R&D MANAGEMENT

The role of top management meetings in enhancing product innovation and performance

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Top management meetings enable the positive flow of knowledge and building of key relationships within the company and its suppliers. This study draws on open innovation and upper echelons theories to analyze the effects of top management meetings on open innovation instruments, product innovation and sales performance. We use partial least squares structural equation modeling and fuzzy-set qualitative comparative analysis to perform the path analysis of the hypothesized effects of top management meetings using data of 1,523 firms across 11 European countries. The results support the hypotheses that declare that top management meetings with suppliers positively influence product innovation while the effects of top management team meetings on product innovation remain negative. Surprisingly, the hypothesis that top management meetings with suppliers positively affect firm sales performance was not confirmed. Additionally, our efforts support the critical role of buyer–supplier relationships for innovation activities, primarily for services rather than manufacturing industries.

1. Introduction

The role of top managers and top management teams, as well as building buyer–supplier relationships enabling social network creation based on mutual trust between partners, has started to expand (Chen et al., 2016; Thompson, 2018). Partners can benefit in the long run because this kind of cooperation is based on mutual trust and the building of positive and trusting relationships. Consequently, firms' innovation can be triggered by the structure and behavior of top management teams (Boone et al., 2019). Top management team meetings (TMTMs) is where executives share values with their team members, while top management meetings with external stakeholders serves as a bridge that connects team members to other members and organizations (Zheng et al., 2019).

The role of top managers and their teams is growing because managerial ability to create a favorable innovation environment in the company is seen as a strong predictor of employee creativity that evoke an appropriate innovation climate and mobilizes the necessary resources for employees to engage in creative behavior (Zuraik and Kelly, 2019). Therefore, prior studies have shown that the efforts to connect the theory of top management meetings and open innovation are growing (Barrena-Martínez et al., 2020). There are also efforts being made to connect the upper echelons theory, which recognizes that top managers have significant impact on firm performance to the theory of relational capital, as upper echelons theory pays less attention to the critical social mechanisms through which top managers actually affect their firms' environments (Shipilov and Danis, 2006).

Earlier research focused on the effect of top management team behavior, leadership and diversity on firm performance (Aljuhmani et al., 2021) and performance of business model innovation (Guo et al., 2018). A positive effect on firm innovation capability was also observed for top management team-shared leadership (Singh, Del Giudice, et al., 2021). Top management meetings have also been considered an essential part of firm life, as they can support knowledge-sharing, decision-making and problem-solving (Aragón Amonarriz et al., 2019; Hardwick and Anderson, 2019). Perhaps the only study analyzing the impact of TMTMs on firm performance was by (Harymawan et al., 2020), providing support to the so-called effective support hypothesis, this is more frequent top management meetings indicate more effective top management team efforts.

However, meetings with external stakeholders have not been considered thus far, and the effect of top management meetings on innovation performance has also been neglected. These activities represent an important way to get up-to-date information and thus face the problems associated with developing new products and services, which could be beyond "*what is required by the needs of users, market demand and the resources of companies*" (Marzi, 2022, p. 1), as connected with the phenomenon of Over Featuring representing a set of various tendencies, which can cause innovation failure as a result. Moreover, prior literature suggests that the mediating effect of open innovation processes facilitating the effect of top management knowledge-sharing processes on firm performance should be considered (Singh, Gupta, et al., 2021).

Therefore, our main motivation is to overcome described drawbacks and to help to fill this research gap. The main objective of this study is to link upper echelons theory and open innovation theory by investigating the effects of top management meetings on open innovation instruments, product innovation, and sales performance.

We provide several contributions. First, top management meetings are used to confirm for the first time the growing role of top management teams and their relationships with suppliers in open innovation and firm performance. Applying upper echelons theory, we analyze the ability of top management teams to influence key firm outputs by meeting internal and external stakeholders while also considering the effective effort hypothesis / decision paralysis hypothesis of top management meetings. We also contribute to the theory of open innovation by including managerial practices (top management meetings) as determinants of open innovation mechanisms. Further, we build on the research conducted by (Artz et al., 2010; Ramadani et al., 2019) and extend the model of product innovation to enhancing firm sales performance by including the effects of TMTMs and top management meetings with suppliers (TMMSs). Next, since the majority of the prior research deals with the effects of buyer–supplier relationships on corporate performance within a single country (Zhang et al., 2020), the generalizability of their findings is limited. In response to this limitation, we analyze data for 1523 firms across 11 European countries. This novel designation allows us to propose more general practical implications.

