and the opening of innovation processes (Chesbrough, 2003), but is also a highly relevant success factor for firms' innovative behavior as incorporated in previous studies (Liefner et al., 2013; Wu & Liu, 2009). Hence, empirical research on innovation processes, systems, and outcomes highlights the importance and varying influence of both types of knowledge, internal and external, as well as public financial support (Szczygielski et al., 2017), since the market alone provides insufficient incentives for knowledge production and long-term R&D investments of firms (Martin & Scott, 2000; Wang, 2018). In this regard, however, the literature about the geography of innovation focuses on the question of whether internal resources at firm level or the external regional innovation environment foster innovation activities of firms. In an early study on this topic, Pfirrmann (1994) investigated regional innovation disparities with a sample of small and medium-sized enterprises (SMEs) from Germany and their usage of R&D resources for achieving innovation. The author concluded that for firms' innovation efforts, internal factors are more important than the regional innovation-related environment (Pfirrmann, 1994). In the same way, Sternberg and Arndt (2001) find that firm-specific capabilities are of higher importance for firms when achieving innovation than external or region-specific factors. This is also true for innovating SMEs in European high-tech regions, for which the authors underline the importance of focusing on respective firm-specific needs than on improving regional innovation conditions in general (Sternberg & Arndt, 2001). Moreover, Beugelsdijk (2007) emphasizes the importance of reducing firm-specific heterogeneity when studying this topic. To understand the effect of a firms' environment on its performance, both firm-specific structures and strategies need to be taken into account. Hereof, the author finds that for successfully producing innovation, firm-specific drivers are of higher importance than firms' regional environment (Beugelsdijk, 2007). In case of the Information and Communications Technologies (ICT) industry in China, C.C. Wang and Lin (2013) likewise find firm-level attributes as the main factor for technological innovation, whereas region-specific factors or relational assets only play a minor role and regions' relevance need to be regarded in terms of differentiating firm attributes, strategies, and motivations (Wang & Lin, 2013).

Although it can be assumed that innovation output in the EE context is often more incremental than radical, the spectrum of innovation is still broad. Innovations in EEs thus involve low-cost and frugal, adaptive, and architectural as well as many forms of user-driven innovation (Ernst & Kim, 2002; Henderson & Clark, 1990; Malecki, 1991; Zeschky et al., 2011). Moreover, foreign firms' subsidiaries in EEs have the option to either use or forego involving local capabilities in their innovation processes (Liefner et al., 2013), whereas domestic firms need to make use of their absorptive capacities (Mathews, 2002) or need to target advanced markets to gain access to superior knowledge and thus obtain strategic assets (Buckley et al., 2007; Jormanainen & Koveshnikov, 2012; Meyer, 2004; Ramamurti, 2004). Due to the fact that such a possession of strategic assets or internal capabilities is an important requirement to internationalize and meet advanced market needs in the first place (Aulakh, 2007; Ramamurti, 2012), R&D sourcing becomes an enabling factor for EE firms to upgrade their knowledge bases in their home country (Ozturk, 2018). Here, absorptive capacity in terms of diffusion channels, interaction mechanisms, and internal R&D resources is a highly relevant factor for successful transfer of technological knowledge (Lin et al., 2002).

The various types of innovation output, reflected in the standard measurements of innovation in the Oslo Manual (OECD/Eurostat, 2018), depend on different knowledge inputs. Regarding this, firms pursue diverse R&D strategies to achieve innovation and thus benefit from varying forms of political support. The policy on innovation distinguishes in this respect between demand-pull and technology-push strategies that both foster innovation. User-driven or demand-pull strategies have a focus on innovation for market needs, where market research and consumer needs indicate the way to achieve innovation (Scherer, 1982). The respective innovation strategy includes rather fast and incremental innovation but with low risks and profit. Technology-push strategies, however, are independent of market needs and indicate a focus on rather long-term radical innovation but with high risks and potential profits. This type of supply driven innovation strategy draws heavily on basic and applied scientific knowledge (Dosi, 1982). However, the two concepts are criticized, which is why weaker versions of both strategies are necessary to explain innovation (Nemet, 2009). In this regard, not only must both concepts exist simultaneously for innovation to result, but also they even closely interact with each other (Arthur, 2007; Mowery & Rosenberg, 1979; Nemet, 2009). In addition, demand-pull absorptive capacities of firms are relevant to access market-related knowledge (i.e., competitors, suppliers, and customers), while technology-push absorptive capacity is an essential source to benefit from external scientific or technological knowledge (i.e., collaboration with scientific partners, acquisition of technology, or licensing) (Murovec & Prodan, 2009). Recent studies have revealed the policy effects of these demand-pull or technology-push innovation strategies (Costantini et al., 2015; Hoppmann et al., 2013; Nemet, 2009; Peters et al., 2012), their effects on absorptive capacity and internal capabilities at the firm level (Murovec & Prodan, 2009; Piva & Vivarelli, 2009) as well as the diverse approaches within the vast amount of literature on the topic (Chidamber & Kon, 1994; Di Stefano et al., 2012).

However, no matter what strategies are pursued, this study does not focus on the measurement of innovation success with quantifiable performance indicators such as patents or new products (OECD/Eurostat, 2018), but rather on the self-assessment of firms as being successful in achieving innovation. This approach helps to identify the supposedly relevant factors or capabilities for firms' self-evaluation of innovation success and effective innovation strategies (Björkdahl & Börjesson, 2012).

2.3 | Studies about the Turkish context

In the following section, recent studies from the Turkish context in terms of economic development, R&D support, and innovation-related activities of firms are briefly described.

The city of Istanbul has established itself as a leading hub for exchange and manufacturing (Akgüngör, 2006; Ersoy, 2018) and is one of the largest and most prosperous urban economies in the Middle East (Ayden et al., 2018). Both inward FDIs and increasingly outward FDIs of TMNEs have been the central factor for the city's and country's economic development in recent years (Ayden et al., 2018). In a comparative study between Turkish regions, Akpinar et al. (2015) highlight Istanbul as the only globally competitive and leading innovation center throughout Turkey. The nation's highest numbers in total wages, firms' revenues and high-tech activities result in an overall productivity level that is twice as high as that of all other Turkish regions (Akpinar et al., 2015). However, the Turkish economy and Istanbul have been affected by globalization-related factors, and hence, require the technological upgrading of domestic firms. In addition, Turkey's partly weak institutional environment affected the country negatively and initially prevented the economy from realizing its full potential of FDIs in the past (Apaydin, 2009; Erdal & Tatoğlu, 2002). In particular, these have been a lack of positive exchange rates as well as economic instability (Erdal & Tatoğlu, 2002). Moreover, in terms of political risk perspectives, Turkey was supposedly closer to markets in the Middle East than to Central and East European Economies (Apaydin, 2009). Nevertheless, this situation and assessment of foreign firms has changed for the better in the past years. Karabag et al. (2011) further emphasize that a sufficient scale of production, private capital, and specific public policies are needed to attract international R&D in the future (Karabag et al., 2011).

