Unlocking the relationships between strategic planning, leadership and technology transfer competence: the mediating role of strategic quality management

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Abstract

Purpose – *This study aims to investigate the relationships between firms' strategic planning (SP), leadership and technology transfer competence (TTC) by specifically incorporating the mediating role of strategic quality management (SQM).*

Design/methodology/approach – *This study performs structural equation modeling using AMOS on survey data collected from 200 Turkish firms operating in multiple industries and sectors.*

Findings – *This study finds that leadership in Turkish firms operating in multiple sectors is positively associated with SQM. This study further finds that SQM positively influences Turkish firms' TTC and mediates the roles of SP and leadership in TTC.*

Research limitations/implications – *A key research implication from this study relates to the mediating role of SQM in TTC in an emerging economy context. This study highlights that SP and leadership can play an essential role in TTC through the mediating mechanism of SQM. Consequently, SQM emerges as a crucial linking pin in conveying the impact of quality management practices on technology transfer in emerging markets.*

Practical implications – *An essential managerial implication of this study relates to the critical roles of leadership, SP and SQM in TTC. For the managers of firms operating in a relatively uncertain emerging context such as Turkey, it is essential to adopt a supportive and empowering leadership style, where open communication and innovative activities are viewed positively and SQM is adopted holistically. Also, SP should be streamlined throughout the firm and followed by SQM to support TTC.*

Originality/value – *This paper links the technology (and knowledge) management and the strategy and leadership literature streams by focusing on the mechanisms of technology transfer and delving into the linkages between SQM, leadership, SP and TTC. It specifically presents SP and leadership as precursors to SQM in their joint influence on TTC. Accordingly, this research bridges technology, strategy and leadership research and provides a broader picture of technology transfer that encompasses the joint role of different processes in firms' TTC.*

Keywords *Leadership, Strategic quality management, Strategic planning, Technology transfer competence, Turkish firms*

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1. Introduction

Technology transfer is an indispensable element of technology management and one of the critical enablers of technological and economic advancement and sustainability (Hilson and Ovadia, 2020; Lee *et al.*, 2010; Meissner and Carayannis, 2017) . There are many different definitions of technology. According to the classical view of economics, technology transfer denotes the transfer of technology from one industry to another. However, according to Kranzberg (1986), the approach that sees technology as knowledge has replaced this classical approach. Over recent decades, there has been a gradual yet substantial transition from physical and tangible assets to intangible assets as key sources of competitive advantage and performance (Hall, 1993; Hussi, 2004). Thus, technology has become a distinctively knowledge-based phenomenon (Honarpour *et al.*, 2017). It is no longer a material good. The knowledge is applied in research and innovation processes, including the process of "learning from others." These processes are often complex and costly. Technology transfer is also a complex and costly learning process, such as the transfer of knowledge (Kranzberg, 1986; Levine *et al.*, 1991). Technology includes tools, machines, production methods, knowledge and know-how. Therefore, knowledge transfer is inextricably intertwined with technology transfer (Barros *et al.*, 2020; Ismail *et al.*, 2018).

The effective transfer of technology can empower and drive a firm to achieve such desirable outcomes as manufacturing productivity, alliance efficiency and adaptability, international expansion and sustainable competitive advantage (Cui *et al.*, 2006; García-Almeida and Bolívar-Cruz, 2020). Particularly in recent years, technology transfer has been found to be relevant in steering Industry 4.0 transformation in supply chains (Hilson and Ovadia, 2020; da Silva *et al.*, 2019, 2021), promoting frugal innovation (Fischer *et al.*, 2020) and fostering entrepreneurial innovation (Guerrero and Urbano, 2019). Firms are therefore compelled to develop and transfer new technology within and across organizational boundaries to differentiate themselves from and compete against, other firms in the severely competitive global marketplace (Lee *et al.*, 2010; da Silva *et al.*, 2021).

However, putting aside its benefits and potential positive outcomes, technology transfer is neither a clear-cut nor a mechanical process. Technology transfer increasingly involves behavioral and relational exchange processes, as well as tacit knowledge (Ferraris *et al.*, 2018; Günsel *et al.*, 2019; da Silva *et al.*, 2021). Accordingly, technology transfer is underpinned by behavioral and structural mechanisms that constitute an essential yet relatively overlooked element of strategy, management and innovation (Corsi *et al.*, 2020; Hilson and Ovadia, 2020; Hsiao *et al.*, 2017). Though often overlooked, strategic planning (SP) and leadership could be important drivers of the technology transfer competence (TTC) of firms in emerging markets (Efstathiades *et al.*, 2002; Ke and Wei, 2008; Soliman, 2020). However, as abstract and high-level constructs, SP and leadership may depend on strategic quality management (SQM) to convey their role in TTC. Thus, an understanding of the role of SQM in linking SP, leadership and TTC is pivotal in explaining how distinct processes with the common interconnecting theme of a strategic perspective enhance TTC.

Although there has been extensive research on the antecedents (drivers and enablers) of TTC (Cui *et al.*, 2006; Leischnig *et al.*, 2014; da Silva *et al.*, 2019, 2021), the extant research has developed a fragmented view of internal and external forces and has overlooked the human element. Hence, there is a lack of knowledge of the key mechanisms and in particular, of the strategic mechanisms of TTC. Furthermore, the interplay between strategic mechanisms in relation to TTC has been overlooked by scholars (Hsiao *et al.*, 2017; Iddy, 2021). This lack of research hinders the full understanding of technology transfer and the processes underlying TTC. Hence, our paper aims to fill this particular gap in the literature, as no prior research (at least to our knowledge) has undertaken such an endeavor.

The specific aim of the current paper is to investigate the relationship between firms' SP, leadership and TTC by explicitly incorporating the mediating role of SQM. Based on a sample of 200 firms drawn from the 1,000 largest manufacturing firms in Turkey, we test our conceptual framework that illuminates the interplay between these strategic factors in explaining TTC.

Our findings are that SP and leadership in Turkish firms operating in many sectors are positively associated with SQM. We further find that SQM acts as a linking pin and mediates the link between Turkish firms' SP, leadership and TTC.

Our research contributes to research on knowledge and technology management and strategy. It is one of the first studies that specifically sheds light on critical technology transfer mechanisms by delving into the linkages between leadership, SP, SQM and TTC. Further, it highlights SP and leadership as precursors to SQM in its influence on TTC. It reveals that a diverse set of processes play a complementary role in enhancing firms' TTC. Accordingly, our research bridges technology, strategy and leadership research and provides a broader picture of technology transfer that encompasses the joint role of different processes in firms' TTC. Hence, our paper enriches these various literature streams.