Paper is structured as follows. Section 2 offers the theoretical background. The research hypotheses are defined in Section 3. Section 4 describes the research methodology and data. Results are presented in Section 5, and discussed in Section 6, including contributions and implications. Section 7 offers overall conclusions, limitations, and proposals for future research.

2. Theoretical framework

From the intellectual capital-based perspective, the previous studies have focused primarily on top management characteristics (Kianto et al., 2017), rather than top management meetings. However, even a highly skilled person needs additional abilities to execute projects, and if these teams are trustworthy and minded to exchange favors or otherwise cooperate, so much the better (Cooke and Wills, 1999). Therefore, team behavior becomes essential to sustain competitive advantage, innovation, and firm performance (Westlund et al., 2014). By promoting interaction, cooperation, and information sharing, team meetings influence innovation activities, thereby influencing economic growth positively (Thompson, 2018).

Up-to-date research into the relationship between relational capital and organizational innovation has led to a growing role for those managers who control a vital part of organization (Chen et al., 2016). At the same time, it is clear that different aspects of the involvement of top managers in business networks can have different benefits, which can lead to different innovative outputs. Peng and Luo (2000) showed that the social context in which managerial ties are deeply rooted is a critical factor in corporate success. Top management teams can also cultivate interpersonal relationships and relationships with actors in other companies through work experience (Li et al., 2014). Top management team members thus influence the relationships within the corporate network, and have more influence on strategic decisions than any other member (Wu et al., 2019;

Zheng et al., 2019). Based on the upper echelons theory, top managers and their teams inject their experience, resources, and links into strategic decisions (Heavey and Simsek, 2013). From this perspective, a firm is a reflection of its top managers and their characteristics while individual top managers heavily affect firm crucial outcomes through their decisions (Hiebl, 2014; Barrett et al., 2021).

However, the previous literature has paid less attention to the crucial social mechanisms through which firms' top managers exercise influence in firm settings (Shipilov and Danis, 2006). While the principles of relational capital play an important role in increasing innovation, research into the role of top management teams and their relationships with suppliers has thus far been neglected. To explain the success or failure of the open innovation practices of firms, their TMTMs' context should be investigated (Lazzarotti et al., 2017). This aspect has led to the growing role of managers and their ability to influence organizational resources through top management meetings, as part of the ongoing research into the relationship between top management behavior and firm innovation (Chen et al., 2016). Since top managers are crucial in business operations, top management teams are significant to business innovation (Zheng et al., 2019). Top managers could support their innovation teams by involving their resources in the social relationships between company members. They also provide intellectual simulation to set the standards for collaboration within top management teams and encourage open communication, leading to greater information sharing. This process can lead to the formation of relationships of trust and cooperation between the team members (Sauer and Kauffeld, 2015).

It is generally accepted that top management team members affect the relationships within the corporate social network, according to Wang and Tao (2019), a firm's top management team plays a crucial role in its strategic decisions and outcomes. This is because upper echelons have the ultimate responsibility for setting strategic directions, making strategic decisions, and creating the different organizational cultures that foster or inhibit innovation, while becoming the basis of organizational performance (Zheng et al., 2019). Various innovation types derive from knowledge creation and dissemination through interaction for co-creating practice, and strategically reflecting on better ways to produce innovations (Hoarau and Kline, 2014). However, not all top management teams are able to develop innovation successfully. The question arises as to whether and how it is possible to assess the effectiveness of top management teams for creating firms' outputs, such as innovation or sales. According to Stanko et al. (2017) and Tsai (2018), researcher focus on individual mechanisms of open innovation has not always exactly reflected managerial practice. These heterogeneous empirical findings call for further explanation of the role of top managers and their teams in the process of open innovation.

From the perspective of the effective effort hypothesis, TMTMs are expected to positively affect firm performance *via* effective and constructive communication and high-quality decisions (Harymawan et al., 2020). TMMSs can also positively influence the creation of both incremental and radical innovations when a firm's innovations are affected by vertical relationships including the strong connection between firms and their suppliers. The development of seamless links and cooperation agreements between technology-based manufacturing companies and their suppliers is, therefore, a key element when generating new knowledge, information and, it becomes a factor that can accelerate innovation (Nieto and Santamaría, 2007). Firms today face ever-changing environments; therefore, ongoing adaptation and improvements are necessary to remain competitive. This is increasingly a case of outsourcing a large share of supply chain-related activities. In such a case, the effective effort hypothesis comes from encouraging teamwork and reducing unwanted behavior, when these activities can affect firms' performance in a positive way (Villena et al., 2011).