In this regard, Mercan (2016) emphasizes that domestic firms residing in Istanbul and the Marmara region have successfully integrated themselves into the globalized economy, attaching importance to management knowledge, and prioritizing technology transfer from other places (Mercan, 2016). Hence, TMNEs might increasingly focus on R&D internationalization to advanced markets, trying to catch up and gain parity with AMNEs, and respective industry leaders in the long term (Awate et al., 2015). Nonetheless, TMNEs' outward FDI activities have primarily been attributed to market-seeking motives up to now (Aybar, 2016; Ayden et al., 2018). At the same time, increasing public efforts are visible that seek to strengthen the domestic scientific and educational knowledge base and aim to promote firm-level upgrading through public support (Bakirci, 2018; TUIK, 2019b; Yildirim, 2017). However, with respect to the private sector in Istanbul, Huggins and Strakova (2012) indicate a demand gap for innovation-related services provided by universities or the national government. In particular, SMEs are not sufficiently aware of existing support options. Overall, the authors describe a lacking innovation culture as the biggest weakness of the city as well as the whole country. Consequently, continuous efforts to create and support an innovation culture are supposedly a highly relevant task (Huggins & Strakova, 2012). In this regard, the 11th development plan of Turkey for the years 2019 to 2023 (Presidency of the Republic of Turkey, 2019) identifies several policies and measures to specifically strengthen the R&D and innovation capabilities of the Turkish manufacturing industry, providing an innovation-based support structure, and aiming to accelerate innovation output.

These policies target both public and private sectors and involve distinct measures for various institutions. For instance, focusing more on innovation output and knowledge commercialization, increasing the quality and numbers of researchers and PhD degrees, increasing collaborations or knowledge and technology transfer between universities and firms, improving Technology Transfer Offices (TTOs), establishing R&D platforms, technology application centers, and frontier R&D laboratories as well as creating specific incentives for large firms, SMEs, and start-up companies. Respective measures thus aim to increase the share of R&D expenditures and R&D personnel in the private sector by approximately 10% until 2023 (Presidency of the Republic of Turkey, 2019).

Özçelik and Taymaz (2008) find an acceleration effect of public R&D support on the private R&D investment of firms in the Turkish manufacturing industry. Smaller firms profit more from public R&D and increasingly engage in R&D. Furthermore, domestic R&D activities and technology transfer from abroad are indicated as complementary processes (Özçelik & Taymaz, 2008). In addition, Taymaz and Ucdogruk (2013) analyze R&D support programs on researcher demand in Turkey and find a positive effect of such programs in raising the demand for researchers within the Turkish manufacturing industry (Taymaz & Ucdogruk, 2013). In a study by Fazlioglu et al. (2019), the authors indicate an existing positive and complementary relation between different forms of innovation, meaning that one type of innovation triggers other innovation activities of firms. In addition, the authors underline the importance of internal R&D with regard to innovation output and productivity of firms, since internal R&D activities build up important firm-specific knowledge. Moreover, the utilization of external R&D resources is often restricted by low levels of firms' absorptive capacities. Therefore, policy interventions and subsidies should be allocated to firms' internal R&D investments instead of promoting external ones (Fazlioglu et al., 2019). Nonetheless, Fındık and Beyhan (2015) find a positive relation between external collaboration and firms' product innovation. Hence, firms that collaborated with external partners during their innovation process observed a positive effect on their product and process innovation activities (Fındık & Beyhan, 2015). Other studies indicate that Turkish firms indeed have strong collaboration ties with external partners, but existing partnerships only have a weak impact on their innovation performance (Cetindamar & Ulusoy, 2008). Moreover, in a study of Turkish manufacturing, Lo Turco and Maggioni (2019) find that technological relatedness and proximity to co-located foreign firms are significantly positive related to the chances of introducing local discoveries by domestic firms. Hereof, knowledge spillovers of foreign MNEs highly depend on their embeddedness within the local market, on their nonstrategic product-specific knowledge advantages, and the overall absorptive capacity of domestic firms (Lo Turco & Maggioni, 2019). In addition, Lo Turco and Maggioni (2016) examine the role of product-specific capabilities at the firm as well as regional level and compare firms' new product output in advanced Western and laggard Eastern Turkish regions. The authors emphasize that in Eastern regions firms industrial output is based on internal resources, whereas product innovation in Western regions is dependent on local technological-related capabilities (Lo Turco & Maggioni, 2016).

Furthermore, more evidence from studies about the Turkish manufacturing industry reveal positive effects of innovation activities on firms' financial performance (Gunday et al., 2011; Karabulut, 2015), and a strong emphasis on the positive effects of technological innovation compared to non-technological innovation (Atalay et al., 2013). Meschi et al. (2011) elaborate a positive and significant relationship between R&D expenditures and skill upgrading of Turkish manufacturing firms, together with a positive impact of foreign technological transfer on the firm level (Meschi et al., 2011). In addition, Özçelik and Taymaz (2004) emphasize that R&D activities are a crucial success factor for Turkish manufacturing firms (Özçelik & Taymaz, 2004). Furthermore, Uzun (2001) describes internal R&D and the size of firms as the main factor for technological innovation activities of firms within the Turkish manufacturing industry, together with product quality improvements and the opening up of new markets as central objectives for firms' innovation strategies (Uzun, 2001).