2. Literature review

2.1 Strategic perspective to technology transfer

Technology transfer is the process of transferring technological information, know-how, experience, equipment and resources from one organization to another organization that develops it further and commercializes it (Pagani *et al.*, 2020; Souder *et al.*, 1990; Sung, 2009). It is "a process that takes place between a variety of actors on both sides – transferors and transferees – and involves a continuous relationship until a real benefit begins to happen to the transferee" (Pagani *et al.*, 2020, p. 406). It is one of the major products of strategic partnerships, as technology transfer requires that an exchange between at least two parties takes place and succeeds (Leischnig *et al.*, 2014). Recent applications of technology transfer include supply chains going through Industry 4.0 transformation (da Silva *et al.*, 2019), frugal innovation (Fischer *et al.*, 2020), international entrepreneurial innovation (Guerrero and Urbano, 2019) and sustainable development (Corsi *et al.*, 2020). Thus, technology transfer is a critical phenomenon of contemporary relevance and shapes how knowledge is created and managed across different contexts and in different situations.

Technology transfer is achieved through key mechanisms, one of which is absorptive capacity (Pagani *et al.*, 2020). Absorptive capacity is one of the primary constituents of organizational learning and it helps firms to identify, communicate and assimilate relevant knowledge. It is of crucial relevance when technology is acquired from external sources, such as through inter-organizational relationships and is one of the most important determining factors for knowledge transfer (Najafi-Tavani *et al.*, 2018). Accordingly, absorptive capacity is inextricably intertwined with technology transfer as a critical strategic capability for enabling technology transfer between partners in networks and increasingly in ecosystems (Najafi-Tavani *et al.*, 2018).

Technology transfer is the movement of technology and knowledge through channels from one organization to another. Mete and Belgin (2021) investigate the impact of knowledge management on organizational performance in Turkey. According to them, there is a significant relationship between knowledge management strategy, the planning, storage and conversion of knowledge performance and the efficiency of the firm. Accordingly, technology and knowledge transfer is an increasingly prevalent phenomenon in emerging markets, as it allows organizational development and advancement toward more knowledge-based processes and structures.

Knowledge is defined in this context as a set of processes, techniques or tools (Landaeta, 2003). Stemberkova *et al.* (2020) define a knowledge management model for successful technology transfer. According to them, technology transfer is a part of knowledge management and it plays a pivotal role in technology transfer processes. The intertwinement of knowledge and technology is manifest in the fact that knowledge is crucial for economic prosperity and technological progress (Urbano and Guerrero, 2013). Various researchers have examined and highlighted the importance of effective knowledge management in technology transfer (Barros *et al.*, 2020; Gunsel, 2015; Silva *et al.*, 2013). For this reason, according to Anderton and Watson (2018), knowledge management is a crucial factor in assisting organizations with gaining, creating, organizing, selecting and disseminating knowledge.

Technology transfer supports these knowledge processes as a necessary component. Anderton and Watson (2018) examine the factors affecting knowledge management in the process of technology transfer and they emphasize its importance. If knowledge management applications are available, then technology can be absorbed, acquired and transformed.

Strategic partnerships for technology transfer are highly sophisticated and replete with behavioral complications and contingent outcomes (Oliveira and Lumineau, 2018; Villena *et al.*, 2011). Strategic partnerships and the transfer of technology, via such strategic partnerships, can be affected by differing grounds of competing priorities and divergent management practices between partners (Caldwell *et al.*, 2017). Thus, the functioning and outcomes of such partnerships are neither straightforward nor predictable. Such potential complexities and unassured technological outcomes require a strategic perspective on the phenomenon of technology transfer and lead to the concept of TTC.

2.2 Technology transfer competence

TTC can be defined as the effectiveness of the coordination processes between the transferring agent and the receiver that make the transferred object (technology and/or associated skills) useful and useable for both parties (Bozeman, 2000; Bozeman *et al.*, 2015). Bozeman *et al.* (2015) highlight several results of TTC in organizations, such as market impact, political reward, opportunity creation, scientific and technical human capital and public value.

Despite the fact that it is a concept that is the product of a strategic perspective on technology transfer, TTC is assessed using criteria that transcend a mere focus on effectiveness. The criteria encompass dimensions such as technology advantage, which includes the acquisition of competitive technology, patent applications and/or new product development and marketing advantage, including improvements in sales, customer satisfaction or market share (Lin *et al.*, 2009). Overall, TTC is crucial for diffusing the firm's resources within and across its network (Ciabuschi *et al.*, 2012) and is a salient proxy for technological competence and technology-based competitive advantage. Consequently, we extend our literature review by discussing the strategic drivers that underlie technology transfer and potentially underpin TTC. In particular, we focus on SP and leadership as high-level precursors to TTC and on SQM as a critical process that connects SP, leadership and TTC.

2.3 Strategic underpinnings of technology transfer competence

SP is defined as a systematic way of managing the firm and its future direction in relation to the implicit and explicit demands of its external environment and stakeholders (Kwakkel *et al.*, 2012). It comprises various dimensions of symbolic planning, rational planning, transactive planning and generative planning that maintain a broad vision and an attention to detail, radical steps and incremental adjustment and decisiveness and reflection (Brews and Purohit, 2007). Although opinion regarding the value of SP is not unanimous, the evidence shows that many managers acknowledge that SP is instrumental – even essential (Bryson *et al.*, 2018). In particular, despite the potential perception that SP is more relevant to stable environments in which the outcomes of inputs and processes are, at least to some extent, predictable, SP may still be needed in contemporary markets that are characterized by volatility, uncertainty, complexity and ambiguity (Brews and Purohit, 2007; Honig and Samuelsson, 2021). Technology itself is an unpredictable force (da Silva *et al.*, 2019). Therefore, SP may be an underlying element of the competent design and execution of complicated technology transfer processes.

In the context of this study, leadership is defined as the quality shown by organizational leaders in influencing their followers to accomplish an objective and in steering the firm toward cohesiveness and coherence (Ke and Wei, 2008). In this vein, we approach the concept of leadership from a perspective of individual attributes. Leadership is a salient innovative process that actually takes place across different echelons within the firm and is often initiated by people of confidence, creativity, conviction, devotion, integrity, inspiration and empowerment (Ang *et al.*, 2000; Gupta, 2020; Wang *et al.*, 2021; Zhang *et al.*, 2014).

Leadership can underpin technology and technology-related processes (Merat and Bo, 2013) such as technology forecasting and technology transfer resulting from challenging and intricate activities executed within firms and between strategic partnerships. For example, Singh (2008) examines the relationship between different leadership styles and knowledge management outcomes and finds that leadership, depending on its style, can influence knowledge management practices both positively and negatively. As technology transfer activities involve risky and convoluted practices with high creativity, cognition and commitment-related demands and changeable potential outcomes, leadership can be essential for underpinning such practices. In such circumstances, leadership can provide a basis for understanding, embracing and executing technology transfer within and across organizational boundaries. TTC is closely associated with leadership in organizations (Ng and Kee, 2018; Soliman, 2020; Tuan Luu, 2017). Prior studies have highlighted aspects such as leaders' relational capabilities with their employees and partner organizations in this specific context (Gupta, 2020; Merat and Bo, 2013; Soliman, 2020; Tuan Luu, 2017). Some studies have also linked the role of knowledge sharing between subordinates in the acquisition and the assimilation stages to technology transfer effectiveness and competence (Soliman, 2020; Whangthomkum *et al.*, 2006).