Despite the above benefits attributed to top management meetings, the decision paralysis hypothesis suggests that more TMTMs indicate procrastination and decision paralysis, which negatively affect firm performance, particularly in the environment of unclear meeting goals, ineffective communication and conflicts in relationships (Harymawan et al., 2020).

An examination of the general relationship based on open innovation has also yielded different results in some cases. For example, the relationships with external partners were found to be insignificant because the emergence of radical innovations can be hindered due to the cost and time then spent on maintaining relationships, inertia, myopia, and other issues (García-Villaverde et al., 2017). Synergies generated using the accumulated relational capital are also subject to diminishing returns due to the fact that with increasing relational capital, the pace of benefits tends to slow as the accompanying inflexibility manifests itself over time (Villena et al., 2011). Because top management teams have limited time and energy, the pressure to nurture relationships that are no longer profitable can impede the ability to foster other relationships. To our knowledge, there are missing studies focusing on the role of TMTMs and TMMSs in innovation and firm performance.

3. Hypotheses development

Previous research examined how managers promote innovation by directing the resources embedded in the social relationships between firm members and explored top management team relationships with external actors for their benefits and innovation opportunities (Chen et al., 2016). That prior study also indicates that firms in developed economies are not so dependent on external ties and, therefore, TMMSs could likely play a much smaller role. This contradiction creates a potential challenge for the research when testing the role of firms' TMTMs and TMMSs in the developed countries.

Knowledge flows are intimately linked to top management meetings by using intensive and frequent shared practice that can lead to deliberate reflection, a crucial activity in fostering firm innovation (Hoarau and Kline, 2014; McDowell et al., 2018). In addition, personal business meetings gain value when entities work toward a mutual goal. Moreover, they help exchange important and timely information faster (Chang, 2017). However, everyday experience clearly shows that although some encounters are effective, many others are not (Leach et al., 2009). Therefore, meetings are often seen as a "notorious waste of time".

Top management team bridges and bonds relationships to spur innovations when combined with firm network position (Zheng et al., 2019). Top management meetings were shown to be an essential part of firm life and its various goals and resources. By contrast, each hour spent in a meeting means less time for real productive work, so meetings are often perceived as ineffective (Sauer and Kauffeld, 2015). Hardwick and Anderson (2019) showed that meetings, exchanges of ideas, and experimentation can lead to exploring collective solutions, and better understanding the problem or technical details. As a result, we noted that meetings rarely are a studied aspect of organizational behavior. However, while it is well known that a lot of time and energy is devoted to working meetings that are aimed at achieving goals like information-sharing, decision-making, and problem-solving (Aragón Amonarriz et al., 2019), questions still remain about the influence of TMTMs on firms' innovation and performance. It should also be noted that it is the eventual use of real-time information that is a key factor in a team's ability to achieve speed and better quality of its decision-making and overall firm action (Collins and Clark, 2003).

Therefore, we investigated the effect of firms' effort *via* TMTMs, and based on the research on the existence of effective effort and decision paralysis hypotheses, we assume different effects of TMTMs and TMMSs and hypothesize that:

H1a: Top management team meetings have a negative effect on product innovation.

Since the use of managerial time may affect a firm's management and performance (Rovelli, 2020), we also expect similar impact of TMTMs on firm's performance expressed by sales growth:

H2a: Top management team meetings negatively influence sales growth.

However, external supply chain relationships can enable access to key sources, opportunities, and information on business practices (Barroso-Castro et al., 2016). Meetings, together with private messaging, video chats, wall discussions, and voice calls, are seen as crucial to realize active collaboration and co-development (Eiteneyer et al., 2019). Therefore, in the case of TMMSs, we assume the prevailing effective effort hypothesis and hypothesize that:

H1b: Top management meetings with suppliers positively influence product innovation performance.

H2b: Top management meetings with suppliers positively influences corporate sales growth.