Based on the innovation success of Turkish firms, Güngör and Gözlü (2012) emphasize international relations as a highly relevant external factor as well as R&D activities, technological licensing, formal training, and managerial experience as significant internal factors. Moreover, the authors still observed a group of firms that invest in internal capabilities but are not involved in any innovation activities (Güngör & Gözlü, 2012). In addition, Beyhan and Fındık (2014) emphasize the importance of firms' internal R&D activities and open innovation strategies for the likelihood of a collaboration with universities, thereby gaining access to external scientific knowledge (Beyhan & Fındık, 2014). However, findings from Temel et al. (2013) indicate negative effects on the profit growth of firms between innovation strategies and collaboration with university (Temel et al., 2013). Empirical evidence by Lenger and Taymaz (2006) reveals findings about innovation activities and technology transfer of foreign and domestic firms in the Turkish manufacturing industry. In this regard, foreign firms show higher levels of innovativeness and a direct transfer of required technology from abroad. Horizontal spillovers show negative effects and vertical spillovers have a positive impact on high-tech suppliers only. Hence, the authors emphasize the importance of tacit knowledge and remind us that technology cannot simply be transferred through passive spillover mechanisms (Lenger & Taymaz, 2006). In addition, Pamukcu (2003) find a nonsignificant effect of technology spillovers on firms' probability to innovate. According to the author, the presence of foreign firms within the Turkish manufacturing industry does not have an effect on innovation activities of domestic firms, and neither do exporting, technological licensing, or collaboration with a foreign partner (Pamukcu, 2003).

Considering the large number of studies about innovation in Turkey and the nation's policy focus on supporting R&D and innovation, this EE is indeed a highly relevant context to study. However, there is a void in the literature about the interplay of factors influencing the innovation success of firms, such as different internal and external R&D resources as well as internationalization strategies. Consequently, our study aims to address this research question with a focus on distinct firm types within the metropolitan region of Istanbul.

Based on the theoretical framework concerning firms' internal capabilities, we postulate that internal R&D resources are likewise relevant for successfully achieving innovation for all types of firms. The internal resource base is used for continuous upgrading efforts, for gaining access to external knowledge as well as for various innovation activities. Therefore, we assume that:

Hypothesis 1 *Internal R&D resources have a positive effect on being successful in achieving innovation for all types of firms.*

With respect to external R&D factors, we expect that different types of external resources also affect diverse innovation strategies of firms. Therefore, we hypothesize that:

Hypothesis 2 *External R&D resources in terms of technological knowledge have a positive effect on being successful in achieving innovation for TMNEs.*

Hypothesis 3 *External R&D resources in terms of market knowledge have a positive effect on being successful in achieving innovation for all types of firms.*

We assume here that TMNEs already have sufficient knowledge about the domestic market, meaning that the respective firms prefer to pursue technological innovation strategies. AMNEs, however, presumably choose Turkey based on market-seeking strategies. Therefore, external resources with respect to market knowledge will be the main factor for innovation success of foreign firms in Turkey. DTFs might not be able to utilize external resources altogether, as respective firms still need to focus on building up internal capabilities in the first place.

Overall, the hypotheses presented test various forms of internal and external R&D resources and their potential effects on the innovation success of different firm types within the EE setting of Turkey. To extend the analysis, three of the usual R&D-related control variables are applied as well. The subsequent research framework of the hypothesized relationship between firm's innovation success, independent variables, and control variables is shown in Figure 1.

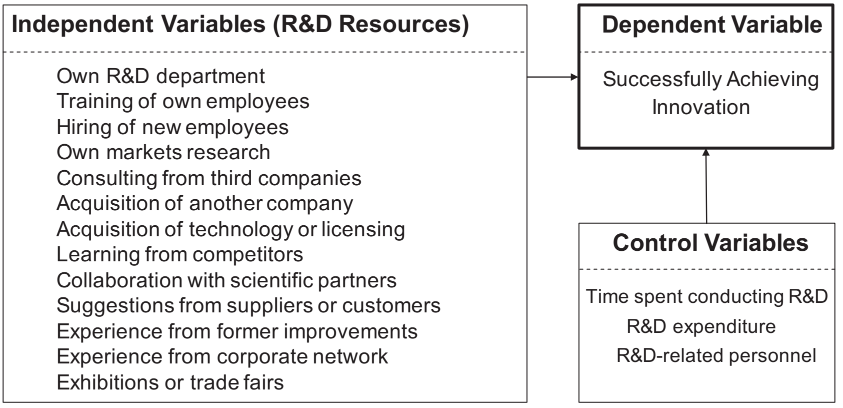

FIGURE 1 Initial research framework

3 | RESEARCH METHOD

3.1 | Survey sampling and data collection

For decades, Istanbul has been the major hub for industry, trade, and manufacturing within Turkey, harboring the majority of corporate headquarters from TMNEs, AMNEs, and DTFs (Ersoy, 2018). Even though the numbers of employees in manufacturing is diminishing and the service industries are on the rise in Istanbul, the city region is still the main manufacturing center in Turkey with about 44.32% of all manufacturing enterprises in Turkey (TUIK, 2020d). Besides being the main economic center with 31% of total Turkish GDP in 2018, Istanbul is also the primary region for inward FDIs with the nation's highest share of MNEs (Gezici et al., 2017; TUIK, 2019a). The city and surrounding Marmara region thus accounts for 77.8% imports and 71.01% exports of the nation's total (TUIK, 2020a, 2020b). Moreover, nearly half of Turkey's production profits and net value added is created in Istanbul (Ersoy, 2018). With regard to R&D-related figures, the city accounted for the nation's highest share of R&D personnel with 27.3% and second highest R&D expenditure with 25.3% in 2018 (TUIK, 2019b). The knowledge-based orientation becomes also evident when taking innovation outputs into account: 44% of all Turkish patents are based in Istanbul (Kaygalak & Reid, 2016) and the city is home to 43.1% of educational enterprises in Turkey (TUIK, 2020c). Istanbul thus provides an excellent setting to investigate how R&D resources might affect the innovation success and strategies of innovation-oriented DTFs, TMNEs, and AMNEs within Turkey.

The survey sampling was based on the database of the *Scientific and Technological Research Council of Turkey* (TÜBITAK). As the leading agency for management, funding, and conducting research in Turkey, TÜBITAK is a very helpful data source for capturing the most innovation-oriented segment of Turkish companies. From the database, a new subset of 838 firms was compiled based on their geographic location in Istanbul and including only those which successfully completed at least three R&D projects which were funded by TÜBITAK. No further distinction was made regarding the amount of financial support firms received. After targeting senior R&D executives and general managers, 265 questionnaires were received, 40 of which were omitted due to a substantial number of missing values, resulting in survey sample of 225 firms. Having an effective response rate of 26.85% is satisfactory given the topic and type of potential respondents. Also, a test for nonresponse bias from early and late respondents showed no statistical problems with the data collected for this study (Armstrong & Overton, 1977). For the purpose of content validity of the chosen measurements, the suggested procedures by Hair et al. (2007) were adopted (Hair et al., 2007). First, exploratory interviews with senior experts in the field of R&D and management in Istanbul were conducted to develop an initial version of the survey. Second, the questionnaire was then revised through discussions with other scholar experts. Finally, a pretest of the survey was conducted with randomly selected firms and adjusted accordingly until it reached a satisfactory level of clarity and maturity. The study was conducted in the first half of 2016.