SQM refers to the process of establishing long-range quality goals, defining an overarching approach to meeting those goals and implementing those goals in line with the overall corporate strategy (Grigg, 2020; Juran and Gryna, 1993; Sadeghi Moghadam *et al.*, 2021). It denotes a strategic perspective to quality management practices and a firmwide adoption of quality management principles, in line with the firm's overall strategy, to leverage quality for greater returns and to achieve competitive advantage. It is critical for maintaining a competitive edge in today's global marketplace (Karsak, 2004). It is attained when SP and quality planning merge into one seamless process through a smooth information flow between strategic planners and quality planners (McAdam *et al.*, 2019). Quality is crucial for developing products and services that deliver sustained and consistent value to stakeholders over time (Boateng-Okrah and Appiah Fening, 2012).

Even though quality may have lost its differentiating role, especially in advanced markets, it is indispensable if a firm is to compete and survive in any market, as it is an essential requirement for any product or service in the customers' minds (Sadeghi Moghadam *et al.*, 2021; Zhao *et al.*, 2021). Therefore, SQM is a fundamental process, a cornerstone, on which the firm can start constructing its competitive base using the factors that lead to market differentiation. It is also deeply intertwined with technology, as quality and technology often go hand in hand (Ang *et al.*, 2000; Leischnig *et al.*, 2014; Sarina *et al.*, 2009).

Conventional wisdom acknowledges and the evidence shows that strategy involves a multifaceted and diverse set of processes that integrate various organizational behaviors and processes (Burton *et al.*, 2020). Firms engaging in technology transfer are compelled to adopt a holistic approach to the capabilities, resources and processes underpinning the technology transfer (Hilson and Ovadia, 2020). They integrate various activities while exchanging a sophisticated set of tacit and explicit information, expertise and resources that constitute the relevant technology (Corsi *et al.*, 2020; Feldman *et al.*, 2002; Roxas *et al.*, 2011). SP constitutes cohesive instrumental blueprints for various technology transfer activities with a long-term and contingent view of the firm's internal and external dynamics and its strategic partnerships. In a similar vein, leadership involves using soft and individual-based technology transfer principles to steer such sophisticated activities amid the challenges and uncertainties involved in running them. By contrast, SQM focuses on realizing the blueprints devised by SP and the principles championed by leadership in the pursuit of technology development and transfer.

In the technology transfer process, the implementation of quality is important if the transferred technology is to be assimilated into the innovative cycle (Quazi and Bartels, 1998). According to Dahlgaard *et al.* (2019), total quality management can be analyzed at strategic, tactical and operational levels. They emphasize that SQM includes the continuous monitoring, planning, analysis and assessment of all necessary fields for an organization to meet its mission, the selection of the areas that should be improved and the setting of aims for improvement. On the other hand, SQM is a key factor in total quality management (Leonard and McAdam, 2002).

3. Hypotheses

3.1 Antecedents of technology transfer competence

SP represents a fundamental mindset that prioritizes a greater fit between the organization and its environment and processes to lead to the firm's long-term success (Kwakkel *et al.*, 2012). In emerging markets, where quality remains a critical element of competitive advantage, SP is likely to incorporate SQM processes into the overall formulation of organizational goals and blueprints (Bolatan *et al.*, 2016; Malik and Blumenfeld, 2012). Once managers with a strategic mindset set up advanced and state-of-the-art SQM processes, they are more likely to use such processes for effective technology transfer activities. In fact, according to Sarina *et al.* (2009), a firm's holistic approach to quality management, driven by SP, can enhance the technology transfer process and the ensuing competence outcomes.

SP is seen as a formal and structured process that typically aims for the efficient and consistent exploitation of a firm's existing resources for long-term performance under the assumption of decent levels of environmental predictability (Sirén and Kohtamäki, 2016). Management processes such as SQM then follow SP in the subsequent step. Thus, the contemporary understanding of quality entails a sophisticated and systematic approach to quality management underpinned by state-of-the-art technologies (Ang *et al.*, 2000; Sadeghi Moghadam *et al.*, 2021). As quality-driven management approaches aim to make firms move forward in a competitive way (Sarina *et al.*, 2009), quality management processes interact positively with knowledge diversification and transformative capacity (Hellström *et al.*, 2000; Qin and Sun, 2020) while technology transfer processes are being executed. Accordingly, there are reasonable grounds to expect that SP is a pivotal element in the effective implementation of SQM processes. SP can set the stage for effective SQM, as firms putting quality management practices high on their strategic agenda are more likely to implement them effectively and successfully. Thus, we argue that:

H1. Strategic planning is positively associated with strategic quality management.

Furthermore, SQM processes require leadership commitment to be developed, implemented and maintained in the long run, especially in competitive environments with resource shortages where cutting corners on quality might be tempting (Clarke and Boersma, 2017). As such, leadership helps SQM processes be established on solid ground and sustained over the long term, instead of being seen as a fashionable yet temporary trend. Leaders with a strong commitment to quality can be essential for establishing effective and long-lasting SQM processes that permeate the whole organization rather than being championed by a small clique in a production department. By contrast, an absence of leaders committed to quality may fatally impede SQM processes, as these processes would no longer be seen as "strategic."

Leadership can also provide an institutional and structural frame that can confine and assist employees in SQM processes (Laureani and Antony, 2019; Merat and Bo, 2013). On the one hand, SQM may mean less space for improvization and experimental creativity. On the other hand, leadership may support SQM processes that require a consistent and well-organized organizational environment (Kalyandurg and Akhilesh, 2012). In fact, moving beyond the conventional conceptualization and application of quality management, SQM acknowledges that quality is an increasingly collaborative, dynamic and fluid concept in a rapidly changing world with diverse and volatile customer preferences (Sadeghi Moghadam *et al.*, 2021). Therefore, the changing nature of quality requires leadership and leadership can support SQM processes. Hence, we hypothesize that:

H2. Leadership is positively associated with strategic quality management.

We view SP as an important precursor to TTC. The main line of argument for our position stems from the strategic view of technology management and transfer (Crupi *et al.*, 2021; Feldman *et al.*, 2002; Roxas *et al.*, 2011). This view indicates that technology transfer cannot rely solely on the technical aspects of the exchange process or on mechanistic approaches, as it is also behavioral in nature (Ferraris *et al.*, 2018) and its management requires a strategic approach. This view is also in line with past research highlighting the positive role of SP in knowledge management (Snyman and Kruger, 2004) and specifically in technology management (Wu *et al.*, 2010).