From the open innovation perspective, R&D spillovers can be transformed into knowledge flows, while internal ideas can be marketed through external channels, outside the existing internal channels, to create additional benefits in cooperation with various stakeholders, such as suppliers, customers, universities, and competitors (Bonaccorsi and Piccaluga, 1994; Chesbrough et al., 2018; Papa et al., 2020). In this context, the creative or innovative capabilities of firms are vital assets. Indeed, innovation requires many resources and depends on practices of joint learning, creation, and implementation of ideas. All of these activities require trust between innovators because partners prefer open participation, unrestricted knowledge sharing, and the creative potential of the idea *per se* (Dragsdahl Lauritzen and Karafyllia, 2019). TMMS is seen as an important stimulator for functioning the knowledge activities for innovation (Tsai, 2018). The open innovation theory suggests that the social relations between firms and external partners can provide essential resources in forms of information, skills, knowledge, friendship, and social support, all important prerequisites for knowledge-sharing and firm innovation success (Chen et al., 2016).

Several studies tended to consolidate the upper echelons theory and open innovation theory (Lazzarotti et al., 2017; Barrena-Martínez et al., 2020). However, their authors did not consider various sources of knowledge and agreed that future studies should also focus on the intensity and importance of the firms' relationships for each knowledge source. Top management knowledge can affect open innovation that then consequently affects firms' performance (Singh, Gupta, et al., 2021). Rass et al. (2013) analyzed the role of social relations in open innovation conditions while developing a model that conceptualized relational capital as a mediator for the introduction of open innovation instruments and firm performance. They confirmed both a direct and mediated effect of open innovation on firm performance. However, the authors only proposed a conceptual framework, without validating it empirically. We thus contribute to the research on the relation between open innovation instruments and top management teams while also extending the above research and conducting an empirical analysis to examine the effects TMTMs and TMMSs on firms' open innovation instruments. We thus build on the above arguments by considering the effective effort hypothesis and decision paralysis hypothesis, respectively. We then can hypothesize that:

H3a: Top management team meetings have a negative effect on firms' open innovation instruments.

H3b: Top management meetings with suppliers positively affect firms' open innovation instruments.

Figure 1 shows the conceptual framework of this study, including the proposed hypotheses that extend the traditional open innovation theory further by considering the top management team-based perspective.

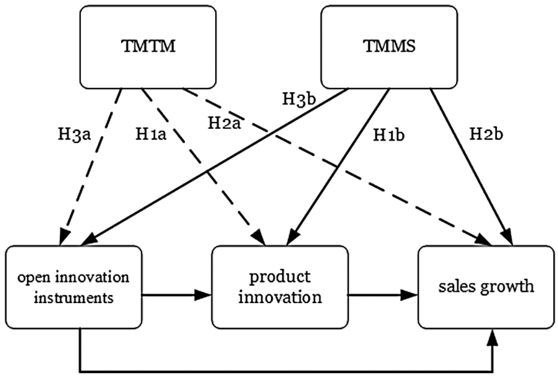

Figure 1. Conceptual framework. Solid lines indicate positive effects; dashed lines indicate negative effects.

4. Research methodology

4.1. Data collection and sample characteristics

We used data on 1523 firms from 11 European countries (the number of firms from each country is noted in brackets), namely, Bulgaria (181), Czech Republic (164), Estonia (80), Latvia (114), Lithuania (108), Poland (92), Portugal (291), Slovakia (108), Slovenia (104), Cyprus (44), and Italy (237) as provided by the World Bank's Enterprise Survey (WBES) 2019. WBES comprises various topics that are focused on the business environment and provides data on enterprises in the manufacturing and service sectors using a standardized uniform sampling survey methodology. WBES is targeted at top managers and business owners, whereas firms with five and more employees are interviewed. The sampling methodology is represented by stratified random sampling, where the strata are based on firm size, business sector, and geographic regions.

We focused on a group of moderate EU innovators (according to the Innovation Performance Scoreboard developed by the European Commission) including Central and Eastern Europe (CEE) countries and Southern Europe countries that are expected to have the greatest development innovation potential (Benetyte and Krusinskas, 2019). These countries have had to face several challenges, such as lack of funds, lagging innovation systems, and less developed social capital within CEE countries (Striteska and Prokop, 2020). Moreover, the economic crisis in South Europe and other peripheral regions caused countries to solve the problem of breaking the vicious circle of low innovation – low productivity – low competitiveness (Komninos et al., 2014).