3.2 | Measurement of variables

In the following section, the classification of firm types as well as the dependent, independent, and control variables are briefly described.

The firm types (DTF, TMNE, and AMNE) are differentiated according to their ownership structure and internationalization stage. Firms defined as AMNEs are either 100% foreign-owned or have entered a joint venture with a Turkish firm. Firms which are 100% Turkish-owned are categorized as either TMNE or DTF and are further distinguished according to their internationalization activities. At the time of this study, DTFs are defined as showing no FDI activities abroad, whereas TMNEs are operating in foreign markets. The study includes a total of 225 firms, with firm groups of 113 DTFs, 61 TMNEs, and 51 AMNEs.

The firms' self-assessment of innovation success was treated as the dependent variable. Therefore, "innovation success" was measured using a 5-point scale regarding the level of agreement (1 = strongly disagree to 5 = strongly agree) for statements about the company's awareness for innovation. The dependent variable was derived from the following statement: "Our company is successful in achieving innovation." As binary logistic regression is used for data analysis, only firms that agreed with this statement ("agreement" or "strong agreement") would be denoted as "being successful in achieving innovation." Mean values for each firm type and their self-assessment as "being successful in achieving innovation" are as follows: DTFs show lowest values with a mean of 3.89, followed by equal self-evaluations from TMNEs with a mean of 4.15 and AMNEs with 4.16 mean value.

Various forms of R&D resources were treated as independent variables and were measured based on the frequency (1 = never used to 5 = frequently used) with which they were used for achieving innovation. Each item was derived from a 5-point frequency scale based on following question: "To what extent have the following aspects been used for achieving innovation in Istanbul and the Marmara region?". In total, 13 forms of R&D resources were rated.

As control variables, the "time spent conducting R&D (in Istanbul)," the "R&D expenditure (of total sales)" as well as the "R&D-related personnel (of white collar employees)" were used. All variables were measured with ordinal scales and are commonly used in firm-level studies to control for firm's R&D capacities. The R&D-related personnel and expenditure represent firms' internal innovation capabilities, whereas the time spent conducting R&D in Istanbul illustrate the importance of the firms' R&D location in Istanbul.

Appendices A and B provide additional information on firms' characteristics and the detailed measurements as well as descriptive statistics of all variables used in this study. Overall, values are relatively high across all firms and variables. This is due to the fact that our survey sample covers the innovation-related subpopulation of manufacturing firms in Istanbul.

3.3 | Data analysis

Having an adequate number of observations or events per variable (EPV) is a vital factor for statistical analysis. Low EPV values of less than ten might lead to statistical problems and could influence the validity of logistic models (Peduzzi et al., 1996). Recent methodological studies suggest a number of at least five to nine EPV for statistically adequate analysis, even though larger case numbers are preferable (Vittinghoff & McCulloch, 2007). Concerning the large set of 13 independent variables and three control variables, EPV values for the three logistic models (DTFs (113/16) = 7.06, TMNEs (61/16) = 3.81, and AMNEs (51/16) = 3.19) are presumably too low to provide satisfactory results, particularly for the groups of TMNEs as well as AMNEs. In addition to this methodological limitation, there are also theoretical aspects that need to be taken into account. All of the R&D resources might have a distinct effect on firm's innovation success, however, it can be expected that some variables partially overlap and correlate with each other. Therefore, instead of making a preselection of specific variables, we make use of a PCA for dimension reduction and the identification of potentially interconnected variables. The PCA is a common method for variable reduction that is similar to exploratory factor analysis. With the help of this technique, a large number of variables are condensed to a smaller set of variables or principal components, which account for the majority of the total variance. Using this two-step approach of methodological analysis is thus a huge advantage of our study, as it not only reveals hidden structures and relationships between variables within the data set, but resulting components can also be subsequently used for further analysis.

Hereinafter, binary logistic regression analysis is applied to estimate the effects of these components on the innovation success of firms. For this, the binary logistic regression models can be expressed as:

$$P(Yi = 1) = \frac{1}{1 + e^{-(\alpha + Xi\beta)}}$$

Here, *Yi* is the dependent variable, which is defined as a dummy variable with a value of either zero or one, where a value of one denotes the probability of an event occurring rather than another denoted by zero. The intercept is shown as α, and *Xi* is the vector of the independent and control variables, with β as the vector of the regression parameters (Amemiya, 1981). The sign of the regression coefficients β estimates the impact of the independent on the dependent variable, where a positive coefficient increases the probability of an event occurring, while a negative sign of the parameter implies the opposite effect on the outcome variable. Here, the regression coefficients estimate the degree to which firms assess themselves as being successful in achieving innovation. Coefficient results are reported as exponentiation of the β coefficient (*Exp(β)*), given an odds ratio of the independent variables.

4 | COMPUTATION AND FINDINGS

The correlation matrix (Spearman's r-square) between independent and control variables for the survey sample of 225 firms is shown in Appendix C. All independent variables are positively and significantly correlated with one another, illustrated by moderate to strong correlation coefficients

(Akoglu, 2018). In particular, variables with a similar focus as either internal or external R&D resources are interrelated. For example, "learning from competitors" is strongly correlated with the "acquisition of technology or another company," whereas "experiences from former improvements" are related to "suggestions from suppliers and customers" or "knowledge from corporate network." Internal resources such as an "own R&D department" as well as the "training and hiring of employees" are also interrelated. Thus, PCA is subsequently used for dimension reduction and to identify connected variables. When taking control variables into account, correlations with independent variables illustrate the reliability of firms' responses. For instance, R&D expenditure and R&D-related personnel are positively and significantly correlated with firms' internal R&D resources.