The behavioral elements of technology transfer are essentially leveraged through the strategic approach (Lager and Hassan-Beck, 2021). SP comes into the picture at this point and highlights the role of a holistic, long-term view of technology transfer within and across organizational boundaries and the expected outcomes of this view (da Silva *et al.*, 2019). Accordingly, SP provides a purpose and a sense of direction for technology transfer activities. It guides vital strategic decisions on technology transfer, such as the selection of the technology, the technological partner and the domain(s) of technology exchange that ultimately foster competence outcomes. In this vein, past research highlights that the decision-making approach to technology transfer has not received sufficient attention in technology transfer studies (Villani *et al.*, 2017).

Tran and Daim (2008) define strategic methods for technology transfer. SP provides a goal or a direction for the technology transfer process. It supports important strategic decisions on technology transfer, such as the selection of the technology and the technology provider that eventually foster competence outcomes. According to Liew (2008), SP affects knowledge management. On the other hand, technology transfer is an important strategic decision. SP therefore supports all of the technology transfer processes, which include acquisition, adoption, assimilation, adaptation and improvement. Technology transfer helps small- and medium-sized companies to compete better. High rates of technological change, new market demands, new needs, international competition, universities, research centers and companies have led to an efficient and dynamic technology transfer process. In a dynamic transfer process, real-time technology transfer can respond to internal and external changes (Morrissey and Almonacid, 2005). Strategic plans may support this dynamic transfer process.

In short, diligent SP might be an essential factor in the effective implementation of technology transfer (Crupi *et al.*, 2021). Likewise, SP is considered essential for safeguarding the successful transfer and implementation of advanced manufacturing technologies (Efstathiades *et al.*, 2002; Zhou and Li, 2020). Therefore, we expect that:

H3. Strategic planning is positively associated with technology transfer competence.

The research on the interplay between leadership and technology suggests that leadership and technological innovation are deeply intertwined (Fleming and Waguespack, 2007; Lager and Hassan-Beck, 2021; Wang *et al.*, 2021). Technological advancement necessitates a forward-looking management approach that promotes innovative attributes and activities (Gupta, 2020; Hsu *et al.*, 2019; Parmentier and Mangematin, 2014). Given the convoluted processes and behavioral hurdles involved in technology transfer (Proskuryakova *et al.*, 2017), a firm needs leadership to allocate sufficient resources to cross-functional R&D, to support technology transfer and to leverage appropriate technologies for the firm's advancement (Lager and Hassan-Beck, 2021; Laureani and Antony, 2019). Firms with effective leadership practices can boost a better diffusion of different technologies across functions and organizational boundaries and pave the way for the proper utilization of technology toward strategic ends.

As leadership is characterized by creativity, inspiration and empowerment (Gupta, 2020; Zhang *et al.*, 2014), technological development and transfer within and across firms can be facilitated by leadership. This facilitating role of leadership concerning technology can, in turn, be reflected in the firm's TTC. For example, firms operating in different industries or following different technological paradigms may need their leaders to rise to the challenge of transferring potentially incompatible or tacit technological knowledge across firm boundaries. Likewise, firms operating in ambiguous and risky environments may require their leaders to have vision and resilience to withstand potential adversities and tensions surrounding technology development and transfer activities (Hannigan *et al.*, 2015; Wang *et al.*, 2021). Accordingly, we hypothesize that:

H4. Leadership is positively associated with technology transfer competence.

3.2 Mediating role of strategic quality management

It has been argued earlier that SP has a positive influence on SQM and TTC. To obtain a better understanding of the interplay between these three factors, we draw on prior studies highlighting the efficiency focus of SP in organizations (Bryson *et al.*, 2018; Honig and Samuelsson, 2021; Philip, 2007). Such studies have argued that SP enhances both firm performance generally and competencies including TTC because it clarifies firm goals, including quality characteristics, and effectively controls the implementation of relevant actions (Bryson *et al.*, 2018; Efstathiades *et al.*, 2002; Song *et al.*, 2011).

Simultaneously, technology transfer has been viewed as a risky and in many cases, costly process for firms (Corsi *et al.*, 2020; Sagafi-Nejad *et al.*, 2017). Thus, organizational approaches to risk-taking and subsequent risk management are also crucial in this context. Earlier research has shown that firms using SP allow their managers to deal with different strategic decisions (Bryson *et al.*, 2018; Elbanna, 2016). Considering that technology transfer is an important strategic decision, it can be expected that organizations using SP give structured autonomy to their managers to link quality management processes and TTC. In this context, past researchers have also highlighted that SP results in the faster development of new products and technologies in organizations (Baxter, 1995; Elbanna, 2016).

In turn, SQM processes yielding high-quality products, services and procedures are likely to yield processes that are more conducive to TTC. Knowledge diversification and transformative capacity stemming from SQM processes can enhance TTC (Honarpour *et al.*, 2017). This can be seen as a spillover effect of quality-driven processes on technology transfer processes. Accordingly, there are reasonable grounds to expect that firms adopting SQM processes will achieve higher levels of TTC. Accordingly, SQM processes driven by SP can channel the influence of SP on technology-related outcomes in different organizational projects, such as technology transfer.

Based on the above discussion, we argue that the relationship between SP and TTC in an organization cannot be fully understood without considering SQM, as this can be a linking pin between these factors. Hence, it is logical to expect SQM to mediate the relationship between SP and TTC, as hypothesized below:

H5. Strategic quality management mediates the link between strategic planning and technology transfer competence.

The importance of leadership for SQM and TTC has been highlighted earlier. However, as leadership is linked to both factors, it is essential to probe their interrelationship further. Significant prior research has addressed the influences of leadership on firm performance, including innovation and technology-focused aspects (Almatrooshi *et al.*, 2016; Jensen *et al.*, 2020; Thamhain, 2014). "Quality (management)" is increasingly often being highlighted by scholars as an important dimension that should be incorporated more specifically in academic research on technology transfer (Lee *et al.*, 2010; Leischnig *et al.*, 2014; da Silva *et al.*, 2021). Prior studies have also stressed that leadership in organizations creates and shapes the social context in which norms and dynamics are developed (Taggars and Ellis, 2007). We extend this argument by emphasizing that organizational leadership can develop an organizational context in which openness emerges as a norm that facilitates technology transfer processes when supplemented with quality management procedures and routines. This argument is rooted in prior studies on leadership that show that a supportive leadership style increases connectivity among organizational actors (Carmeli and Spretizer, 2009; Gupta, 2020), positively influencing quality and performance (Dimmock and Walker, 2004; Jensen *et al.*, 2020). Technology transfer is also an organizational process in which relational factors play an essential role (Plewa *et al.*, 2013). Therefore, the connectivity resulting from supportive leadership can enhance quality management processes, increasing TTC (Leonard *et al.*, 2014).

Moreover, as mentioned earlier, technology transfer is a risky and costly process (Corsi *et al.*, 2020; Sagafi-Nejad *et al.*, 2017). Thus, because leadership can enhance SQM (Hannigan *et al.*, 2015; Soliman, 2020) and in turn, foster commitment to technology transfer for organizational success, SQM can strengthen the relationship between leadership and TTC. Based on this discussion, we hypothesize that SQM mediates the link between leadership and TTC, as presented in the following hypothesis:

H6. Strategic quality management mediates the link between leadership and technology transfer competence.