For the explained variables, firms' product innovation activity (whether or not the firm introduced new or improved products or services) and year-on-year sales growth were chosen. Regarding the remaining latent and manifest variables, since WBES offers predefined variables, we selected those from the questionnaire that meet the requirements of the defined theoretical concepts described above. Focusing on upper echelons, we selected variables representing behavior (meetings) of top management teams, considering building internal and external relationships (Heavey and Simsek, 2013). The extent to which top management teams meet was revealed though the weekly frequency of top manager meetings with top management and employees, such as plant managers. Such types of upper echelon meetings are generally recognized as vital for building good relationships within firms and for strategic decisions (Wang and Tao, 2019). Similarly, we chose the relationships with suppliers, which are seen as important trigger of firm's innovation, since it allows firms to access external ideas, trends, and information (Bendig et al., 2020). These relationships were assessed using the weekly frequency of top manager meetings with suppliers.

Building on the open innovation theory suggesting that the social relations between firms and external partners can provide essential resources for firm innovation success (Chen et al., 2016), we also selected such variables that can be considered as proxy variables for open innovation instruments. These are expected to allow the flow of internal and external (foreign) knowledge and thus to bring additional resources for innovation (Prokop et al., 2022). We selected four proxy variables – acquisition of external knowledge, R&D, and intangible assets, and the use of foreign licensed technology. Last, we controlled for the market orientation. The description of the latent and manifest variables is presented in Table 1 (in Appendix A, we present a statistical description).

4.2. Methods

Research methodology had three steps, according to Su and Cheng (2019). First, we evaluated the model fit – the model's reliability and validity, and confirmatory factor analysis. Next, we performed the path analysis and assessed the hypothesized relationships, by using partial least squares structural equation modeling (PLS-SEM). It is variance-based structural equation modeling technique, which is widely used for example in management and the social sciences. We used PLS-SEM because it is robust against distributional assumptions, has high degree of statistical power, and effectively process constructs with small number of items (Hair et al., 2019). PLS-SEM is a useful tool for testing hypotheses, specifically for complex path models in an explorative manner (Nitzl et al., 2016).

The PLS-SEM model can be generally defined as follows:

$$EV = \beta_0^{(k)} + \sum \beta_i^{(k)} z_i + v_k, \tag{1}$$

where EV is the explained variable (product innovation, sales performance), $\beta_0^{(k)}$ is the constant term, $\beta_i^{(k)}$ is the regression coefficient, z_i is the latent variable, and v_k is the residual term. Following Ringle et al. (2015), we used SmartPLS 3 and a consistent PLS bootstrapping technique to estimate the path models by applying the path-weighting scheme that combines regression analyses with bivariate correlations of latent construct scores to maximize the explanatory power.

Third, we performed fuzzy-set Qualitative Comparative Analysis (fsQCA), which is generally suggested as a method supplementing the results performed by PLS-SEM (Marzi et al., 2023), therefore providing the combination of symmetric and asymmetric perspectives in model evaluation (Rasoolimanesh et al., 2021). FsQCA is the method that, compared to traditional regression models, can identify asymmetrical dependencies between the input and output variables and can capture alternative decision-making (configuration) paths (Woodside, 2014). We used the fsQCA program environment (Ragin, 2000).

5. Results

5.1. Model estimation

To ensure the model's validity, factor analyses were conducted (Table 2). The values of selected indicators (Cronbach's alpha, rho alpha, and composite reliability) measuring the construct reliability and validity were higher than 0.60. It is considered acceptable (Hair et al., 2019). The variance inflation factor (VIF) values were lower than 5 (the recommended value). Therefore, convergent validity was established, and it was not needed to address the problem of collinearity.

We also tested our model for the discriminant validity by testing the Heterotrait–Monotrait (HTMT) ratio of the correlation's values (Table 3), and for the goodness of fit by testing the standardized root mean squared residual (SRMR) criterion (Table 4). HTMT values were lower than the threshold of 0.85 (Franke and Sarstedt, 2019), and the values of SRMR were lower than the recommended value 0.08, suggesting a good fit of the model (Gelaye et al., 2015).

We also used the square root of average variance extracted from each construct, to evaluate construct discriminant validity. The square root of average variance that was extracted was greater than all the inter-construct correlations (see Table 5). Each construct was more correlated with itself than with any other construct (Šerić et al., 2018) (in Appendix B, we present the empirical correlation matrix of the variables). The model's discriminate validity can be considered as satisfactory. The construct validity of the measurement model can be considered as acceptable.