In the following section, the results for the PCA of 13 variables measuring firms' R&D resources are described. The suitability of this analysis is confirmed by the Kaiser–Meyer–Olkin (KMO) measurement of 0.867 and a statistically highly significant Bartlett's test ($p < .01$). Individual KMO measurements for the observed variables show consistently high values of more than 0.80, proving "meritorious" to "marvelous" measurements of sampling adequacy (Kaiser, 1974). Subsequent analysis shows a three-component solution for components with an Eigenvalue greater than one and a total of 56.66% of total variance explained, with individual component explanation of 36.42, 10.74, and 9.49% of total variance. The resulting three-component solution with highlighted component scores is shown in the rotated component matrix in Table 1. Resulting component scores for each firm are saved and used as independent variables during further analysis with binary logistic regression.

The interpretation of the PCA results is consistent for the variables used and can be described as follows. Principal Component 1 can be described as "external resources I (technological knowledge," Component 2 as "external resources II (market knowledge)," and Component 3 as "internal resources." In more detail, Component 1 contains R&D resources that are related to external factors such as acquisitions of another company, technology, or licensing as well as consultation from third companies,

TABLE 1 Rotated component matrix for PCA of the independent variables

Rotated component matrix[a]	Component		
	1	2	3
Acquisition of another company	0.805	0.086	0.064
Acquisition of technology or licensing	0.719	0.235	0.182
Consulting from third companies	0.692	0.042	0.272
Learning from competitors	0.554	0.502	0.009
Collaboration with scientific partners	0.466	0.295	0.421
Suggestions from suppliers or customers	0.123	0.795	0.026
Experience from former improvements	0.107	0.755	0.224
Knowledge from corporate network	0.156	0.655	0.316
Exhibitions or trade fairs	0.118	0.558	0.066
Training of own employees	0.154	0.033	0.831
Own R&D department	0.008	0.209	0.775
Hiring of new employees	0.325	0.115	0.621
Own market research	0.392	0.326	0.466

Note: Extraction method: Principal component analysis. Rotation method: Varimax with Kaiser normalization.

[a]Rotation converged in five iterations.

revealing a focus on technological knowledge internalization. Component 2 likewise includes external resources, however, related factors such as suggestions from suppliers and customers, experience from former improvements as well as knowledge from corporate networks and exhibitions or trade fairs can be summarized as market knowledge. Finally, Component 3 contains internal resources, namely the training of existing and the hiring of new employees as well as an own R&D department and market research. Both R&D resources "learning from competitors" and "collaboration with scientific partners" show their highest factor scores with Component 1, and also load on Component 2 and 3 which need to be interpreted accordingly. The variable "learning from competitors" could be related to either technological or market knowledge, depending on the competitor as well as the firms' innovation strategy. The external resource "collaboration with scientific partners" is most likely linked to technological knowledge, although it is also closely related to internal resources, as internal capacities are required to work with scientific partners in the first place. In addition, it is important to note that the resulting components have been established from our survey data alone, but match well with basic insights from previous theoretical considerations (Cohen & Levinthal, 1989, 1990; Mathews, 2002). Hence, a consolidated research framework after the use of PCA is shown in Figure 2.

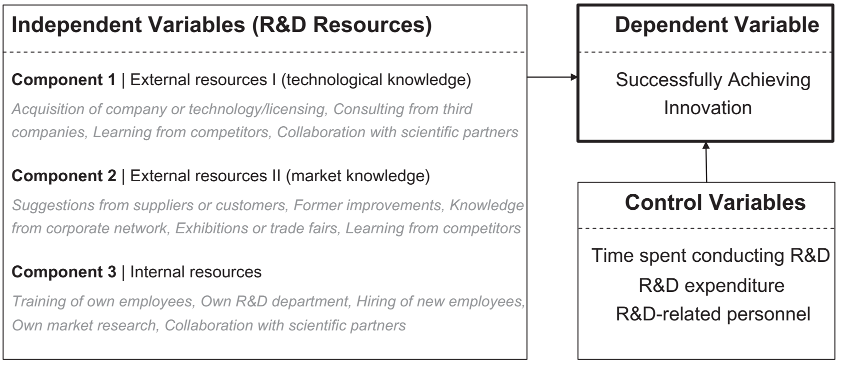

FIGURE 2 Consolidated research framework (after dimension reduction with PCA)

To answer this study's research questions and to test the hypotheses, three binary logistic regressions are modeled, one for each type of firm: (1) DTFs, (2) TMNEs, and (3) AMNEs. The outcomes for these models are reported in Table 2. Consequently, binary logistic regression is used to predict the probability that firms assess themselves as being successful in achieving innovation. We thus attempt to identify R&D resources that are statistically relevant for firms to fall into the category of successfully achieving innovation (denoted as one in our statistical models).

With regard to reliability measurements, all models demonstrate high and significant chi-square statistics which are most significant for model one ($p < .01$). The predicted models thus fit significantly better for the survey sample than a null model. Also, the Cox and Snell and Nagelkerke pseudo-r-square models indicate a good overall fit, explaining about 37% of the variance for model one, about 29% for model two as well as about 43% for model three (based on the Nagelkerke r-square values). The models demonstrate medium to large effect sizes, indicating good validity for subsequent analysis (Cohen, 1992). Finally, the nonsignificant chi-square values of the "Hosmer and Lemeshow" test show that no significant differences ($p > .10$) between observed and predicted values are present. Therefore, another good overall fit for the selected independent and control variables can be assumed (Hosmer et al., 2013).

With regard to model one, only one independent variable has a statistically significant effect on DTFs being categorized as successfully achieving innovation: Component 3 relating to internal resources has a highly positive and significant ($Exp(\beta) = 2.892$, $p < .01$) impact on innovation success.

TABLE 2 Binary logistic regression models with self-assessment of "being successful in achieving innovation" as dependent variable

Variables	MODEL 1 Innovation success of DTFs Exp(β)	MODEL 2 Innovation success of TMNEs Exp(β)	MODEL 3 Innovation success of AMNEs Exp(β)
Independent variables			
Component 1: External resources I (technological knowledge)	0.792	1.477	0.632
Component 2: External resources II (market knowledge)	1.439	2.716**	2.698*
Component 3: Internal resources	2.892***	2.301*	0.816
Control variables			
Time spent conducting R&D (in Istanbul)	1.015	0.569	0.379
R&D expenditure (of total sales)	0.902	0.559	1.264
R&D-related personnel (of white collar)	3.420*	1.833	1.692
Intercept	0.944	73.142**	70.816**
Reliability measurements			
Model chi-square	29.358***	10.512*	11.645*
Cox and Snell r-square	0.254	0.171	0.237
Nagelkerke r-square	0.369	0.292	0.428
Effect size (Nagelkerke r-square)	0.765	0.642	0.865
Hosmer and Lemeshow chi-square	3.671	3.574	7.215

Note: $N = 225$ (DTFs = 113; TMNEs = 61; AMNEs = 51).
$^{*}p < .10$; $^{**}p < .05$; $^{***}p < .01$.