4. Research methods

4.1 Survey instrument

A survey instrument was developed to investigate the relationships between SQM, leadership, SP and TTC, based on a comprehensive review of the relevant literature. The constructs of the study are measured using five-point Likert-type scales, ranging from 1 = "strongly disagree" to 5 = "strongly agree." While it has been generally claimed that the ideal number of item alternatives is seven, the literature suggests that a five-point scale appears to be less confusing and much simpler (Dawes, 2008) and increases response rate and response quality (Bouranta *et al.*, 2009). It should also be noted that the five-point scale has been widely used in technology transfer literature and quality management literature (Abbas, 2020; Pagani *et al.*, 2020; Zaim *et al.*, 2007; Zhou and Li, 2020).

4.2 Sample and data collection

To establish the content validity of the measures used in this study, the procedure suggested by Hair *et al.* (2007) was used. First, in-depth interviews were conducted with four senior managers from two prominent companies operating in appliances and consumer electronics. These two companies were selected because of their highly acknowledged R&D capabilities and TTC in their respective industries. The interviewed managers possessed detailed knowledge of the research subjects of quality management, SP and technology transfer and the integration of these subjects into their internal business processes. The interviews took place in their offices and lasted 1–1.5 h. Following the interviews, some modifications were made to the questionnaire. Second, an initial version of the survey questionnaire was revised on the basis of discussions with several expert academics. Finally, a pre-test was conducted with ten business professionals who provided fine-tuning opportunities to develop an informative, precise and well-structured survey questionnaire.

The database of the Istanbul Chamber of Industry constituted the sampling frame for this study. This database covers Turkey's largest 1,000 manufacturing firms, which operate in a wide variety of industry sectors. For several years, Turkey has been one of the leading emerging economies linking Southeastern Europe and the Middle East (Manolopoulos *et al.*, 2020). Turkish firms are connected to an increasing number of firms exchanging not only goods and services but also knowledge and technology (Turker and Altuntas, 2014). However, Turkey is still far behind other OECD countries regarding R&D competencies and the capability to innovate and enable TTC for innovation (Kleiner-Schäfer and Liefner, 2021). Given its nascent status in technology competence (in which it is similar to many other emerging economies (Li and Kozhikode, 2008)) and its role in connecting different geographies, Turkey can be a suitable context for examining TTC and its strategic underpinnings. Accordingly, it was chosen as the research context in this study.

An invitation letter was sent to the general manager of each participant firm, requesting them to participate in the survey and to identify a manager with knowledge and expertise in quality management and technology transfer issues. A total of 200 companies agreed to participate in the survey, representing an effective response rate of 20%, which was highly satisfactory, given the respondents' concern for confidentiality and their level of seniority. The survey questionnaire was administered through an interview with the single respondent identified by each company. While several researchers have opposed the use of single respondents because of the inherent restrictions with this approach and have recommended using multiple respondents (Krause *et al.*, 2018; Montabon *et al.*, 2018), the knowledge and expertise of the key informants in this study were well aligned with the constructs of the research model. All the respondents also had serious decision-making authority, building the case for choosing a single key respondent (Montabon *et al.*, 2018).

The main characteristics of the sample are summarized in Table 1. The sample consists of firms from a wide variety of industries, including the following: metals, machine and equipment (19.5%); food and tobacco (17%); construction, wood, furniture, paper, paper products and publishing (15.5%); textiles (15%); automotive and electronic (13%); chemicals, plastic, drugs and cleaning materials (10%); and energy, stone and clay products and mining and mine products (10%). The majority of the firms (46.5%) have been operating for more than 20 years. The majority of the sample are large enterprises (81%), whereas the remainder are small- and medium-sized enterprises (SMEs). Most of the sample are indigenous firms (81.5%), with the remaining firms having some foreign ownership at varying levels.

The responding firms were compared with non-responding firms across the sample's main features, including size, age, geographical location, ownership type and industry sector and no significant variations were found. The main characteristics of the sample are summarized in Table 1.

Table 1 Characteristics of sample firms		
Characteristics	*No.*	*(%)*
Industry sector		
Metals industry, machinery and equipment	39	19.5
Food and tobacco	34	17
Construction, wood, furniture and paper	31	15.5
Textile and apparel	30	15
Automotive and electronics	26	13
Chemicals and pharmaceuticals	20	10
Energy and mining	20	10
Firm size (number of employees)		
SMEs (less than 250)	38	19
Large size (equal or more than 250)	162	81
Firm age (years of operation)		
Young firms (less than 10 years)	44	22
Middle age firms (10–20 years)	63	31.5
Mature firms (More than 20 years)	93	46.5
Type of ownership		
Locally-owned	163	81.5
Foreign-owned	37	18.5
N	200	

4.3 Measurement of variables

Brief descriptions of the measures used in this study are provided in the following subsections.

4.3.1 Dependent variable. 4.3.1.1 Technology transfer competence. The items that measure TTC in this study were adapted from the extant literature (Greiner and Franza, 2003; Lin *et al.*, 2002; Pagani *et al.*, 2020; Soliman, 2020; Souder *et al.*, 1990; Sung, 2009). TTC is composed of 15 items, which include three underlying dimensions. These TTC dimensions are labeled as R&D sufficiency (TTC1), support for technology transfer (TTC2) and technology transfer appropriateness (TTC3).

4.3.2 Independent variables. 4.3.2.1 Strategic planning. To measure SP, scales adapted from earlier studies were used (Abbas, 2020; Ang *et al.*, 2000; Negron, 2020; Prajogo and Sohal, 2006; Sirén and Kohtamäki, 2016). The items that measure the level of SP are as follows:

- identifying strategic issues;
- analyzing strategic issues;
- making strategic decisions;
- formulating strategic plans;
- documenting SP;
- arranging the firm's plans according to short- and long-term objectives; and
- considering business partners' needs when determining the firm's plans, policies and objectives.

4.3.2.2 Leadership. The items that measure leadership were drawn from previous research (Abbas, 2020; Ang *et al.*, 2000; Negron, 2020; Saraph *et al.*, 1989; Soliman, 2020) and are the following:

- creating vision and mission;
- communicating quality values to staff;

- empowering staff for continuous improvement;
- facilitating communication between top management and other staff;
- establishing a quality culture;
- determination by top management of the company's specific quality targets;
- supporting employees on quality;
- management by top management of the company's quality management program; and
- ensuring that quality objectives and quality policies are understood by the employees.

4.3.3 Mediator variable. 4.3.3.1 Strategic quality management. The items that measure the level of SQM adopted were drawn from earlier studies (Ang *et al.*, 2000; Djordjevic *et al.*, 2020; Malik and Blumenfeld, 2012; Saraph *et al.*, 1989) and are the following:

- feedback of quality data to employees and managers to solve problems;
- preparation of quality standards;
- controlling work processes;
- using quality tools such as flow charts, histograms and Pareto charts for quality control;
- using statistical process control; and
- improving continuously.