Table 1. Description of the used variables

Latent variable (reflective indicator)	Manifest variable (measurement variable)	Description	Justification
Top management team meetings (TMTM)	$TMTM_1$	In a typical week, how often does the top manager meet with one or more of the following: Chief Administrative Officer, Chief Marketing Officer, Chief Operating Officer, Business Unit managers, Board members, or managers from a parent company?	From research on top management social networks, a top team's network size is a joint function of the intrafirm and interfirm networks in which team members are embedded (Collins and Clark, 2003). Top management team meetings pertains to the set of relationships that top managers maintain with employees and managers (Heavey and Simsek, 2013). In addition, top management team meetings foster organizational knowledge creation and exchange through facilitating information dissemination (Bendig et al., 2020)
	$TMTM_2$	In a typical week, how often does the top manager meet with employees involved in production activities?	
Top management meetings with suppliers (TMMS)	$TMMS_1$	In a typical week, how often does the top manager meet with suppliers?	Top management meetings with suppliers can be utilized by the firm to produce new knowledge and increase confidence in the knowledge that firms already possess through access to external ideas, trends, and information (Bendig et al., 2020). Building relationships with suppliers can also increase the recognition of factor market inefficiencies (Collins and Clark, 2003)
Open innovation (OI) instruments	OI_1	Over the last three years, did this establishment spend on the acquisition of external knowledge?	Firms typically tap external knowledge sources through licensing, R&D outsourcing, or hiring external qualified workers with relevant knowledge to contribute to the new product development and foster innovation (Yu and Chen, 2020). Additionally, R&D expenditures and a firm's internal communication are significant drivers of innovative turnover (Hájek and Stejskal, 2018)
	OI_2	Over the last three years, did this establishment spend on R&D activities contracted with other companies?	
	OI_3	Does this establishment at present use technology licensed from a foreign-owned company, excluding office software?	There is synergy between foreign technology and firms' in-house R&D (Fu et al., 2016). Moreover, firms can directly use technology knowledge through technology import (Wang and Tao, 2019)
	OI_4	In the last fiscal year, did you purchase or acquire any patents, trademarks, licenses, or other intangible assets?	Intangible assets play a critical role in the open innovation era, both as products and as facilitators of innovation (Grimaldi et al., 2017), and they are seen as a source of firm competitive advantage (Ocak and Findik, 2019)
Control Var. (CV)	CV_1	In the last fiscal year, which was the main market in which you sold the main product (local/national/international)?	The choice of the market in which companies face competition is a key factor that forces managers to make efficient decisions' influencing that firm's performance and innovation (Sheikh, 2018)

Table 2. Model reliability and validity

	Var.	VIF	CA	RA	CR
TMTM	$TMTM_1$	1.344	0.672	0.674	0.673
	$TMTM_2$	1.344			
OI	OI_1	1.171	0.665	0.697	0.664
	OI_2	1.506			
	OI_3	1.162			
	OI_4	1.157			

CA, Cronbach's alpha; CR, composite reliability; OI, open innovation; RA, rho alpha; TMTM, top management team meetings; VIF, variance inflation factor.

Table 3. Discriminant validity – heterotrait-monotrait (HTMT and HTMT2)

	TMMS	OI	PI	TMTM	CV
TMMS					
OI	0.087				
PI	0.037 (0.027)	0.401 (0.357)			
TMTM	0.348 (0.315)	0.339	0.252 (0.238)		
CV	0.015	0.365	0.092	0.209 (0.171)	
SP	0.037	0.118 (0.079)	0.055 (0.049)	0.054	0.031

HTMT2 (improved HTMT) values are in parenthesis (can only be obtained for positively correlated variables).
CV, control variable; OI, open innovation; PI, product innovation; SP, sales performance; TMTM, top management team meetings; TMMS, top management meetings with suppliers.

Table 4. Model fit

	Saturated model	Estimated model
SRMR	0.042	0.063
Chi-Square	177.534	251.075
NFI	0.873	0.820

NFI, normed fit index; SRMR, standardized root mean squared residual.

5.2. Hypotheses testing

Figure 2 and Table 6 show the results of the PLS-SEM analyses. TMTMs negatively influenced the firms' open innovation instruments, product innovation, and sales growth.

These results are consistent with our hypotheses and corroborate the findings of related studies (discussed below).