Increasing the usage of internal resources is thus related to a 189.2% higher chance of DTFs assessing themselves as being innovative. Both external components 1 and 2 are statistically insignificant, but indicate a negative effect of technological knowledge ($Exp(\beta) = 0.792$, $p > .10$) and a positive one for market knowledge ($Exp(\beta) = 1.439$, $p > .10$) for the innovation success of DTFs. This result is even more evident when taking the control variables into account, of which the R&D-related personnel variable also shows a high positive and significant impact ($Exp(\beta) = 3.420$, $p < .10$).

Regarding model two, we can find two positive and significant independent variables. Both internal resources ($Exp(\beta) = 2.301$, $p < .10$) as well as external market knowledge ($Exp(\beta) = 2.716$, $p < .05$) have a notably positive and significant impact on TMNEs' innovation success. External resources in terms of technological knowledge show a likewise positive but nonsignificant coefficient ($Exp(\beta) = 1.477$, $p > .10$). With regard to the control variables, the time spent conducting R&D ($Exp(\beta) = 0.569$, $p < .10$) and the R&D expenditure ($Exp(\beta) = 0.559$, $p < .10$) are negative but insignificant for TMNEs' innovation success, whereas the R&D-related personnel shows positive but still insignificant results ($Exp(\beta) = 1.833$, $p < .10$).

Concerning model three, only external resources with regard to market knowledge indicate a positive and significant effect for AMNEs to assess themselves as being innovative ($Exp(\beta) = 2.698$, $p < .10$). Both internal resources ($Exp(\beta) = 0.816$, $p > .10$) and external technological knowledge ($Exp(\beta) = 0.632$ $p > .10$) show negative and insignificant coefficients. Furthermore, all control

TABLE 3 Degree of support for hypotheses (summary)

Hypotheses	Degree of support
Internal resources	
Hypothesis 1: Internal R&D resources have a positive effect on being successful in achieving innovation for all firm types.	Partially supported
External resources	
Hypothesis 2: External R&D resources in terms of technological knowledge have a positive effect on being successful in achieving innovation for TMNEs.	Not supported
*Hypothesis 3:*External R&D resources in terms of market knowledge have a positive effect on being successful in achieving innovation for all firm types.	Partially Supported

variables are statistically insignificant, however, R&D expenditure ($Exp(\beta) = 1.264$, $p > .10$) and R&D-related personnel ($Exp(\beta) = 1.692$, $p > .10$) indicate a positive impact.

A summary with the degree of support for all hypotheses is shown in Table 3. Hypothesis 1 is partially supported for DTFs and TMNEs. No support is found for Hypothesis 2. Hypothesis 3 is partially supported for TMNEs and AMNEs. In the following section, the findings are discussed in more detail.

5 | DISCUSSION AND CONCLUSION

5.1 | Summary of main results

The results from three binary logistic regression models reveal important findings about firms' innovation activities. From these, we gain not only results about important factors for firms to assess themselves as being successful in achieving innovation, but also relevant information about firms' internationalization strategies, as both external resources components are related to either demand-pull (market knowledge) or technology-push (technological knowledge) strategies.

First, it is evident that internal R&D resources are still the main success factor for DTFs for achieving innovation. This can also be observed when looking at the coefficients for the control variables where R&D-related personnel is the main influencing factor. Both external R&D resources have a nonsignificant influence on innovation success. It is thus evident that DTFs still need to build internal capacity in the first place before assessing external resources, particularly with regard to technological knowledge, which shows a negative coefficient. In addition, the time spent conducting R&D in Istanbul not only has a small positive, but also insignificant coefficient, which still is an important aspect for DTFs compared to TMNEs and AMNEs.

Second, internal R&D resources also have an effect on the probability of TMNEs being categorized as successfully achieving innovation. However, a negative coefficient for internal R&D expenditure can be observed, whereas R&D-related personnel indicates a positive but insignificant impact on innovation success. Furthermore, the time spent conducting R&D in Istanbul has a negative significant effect. In this regard, it can be assumed that R&D activities located in Istanbul only recently became important for TMNEs' innovation activities, indicating the relative importance of the firms' location there. In terms of external resources, Component 2 reveals a highly positive and significant coefficient, whereas Component 1 is also positive but insignificant. Hence, external resources in terms of market knowledge have a high influence on the innovation success of TMNEs. However, the insignificant finding for external technological knowledge indicates that TMNEs keep their core competencies in Turkey and do not yet have enough power to compete globally in advanced markets (Ayden et al., 2018).

Finally, internal resources of AMNEs subsidiaries in Istanbul do not have an effect on them being categorized as successfully achieving innovation. Although both R&D expenditure and R&D-related personnel show a positive coefficient, these findings are insignificant. In addition, the time spent conducting R&D in Istanbul shows a negative and insignificant coefficient. It is thus evident that Istanbul is not the prime location for R&D activities of AMNEs. Regarding external resources, market-related knowledge shows a highly positive and significant influence on foreign firms' innovation success, while technological knowledge resources show a negative coefficient. Hence, AMNEs supposedly pursue a demand-pull, that is, market-seeking innovation strategy. Model three is different from models one and two in that it includes fewer significant factors and more unexplained variation, highlighted by a significant intercept. This is, however, not really surprising since AMNEs are the only companies in the sample which supposedly not place their key strategic competence and innovation capabilities in Istanbul. As discussed previously (Kuemmerle, 1999; von Zedtwitz & Gassmann, 2002) most MNEs use their headquarters for carrying out R&D and strategic innovation activity, and build up those functions only at selected foreign subsidiaries. The significance of seeking market-related knowledge indicates Istanbul's AMNEs' prevailing focus is on market-oriented adaptations and manufacturing, while the insignificance of both the internal technological capacity and the technology-related component may indicate AMNEs access to the R&D resources at their headquarters.