4.3.4 Control variables. The following four control variables were used to consider possible extraneous effects on the dependent variable.

Firm age (AGE) was measured by an ordinal variable that refers to three categories based on the total number of years elapsed since the formation of the firm (i.e. 1 = "less than 10 years," 2 = "10 to 20 years" and 3 = "more than 20 years"). AGE is a common control variable to test whether older and more established firms differ from newer ones as regards the study's dependent variable.

To control industry variations (IND), a dichotomous variable was used to represent technology-intensive manufacturing industries and resource-intensive manufacturing industries. The technology-intensive industries were the automotive, electronics, machinery, equipment, metals, chemicals and pharmaceuticals industries, whereas the resource-intensive industries comprised the food, tobacco, textile, paper, wood and furniture, energy and mining industries.

Firm size (SIZE) was measured by a categorical variable that distinguished large firms from SMEs. Within the Turkish context, firms with fewer than 250 employees are considered SMEs and those with 250 or more workers are considered large firms (Bayraktar *et al.*, 2009).

Type of ownership (OWN) was measured by a categorical variable, with 0 denoting a local firm and 1 representing a foreign-owned firm.

5. Results

The data analysis was conducted in three stages. First, the reliability and validity of the study's constructs were tested using confirmatory factor analysis (CFA). Second, the possibility of common method bias (CMB) was checked through Harman's single factor test. Finally, the hypothesized relationships among the study's constructs were examined through a structural equation modeling (SEM) procedure.

5.1 Reliability and validity of constructs

Consistent with Anderson and Gerbing's (1988) suggestions, three items were eliminated from TTC as a result of high collinearity problems and low factor loadings. Table 2 presents the results of the CFA. As indicated in Table 2, the standardized regression weights for all the variables are greater than 0.65 and significant ($p < 0.01$). The CFA displays an excellent fit with the data, as the model fit indices are within the generally acknowledged ranges (χ^2 statistic = 756.79, $p < 0.01$; df = 506, χ^2/df = 1.49, GFI = 0.83, AGFI = 0.80,

Table 2 Confirmatory factor analysis

Constructs	*Variable name*	*Standardized loadings*[a]	*CA*[b]	*CR*[c]
R&D sufficiency	TTC1		0.92	0.92
Sufficient financial resources for R&D	TTC1a	0.89		
Sufficient human resources for R&D	TTC1b	0.88		
Sufficient hardware and software support for R&D	TTC1c	0.75		
R&D department employees' sufficient interests and requests for innovation	TTC1d	0.93		
Support for technology transfer	TTC2		0.83	0.84
The attitude and values of the company are receptive to technological innovation	TTC2a	0.69		
A realistic goal for technology transfer	TTC2b	0.80		
Company management provides sufficient support for technology transfer	TTC2c	0.75		
The main characteristics of the transferred knowledge are clearly understood	TTC2d	0.72		
Technology transfer appropriateness	TTC3		0.82	0.82
The customer needs are taken into consideration during the technology selection process	TTC3a	0.79		
Transferred technology is adaptable to the user's requirements	TTC3b	0.77		
The most appropriate technology is chosen for the needs of the company	TTC3c	0.68		
Technology selection is made considering the company's infrastructure, existing system, capital, etc.	TTC3d	0.67		
Strategic quality management	SQM		0.86	0.87
Feedback of quality data to employees and managers to solve the problem	SQM1	0.68		
Preparation of quality standards	SQM2	0.75		
Controlling work processes	SQM3	0.71		
Using quality tools such as flow charts, histograms and Pareto charts for quality control	SQM4	0.79		
Using statistical process control	SQM5	0.68		
Improving continuously	SQM6	0.73		
Strategic planning	SP		0.94	0.95
Identifying strategic issues	SP1	0.86		
Analyzing strategic issues	SP2	0.83		
Making strategic decisions	SP3	0.67		
Formulating strategic plans	SP4	0.88		
Documenting strategic planning	SP5	0.91		
Arranging the firm's plans according to short- and long-term objectives	SP6	0.93		
Considering business partner's needs when determining the company's plans, policies and objectives	SP7	0.73		
Leadership	LP		0.92	0.92
Creating vision and mission	LP1	0.68		
Communicating quality values to staff	LP2	0.78		
Empowering staff for continuous improvement	LP3	0.80		
Facilitating communication between top management and other staff	LP4	0.70		
Establishing a quality culture	LP5	0.75		
Determining the company's specific quality targets by top management	LP6	0.76		
Supporting employees about quality	LP7	0.86		
Managing the company's quality management program by top management	LP8	0.71		
Ensuring that the quality objectives and quality policies are understood by the employees	LP9	0.74		

Notes: [a]All loadings are significant at $p < 0.01$; [b]CA = Cronbach's alpha; and [c]CR = Composite reliability

CFI = 0.95, TLI = 0.95, IFI = 0.94, RFI = 0.84, RMSEA = 0.05) (Hair *et al.*, 2010). The method of maximum likelihood was used to estimate the model parameters.

Table 2 also provides Cronbach's alpha (CA) and composite reliability (CR) values to measure the constructs' internal consistency. The values for both CA and CR exceed 0.80, indicating satisfactory construct reliability levels (Bagozzi and Yi, 1988).

Table 3 shows the convergent and discriminant validity measures along with the descriptive statistics. The average variance extracted (AVE) values are higher than 0.50, suggesting an acceptable level of convergent validity for the constructs of the study (Fornell and Larcker, 1981).

The discriminant validity was checked by looking at the square root of average variance extracted, as suggested by Fornell and Larcker (1981). Table 3 shows that the square root of the AVE for each construct is higher than the inter-construct correlation values, indicating a satisfactory level of discriminant validity.

5.2 Common method bias and endogeneity

When data are collected from a single source, CMB tends to provide higher forecasts of the relationships between the variables (Podsakoff and Organ, 1986) that may contaminate the results. Several procedural precautions were taken to minimize CMB, including using established scales, counterbalancing the question order and protecting anonymity. A widely used approach for assessing CMB in a single-method research design is Harman's single-factor test (Podsakoff *et al.*, 2003; Podsakoff and Organ, 1986), in which all of the factors in a study are subjected to exploratory factor analysis (EFA). If a single factor emerges from unrotated factor solutions, or a first factor explains most of the variance in the variables, CMB is likely to exist (Podsakoff and Organ, 1986, p. 536). The findings of the EFA for all items with eigenvalues greater than one are combined to account for 62.25% of the total variance. While the first factor accounted for 24.15% of the total variance, it did not account for most of the variance. For the data in this study, neither of the two conditions is observed, suggesting that CMB is not an issue for this study.