To check the robustness of the used model, we performed a series of tests. First, we tested the moderation effect of industry on every path of the model. Figure 3 shows the results of the multi-group analysis (MGA) performed by considering the manufacturing and retail (and other services) industries. Note that a manufacturing industry comprised 69% of the firms in the data. Generally, human resources, including access to networks and communication infrastructures, will represent key elements of innovation activities in services (Petrou and Daskalopoulou, 2013). The results were consistent for both industry categories with two exceptions. First, the effect of TMMSs on open innovation instruments was significantly positive for the service industry, whereas it was significantly negative for the manufacturing industry. This finding supports the assumption regarding the critical role of external social relationships for innovation activities in services. Further, the effect of open innovation instruments on sales growth was significant only for manufacturing industry, which also agrees with the earlier research (Greco et al., 2016).

Next, we performed SEM-MGA on two country groups, (1) CEE (Poland, Latvia, Lithuania, Estonia, Bulgaria, Czech Republic, Slovakia, and Slovenia; 61% of the researched firms) and (2) Southern Europe (Portugal, Cyprus, and Italy; 39% of the firms). As noted above, the relational capital stocks in these EU countries tend to be lower than those in the Northern and Western countries, and informal relationships are generally more important in the South and East of Europe. However, substantial differences were still found between these two country categories (Pichler and Wallace, 2007). Figure 4 shows consistent results for both country categories, indicating no significant differences in the effects of top management meetings between the two country profiles.

To validate the linear relationship assumption between the constructs, we performed two sets of tests by considering quadratic and inverted U-shaped effects. Testing quadratic effects is the most common

Table 5. Discriminant validity of the measurement scales – the Fornell-Larcker Criterion

	TMMS	OI	PI	TMTM	CV	FP
TMMS	**1.000**					
OI	–0.057	**0.510**				
PI	0.037	0.410	**1.000**			
TMTM	0.351	–0.331	–0.250	**0.712**		
CV	–0.015	–0.369	–0.092	0.207	**1.000**	
FP	–0.037	0.119	0.055	–0.054	–0.031	**1.000**

Diagonal values in bold are the square root of average variance extracted and others (off-diagonal) that are correlations between the variables.

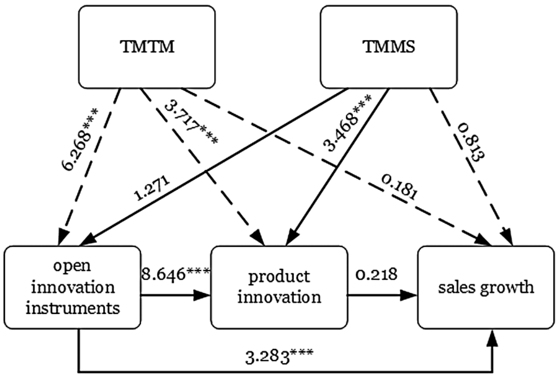

Figure 2. Results for the structural equation models. Solid lines indicate positive effects, dashed lines indicate negative effects; the values on the arrows represent *t*-statistics; ***significant at $P<0.01$; **significant at $P<0.05$; *Significant at $P<0.10$.

robustness check. A polynomial model is considered by adding a quadratic term to the structural equation models. Nonsignificant quadratic terms can be observed in Figure 5, providing evidence for the robustness of the linear effects. Previous studies also reported an inverted U-shaped relationship between a firm's social network and its innovation performance (Yu, 2013). Therefore, we also examined the inverted U-shaped effects of TMTMs and TMMSs. More precisely, we converted the values of $TMTM_1$, $TMTM_2$, and $TMMS_1$ by calculating their squared diversity. Figure 6 indicated no significant effect of these modified constructs, thereby confirming the robustness of these linear effects.

To verify that our findings were unbiased and reliable, we performed a test of unobserved heterogeneity (we tested different numbers of segments, in total 1 to 5 segments). The Akaike's information criterion (AIC) and its modified version using Factor 3 were also considered. We confirmed a one-segment solution and consistent criteria, indicating that unobserved heterogeneity was not a concern in the data. In line with Marzi et al. (2023), we also confirmed that unobserved heterogeneity did not critically affect our results by using the FIMIX-PLS procedure, jointly considering AIC with factor 3, Consistent AIC, and entropy (EN) statistic, as suggested by Sarstedt et al. (2017). Table 7 shows the decisions on the different hypotheses. Three out of the six hypotheses (H1a, H1b, H3a) were fully accepted. For product innovations, there is an effective effort effect of external supply chain top management meetings and a decision paralysis effect of TMTMs. Similar results were obtained for the open innovation instruments. However, in this case, hypothesis H3b was only partially accepted (*t*-stat. = 1.271; a positive but statistically insignificant effect), whereas we revealed a positive influence of TMMSs on firms' open innovation instruments only in the service industry (see Figure 3). Hypothesis H2a was also partially accepted in that firms' TMTMs negatively influence sales growth (*t*-stat. = 0.181; a negative, but a statistically insignificant effect). Finally, hypothesis H2b was rejected.