In summary, Hypothesis 1 is only partially supported, as internal R&D resources are just relevant for DTFs and TMNEs as being important for achieving innovation. However, this finding does not imply that internal capacities are irrelevant for AMNEs at all, but rather illustrates that respective firms assess these resources as unimportant for achieving innovation in Turkey. This might also be due to the fact that AMNEs assess internal capacities as granted anyway and in fact exploit external resources. Hypothesis 2 is not supported, as findings suggest insignificant effects of external technological knowledge on innovation success of TMNEs, which is also true for DTFs and AMNEs. Finally, binary logistic regression analysis only partially supports Hypothesis 3, as external market knowledge is only relevant for TMNEs and AMNEs. This finding is most likely related to lacking internal innovation capabilities of DTFs.

5.2 | Limitations

Based on the exploratory nature of this study, findings and implications need to be interpreted with caution. First, the single country setting might be a limitation to the generalizability of our results. Therefore, conducting a similar study in a different EE setting could help to contrast our findings and add to the existing body of literature in the field of EEs research (Nielsen et al., 2018), particularly as compared to studies from the technology-driven East Asian or resource-based Latin American context. Second, our spatial or geographic focus on Istanbul as well as the intended sampling of R&D-intensive firms also produce specific outcomes for certain firm types and within metropolitan regions. One should thus not generalize the results for the entire EE of Turkey and over all sectors or for non-innovative firms. Finally, the self-assessment of firms as being successful in achieving innovation needs to receive some attention when interpreting the results. Although the usage of this type of dependent variable does not allow for an objective measurement of innovation success, it still allows for different insights about firms' self-evaluation on innovation strategies and supposedly important factors for essential internal innovation capabilities. Nevertheless, it would be desirable for future research to make use of an objective R&D output measurement as an outcome variable.

5.3 | Theoretical implications

Our findings have important implications for the theoretical understanding of innovation in an EE context. In this regard, our results underline the importance of distinguishing between internal and external resources and in particular between technological and market knowledge when studying the innovation success of a differentiated corporate landscape. These results relate to findings by Scandura (2019) who shows that a joint use of both external scientific and external market knowledge is highly positively related to firms' internal inventive processes and consequently influences industry inventors' innovation performances (Scandura, 2019). Moreover, they resonate with recent approaches to rediscover technology-oriented and user-driven innovators and their particular relevance in EEs (Liefner & Losacker, 2020). Most importantly, however, these findings underline that an understanding of factors affecting innovation in EEs critically depends on differentiating the roles of firms in the process of economic globalization. It is the interplay of internationalization, innovation, and location that explains the relevance of each factor. Only through categorizing firms according to their internationalization strategies or stage does it become possible to identify key differences regarding the influence of different types of resources. This is particularly evident for distinguishing both Turkish firm types: DTFs and TMNEs. In that respect, Kafouros et al. (2008) find similar results for the interrelated concepts of firms' internationalization activities and innovation performances. The authors conclude that only firms that feature a sufficient degree of internationalization are able to successfully benefit from innovation in terms of their economic performance. Therefore, internationalization activities enhance firms to improve their innovativeness and a certain threshold level is even necessary to benefit from innovation at all (Kafouros et al., 2008). Our results thus contribute to the authors' findings and highlight the importance of considering firms' internationalization activities when conducting research on innovation in EEs. Hence, in terms of the firms' exposure to global competition, future studies on innovation in regional settings that are similar to that of Istanbul should seek to implement internationalization as a categorizing perspective or as an independent factor. Otherwise, an important factor contributing to a differentiated pattern will be overlooked.

5.4 | Policy implications

As a policy finding of this study, our results indicate that a mere focus on technology-push strategies neglects other aspects that explain innovation success of firms within an EE setting. Even though our survey sample captures information for a highly competitive region with one of the highest R&D shares and the most innovative firms (Akpinar et al., 2015), results suggest that such a technology-driven approach is not a vital strategy for all types of firms. Therefore, policy makers should not only rely on building technological capacities, but also need to make room for various forms of political support to foster innovation efforts and strategies. Hence, it is necessary to distinguish between different firm types and their needs, as relevant input factors for innovation success vary among them. This is especially relevant as innovation support measures by TÜBITAK are publically funded. In this regard, DTFs are most in need of support for internal R&D capabilities, particularly related to white collar or R&D-related personnel. Such a form of support should enable firms to increase their absorptive capacities and consequently their ability to make use of external technological knowledge (Fazlioglu et al., 2019). Based on this overall moderating role of absorptive capacity, it is evident that otherwise only a small subset of DTFs would be able to benefit from knowledge and technology spillovers from foreign MNEs residing in the Turkish market (Lo Turco & Maggioni, 2019). With regard to TMNEs, firms would greatly profit from support aiming at building internal R&D capabilities. Furthermore, TMNEs are already utilizing external resources in terms of market knowledge as part of their innovation strategies. However, further support for TMNEs' technology-push strategies are most relevant for these firms to pursue an internationalization process of targeting advanced and competitive markets (Ayden et al., 2018) as well as offshore R&D sourcing (Ozturk, 2018). In contrast, AMNEs target the Turkish market for market-seeking reasons and embark on an innovation strategy that is based on external market knowledge. Policy makers could further support AMNEs in this strategy or encourage more technological innovation and R&D activities within Turkey, hoping for spillover effects on domestic Turkish firms (Blomström et al., 2001).

Overall, managers and policy makers in particular need to acknowledge that opening an economy to trade and investment does not bring a fixed set of opportunities and outcomes but instead puts firms in a dynamic situation in which they have to adjust their investment priorities as to benefit economically from their relative, and constantly developing, advantages. More than advanced economies' governments, EEs such as Turkey must take into regard the individual firms' differing and changing needs when designing adequate public support for upgrading processes.

Hence, to support the heterogeneous corporate landscape in Turkey, different policy options are conceivable and depend on the strategy that national and regional governments would like to pursue. A policy approach to support DTFs in their effort to establish innovation capacities could be the facilitation of higher shares of R&D or white-collar personnel within these firms, as well as an increasing investment in higher education and R&D spending. Respective policies might also foster technology-push strategies to support domestic TMNEs (Ayden et al., 2018). However, this still requires large investments in public and private R&D. Another policy could be focusing on a demand-pull strategy, especially if there is no strong historical tradition in technology development. For this, policy needs to foster the financial base as well as consulting and other institutions within the market environment. It seems that Turkey is pursuing such a demand-pull strategy, as a fiscal stimulus just recently boosted the domestic demand in 2019. However, geopolitical uncertainties and low investor confidence are still resulting in a weak external trade demand and a projected GDP growth rate below potential. Therefore, a more transparent and simplified macroeconomic policy framework would be necessary to rebuild international and domestic confidence as suggested by the OECD (OECD, 2019) as well as to foster innovation activities of domestic firms.