Before testing the hypotheses, it was also considered to be necessary to check whether endogeneity is a serious concern because of possible reverse causality (Lu *et al.*, 2018). In particular, there is the possibility of reverse causality between SP and SQM because of the theoretical potential of SQM influencing SP, raising the risk of SP being endogenous. Nonetheless, the risk of endogeneity for the link between LP and SQM would not pose a threat due to the much-reduced possibility of SQM influencing LP. Thus, endogeneity tests were conducted for SP to determine whether endogeneity was likely to pose a severe threat.

First, a two-stage least squares (2SLS) regression was performed using instrumental variables. Type of ownership, communication of quality values and employee empowerment for continuous improvement were selected as potential instrumental variables because

Table 3 Descriptive statistics, convergent and discriminant validity of the measurement models[a]

Constructs	*Items*	*Mean*	*SD*	*AVE*[b]	*TTC1*	*TTC2*	*TTC3*	*SQM*	*LP*	*SP*
TTC1	4	3.75	0.99	0.55	*0.75*					
TTC2	4	4.25	0.59	0.75	0.52	*0.87*				
TTC3	4	4.25	0.52	0.54	0.64	0.41	*0.73*			
SQM	6	4.26	0.56	0.52	0.56	0.35	0.47	*0.72*		
LP	9	4.30	0.56	0.57	0.66	0.42	0.50	0.71	*0.76*	
SP	7	4.23	0.63	0.69	0.56	0.43	0.52	0.70	0.72	*0.84*

Notes: [a]Italicized values on the diagonal are the square root of the AVE values; [b]Average variance extracted; SD = standard deviation these variables were not correlated with the error terms. To perform the 2SLS regression, the SP construct was first regressed on the control and instrumental variables, then the residual of this regression was used as an additional regressor in the hypothesized equations. The parameter estimates for the residual were not significant, indicating that the SP construct was not endogenous in this particular setting, consistent with the conceptualization.

Second, the Durbin–Wu–Hausman endogeneity test was conducted to determine whether the exogenous variables are endogenous. The results of this test were not significant (Wu–Hausman $F(1,164) = 1.80728$, $p > 0.10$, suggesting that the estimates of the OLS and 2SLS models do not differ from one another. Thus, the test results confirm instrument validity, indicating that the results are unlikely to be influenced by endogeneity.

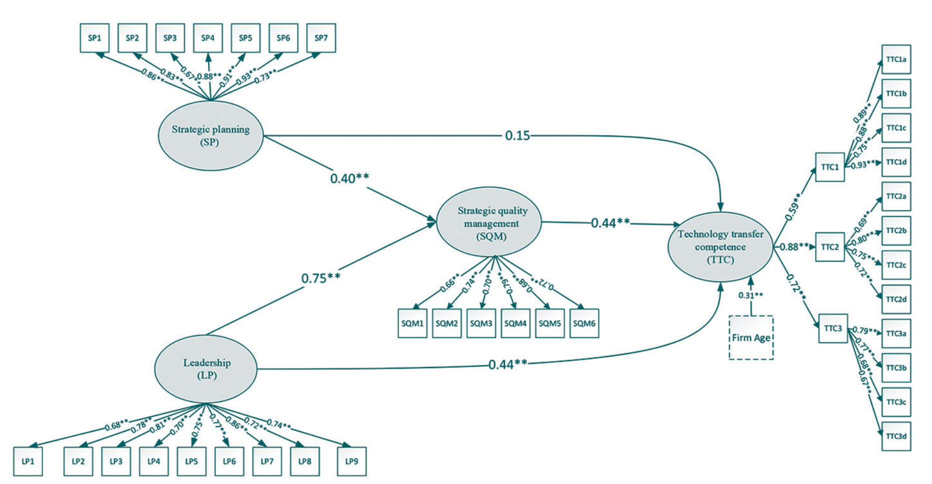
5.3 Hypotheses testing

SEM analysis using AMOS was conducted to test the study's hypotheses. Figure 1 presents the results of the structural model. The model fit indices are within the accepted ranges, indicating a good fit with the data ($\chi^2 = 770.23$, $p < 0.01$, df = 513; χ^2/df = 1.50; GFI = 0.83; AGFI = 0.80; TLI = 0.94; CFI = 0.95; RMR = 0.03; RFI = 0.84; IFI = 0.95; RMSEA = 0.05) (Schumacker and Lomax, 2004).

As shown in Table 4, the direct relationships in the model underlying *H1*, *H2* and *H4* are statistically significant ($p < 0.01$). The links between SP and SQM (*H1*), LP and SQM (*H2*) and LP and TTC (*H4*) have standardized regression weights of 0.40, 0.75 and 0.44, respectively. However, although it is positive, the direct relationship between SP and TTC is not significant ($p > 0.01$), indicating no support for *H3*.

As for the mediation hypotheses (*H5* and *H6*), the traditional Sobel test approach (Baron and Kenny, 1986, p. 1177) was first applied to check the mediation effects of SQM on the relationships between SP and TTC and LP and TTC. The test results indicate that SQM fully mediates the link between SP and TTC (Sobel test statistics = 2.13; $p < 0.05$), confirming *H5* (SP → SQM → TTC). Also, SQM was found to have a partial mediating effect on the relationship between LP and TTC (Sobel test statistics = 2.14; $p < 0.05$), which provides some support for *H6* (LP → SQM → TTC). Overall, these results tend to validate the mediating effects of SQM.

Figure 1 Results of the mediation model



Notes: *$p < 0.05$; **$p < 0.01$

Table 4 Hypotheses testing results			
Hypotheses	*Path coefficients direct effect*	*Path coefficients indirect effect (CI)*	*Level of support*
Direct effects			
H1: SP → SQM	0.40**		Supported
H2: LP → SQM	0.75**		Supported
H3: SP → TTC	0.15		Unsupported
H4: LP → TTC	0.44**		Supported
Mediation effects			
H5: SP → SQM → TTC	0.15	0.18* (0.03, 0.41)	Supported
H6: LP → SQM → TTC	0.44**	0.33* (0.11, 0.60)	Supported
Control variables			
AGE → TTC	0.31**		
IND → TTC	0.09		
SIZE → TTC	−0.18		
OWN → TTC	−0.14		

Notes: $^{*}p < 0.05$; $^{**}p < 0.01$; bootstrapping $N = 5{,}000$; CI = upper and lower limits of 99% confidence interval

The existence of mediation effects was also checked using the bias-corrected bootstrap confidence interval method, in line with Preacher and Hayes (2008). This method has been recommended over the traditional Sobel test or the causal steps approach because the bootstrapping method has higher power in controlling Type I error (Preacher and Hayes, 2008). To run the bias-corrected bootstrapping method, 5,000 resamples were generated to check whether the indirect effects differed significantly from zero. Bias-corrected bootstrapping analysis shows that the standardized estimates for the indirect effects of SP on TTC, through SQM, are 0.18, 95% bias-corrected CI [0.03, 0.41] and significant ($p < 0.05$). In a similar vein, the standardized estimates for the indirect effects of LP on TTC, through SQM, are computed as 0.33, 95% bias-corrected CI [0.11, 0.60] and significant ($p < 0.05$). Both *H5* (SP→SQM→TTC) and *H6* (LP→SQM→TTC) regarding the mediating effects of SQM are supported.