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DATA AVAILABILITY STATEMENT

Research data are not shared. The data are not publicly available due to privacy or ethical restrictions.

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APPENDIX A

Descriptive figures of the control variables and firms' characteristics

	Total		DTFs		TMNEs		AMNEs	
	N	%	*N*	%	*N*	%	*N*	%
Time spent conducting R&D (in Istanbul)								
<5 years	39	17.7	24	21.4	7	11.9	8	16.3
5–10 years	57	25.9	29	25.9	17	28.8	11	22.4
11–20 years	54	24.5	30	26.8	9	15.3	15	30.6
21–40 years	45	20.5	21	18.8	14	23.7	10	20.4
>40 years	25	11.4	8	7.1	12	20.3	5	10.2
R&D expenditure (of total sales)								
<20%	110	50.5	51	46.8	38	63.3	21	42.9
21%–40%	48	22.0	26	23.9	10	16.7	12	24.5
41%–60%	28	12.8	16	14.7	4	6.7	8	16.3
61%–80%	12	5.5	2	1.8	6	10.0	4	8.2
>80%	20	9.2	14	12.8	2	3.3	4	8.2
R&D-related personnel (of white collar)								
<20%	160	73.7	79	73.1	50	83.3	31	63.3
21%–40%	34	15.7	15	13.9	8	13.3	11	22.4
41%–60%	11	5.1	6	5.6	2	3.3	3	6.1
61%–80%	6	2.8	5	4.6	0	0.0	1	2.0
>80%	6	2.8	3	2.8	0	0.0	3	6.1
Industry class								
Manufacturing	161	71.6	74	65.5	54	88.5	33	64.7
Information and communication	26	11.6	15	13.3	1	1.6	10	19.6
Manufacturing-supportive	17	7.6	10	8.8	4	6.6	3	5.9
Others	21	9.3	14	12.4	2	3.3	5	9.8
N	225		113		61		51	

APPENDIX B

Descriptive figures of the dependent and independent variables

	Total		DTFs		TMNEs		AMNEs	
Dependent variable	$\bar{x}$	*SD*	$\bar{x}$	*SD*	$\bar{x}$	*SD*	$\bar{x}$	*SD*
Being successful in achieving innovation	4.02	0.89	3.89	0.96	4.15	0.79	4.16	0.78
Independent variables								
Own R&D department	4.12	1.17	3.99	1.15	4.26	1.18	4.22	1.17
Training of own employees	4.14	0.89	3.96	0.93	4.16	0.93	4.50	0.58
Hiring of new employees	3.61	1.01	3.48	1.07	3.66	0.96	3.86	0.87
Own market research	3.98	0.97	3.92	0.96	3.95	0.99	4.16	0.98
Consulting from third companies	3.36	1.06	3.31	1.07	3.45	1.11	3.39	1.00
Acquisition of another company	2.46	1.36	2.20	1.37	2.52	1.32	2.96	1.23
Acquisition of technology or licensing	3.34	1.28	3.28	1.32	3.30	1.24	3.51	1.25
Learning from competitors	3.24	1.19	3.27	1.21	3.10	1.09	3.34	1.26
Collaboration with scientific partners	3.64	1.08	3.52	1.15	3.72	0.99	3.80	1.00
Suggestions from suppliers or customers	4.08	0.80	4.14	0.78	4.02	0.85	4.02	0.80
Experience from former improvements	4.31	0.81	4.36	0.78	4.25	0.75	4.26	0.94
Knowledge from corporate network	4.00	0.92	3.94	0.97	3.93	0.83	4.20	0.92
Exhibitions or trade fairs	4.02	0.94	4.08	0.93	4.18	0.77	3.71	1.10
N	225		113		61		51	

Notes: $\bar{x}$ = Arithmetic mean; *SD* = Standard deviation.

APPENDIX C

Correlation matrix (Spearman's r-square) of the independent and control variables

	Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	Own R&D department	1.00															
2	Training of own employees	0.53**	1.00														
3	Hiring of new employees	0.41**	0.43**	1.00													
4	Own market research	0.32**	0.45**	0.40**	1.00												
5	Consulting from third companies	0.18**	0.32**	0.32**	0.35**	1.00											
6	Acquisition of another company	0.16*	0.21**	0.30**	0.32**	0.40**	1.00										
7	Acquisition of technology/licensing	0.15*	0.25**	0.30**	0.39**	0.43**	0.48**	1.00									
8	Learning from competitors	0.20**	0.19**	0.32**	0.35**	0.30**	0.48**	0.40**	1.00								
9	Collaboration with scientific partners	0.34**	0.38**	0.36**	0.30**	0.37**	0.33**	0.41**	0.43**	1.00							
10	Suggestions from suppliers/ customers	0.15*	0.18**	0.19**	0.33**	0.16*	0.14*	0.28**	0.42**	0.38**	1.00						
11	Experience from former improvements	0.26**	0.24**	0.28**	0.42**	0.18**	0.18**	0.31**	0.37**	0.35**	0.52**	1.00					
12	Knowledge from corporate network	0.32**	0.29**	0.31**	0.42**	0.20**	0.30**	0.36**	0.36**	0.28**	0.43**	0.53**	1.00				
13	Exhibitions or trade fairs	0.19**	0.11	0.19**	0.24**	0.20**	0.20**	0.27**	0.24**	0.22**	0.30**	0.31**	0.37**	1.00			
14	Time spent conducting R&D (in Istanbul)	0.31**	0.26**	0.16*	0.14*	0.18**	0.13	0.08	0.07	0.11	0.09	0.05	0.12	0.08	1.00		
15	R&D expenditure (of total sales)	0.09	0.16*	0.20**	0.13	−0.05	0.08	0.19**	0.08	0.25**	0.16*	0.15*	0.15*	−0.04	0.03	1.00	
16	R&D-related personnel (of white collar)	0.25**	0.19**	0.31**	0.19**	0.04	0.13	0.15*	0.16*	0.22**	0.05	0.13	0.07	0.01	0.01	0.40**	1.00

* $p < .05$; ** $p < .01$ (two-tailed test); $N = 225$.