As for the control variables, only AGE was found to have a positive and significant effect on TTC ($p < 0.05$). This emphasizes that older and more established firms differ from newer ones and exhibit higher levels of TTC.

6. Discussion and conclusions

Technology transfer is a fundamental dimension of knowledge management (Crupi *et al.*, 2021; Osabutey and Jackson, 2019) and is increasingly indispensable for competitive advantage in a world in which technology plays an unprecedented role. For this reason, firms are compelled to enhance their TTC. That said, the path-dependent role of the relevant processes in enhancing TTC has not been fully understood. Our paper fills this gap in the extant literature by highlighting the role of SP, leadership and SQM in relation to TTC in the emerging market context of Turkey. It advances the understanding of how SP and leadership can be used to enhance TTC through SQM, especially in the context of emerging markets.

6.1 Theoretical implications

Our study's findings reveal that SP and leadership in Turkish firms operating in various different sectors are positively associated with SQM. These findings support prior studies, highlighting the importance of SP and leadership for firms and their influences on SQM (Alidrisi and Mohamed, 2012; Clay-Williams *et al.*, 2020; Kalyandurg and Akhilesh, 2012;

Laureani and Antony, 2019). The findings further show that TTC in Turkish firms is influenced positively by SQM, thereby supporting the findings of prior studies in this context (Efstathiades *et al.*, 2002; Hannigan *et al.*, 2015; Lager and Hassan-Beck, 2021; da Silva *et al.*, 2019, 2021). Our research also shows that while leadership positively influences TTC, SP does not. Our findings indicate that SP, although it is important, is a neutral force. As illustrated by our findings that reveal a full mediation effect of SQM in the link between SP and TTC, the direction and implementation of SP, rather than its mere existence, matter more for TTC. This means that leadership requires SQM if it is to enhance TTC.

The study results also show that SQM mediates the links between SP, leadership and TTC. As such, our findings advance the research on the intersection of knowledge and technology management and strategy by illustrating the key mechanisms of TTC. It is particularly important to highlight the mediating role of SQM in the context of our research. While the importance of SQM is well-established in the context of emerging markets (Ali *et al.*, 2020; Malik and Blumenfeld, 2012), its potential contribution to TTC and consequently to the overall knowledge management field has been overlooked. In particular, little research has been conducted to investigate the mediating mechanisms between SP, leadership and TTC. This research highlights the fact that SP and leadership can play an essential role in TTC through the mediating mechanism of SQM. Hence, our findings corroborate prior studies that stress the critical role of SQM (Grigg, 2020; Sarina *et al.*, 2009; Zhou and Li, 2020), SP (Bryson *et al.*, 2018; Honig and Samuelsson, 2021; Philip, 2007) and leadership (Jensen *et al.*, 2020; da Silva *et al.*, 2021) separately in relation to organizational performance. It highlights the importance of looking at their interrelationship, especially in the context of complex processes such as technology transfer. We reveal that SQM is a pivotal linking pin in conveying the impact of quality management practices on technology transfer in emerging markets.

Another theoretical implication of our study concerns the importance of technological transfer competence for both SMEs and large firms, especially in an emerging market context like Turkey. In recent years, in-house innovation and open-source innovation have been highlighted as essential sources of technological competencies in organizations. However, despite these advances, technology transfer from partner firms remains essential, and its importance is expected to increase in the future. In the current COVID-19 crisis, it is already being argued that inter-organizational collaboration, especially as regards technological aspects, will play an essential role in the recovery process (Arslan *et al.*, 2021). Therefore, for emerging market firms, strengthening TTC is critical. It has emerged that SP and leadership are very important in the context of the development of TTC in firms. Therefore, our study's important theoretical implications are related to incorporating SP and leadership in TTC research.

6.2 Managerial implications

An essential managerial implication of our study relates to the critical role of SQM in TTC. For the managers of firms operating in a relatively uncertain emerging context like Turkey, it is essential to adopt a supportive and empowering leadership style, where open communication and innovative activities are viewed positively. That said, SQM is necessary for the better realization of the potential of leadership in relation to TTC. Also, SP should be streamlined throughout the firm and followed by SQM to support TTC. Hence, managers should develop and deploy leadership competencies and implement SP through SQM to enhance their TTC.

As highlighted by our paper, the role of SQM is also vital in areas other than technology transfer for manufacturing firms in emerging economies. A key barrier faced by manufacturing firms originating in emerging economies has been the concerns of buyers, especially in developed (primarily western) economies, related to quality levels. Hence, the implementation of SQM throughout such manufacturing firms, coupled with supportive leadership, can strengthen their competitiveness as well as their attraction to their (current and potential) buyers at multiple levels.

6.3 Limitations and future research

Like any other scholarly paper, our study has several limitations. First, the empirical sample consists only of Turkish firms, which limits the generalizability of the findings. Also, our sample includes firms operating in many industries and sectors. However, the dynamics of TTC may be different in different sectors because of the nature, role and importance of technologies in those contexts. Therefore, future studies could analyze only firms operating in a specific sector and see whether or not the results concerning TTC support our findings. Also, our research is cross-sectional in nature and follows covariance-based structural equation modeling. Thus, it cannot establish causal relationships between the concepts examined in the paper. Accordingly, future research could adopt a longitudinal or experimental research design to remedy this limitation and increase the confidence in the causal mechanisms in the purported linkages.

In the prior literature, it has been found that leadership is closely linked with the cultural values of the specific society. Hence, future research could also probe the linkages between culture, leadership and technology transfer performance. The greater importance of SQM compared to SP that we found in our paper also needs further probing by future scholars, especially in the context of manufacturing firms in emerging economies. Future scholars can try to untangle the specific role of SQM in the development of competencies in such organizations in different markets and the way in which it strengthens other organizational functions, including knowledge management, exporting and new product development.

Furthermore, technology transfer has morphed into new forms in the age of digital technologies. That said, the behavioral elements of technology transfer and knowledge management cannot be overlooked. Thus, future scholars could delve deeper into the behavioral dimensions of the interplay between technology transfer and knowledge management amid the digital transformation. Likewise, further research on the boundary conditions of the relationships between SP, leadership and technology transfer could provide valuable insights. In particular, investigating the moderating role of innovation management or innovative capabilities could reveal interesting findings about the innovation-driven conditions, in which the impact of SQM on technology transfer is stronger or weaker. Finally, future scholars could try to bring a process perspective into the research on TTC, as a longitudinal analysis in a specific firm could reveal the different and changing roles of factors such as leadership and SP during the different phases. Such research would further strengthen our understanding by highlighting the potential differences in the processes in the emerging economy context as opposed to the developed economy context.

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