To validate the results of the structural equation models, we followed previous studies (Rasoolimanesh et al., 2021) and used fsQCA (Ragin, 2000). First, in agreement with Marzi et al. (2023), the percentile method was used to perform the calibration of fuzzy sets. Then, the conditions were combined to produce configuration paths. It is worth noting that only the consistent configurations were retained in the solution (with the consistency cutoff of 0.25). Five configuration paths were obtained, leading to sales growth (Table 8). The results of fsQCA provide evidence of the importance of TMTM and TMMS, especially in combinations with open innovation and control variables.

6. Discussion and implications

6.1. Discussion of obtained results

We confirmed the effective effort hypothesis for TMMSs and the decision paralysis hypothesis for TMTMs, primarily for product innovation. It refutes

Table 6. Bootstrapping test on path coefficients

Path	OS	*M*	SD	*t*–stat.	*P*-value
TMTM → product innovation (H1a)	–0.185	–0.182	0.050	3.717	0.000***
TMMS → product innovation (H1b)	0.125	0.125	0.036	3.468	0.001***
TMTM → sales growth (H2a)	–0.007	–0.006	0.039	0.181	0.856
TMMS → sales growth (H2b)	–0.027	–0.027	0.034	0.813	0.417
TMTM → open innovation instruments (H3a)	–0.352	–0.354	0.056	6.268	0.000***
TMMS → open innovation instruments (H3b)	0.067	0.068	0.053	1.271	0.204
Open innovation instruments → product innovation	0.389	0.392	0.045	8.646	0.000***
Product innovation → sales growth	0.007	0.004	0.033	0.218	0.828
Open innovation instruments → sales growth	0.117	0.124	0.036	3.283	0.001***
Control var. → product innovation	0.091	0.091	0.038	2.421	0.016**
Control var. → sales growth	0.014	0.018	0.030	0.464	0.643

M, sample mean; OS, original sample; SD, standard deviation.
*** Significant at $P<0.01$,
**Significant at $P<0.05$.

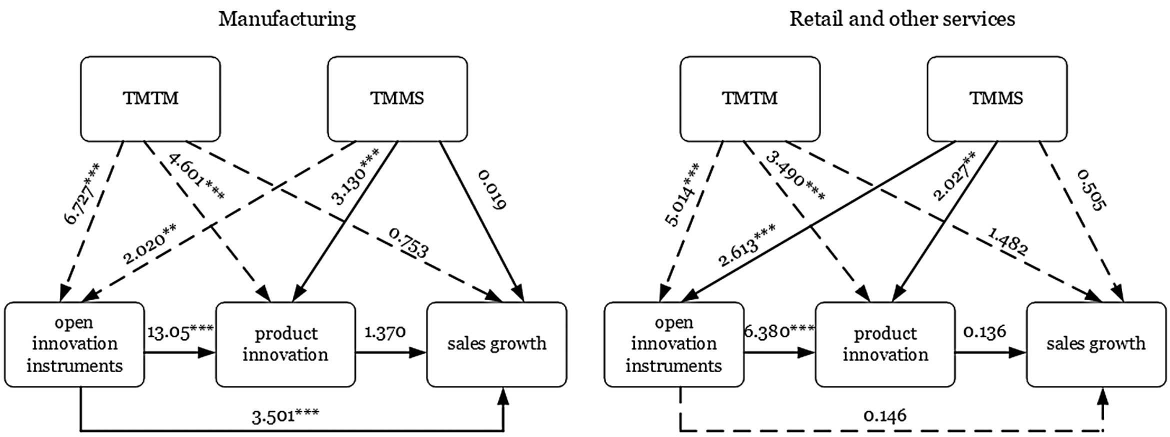

Figure 3. Results of SEM-MGA for the different industry categories. Solid lines indicate positive effects, dashed lines indicate negative effects; the values on the arrows represent *t*-statistics; ***significant at $P<0.01$; **significant at $P<0.05$; *significant at $P<0.10$.

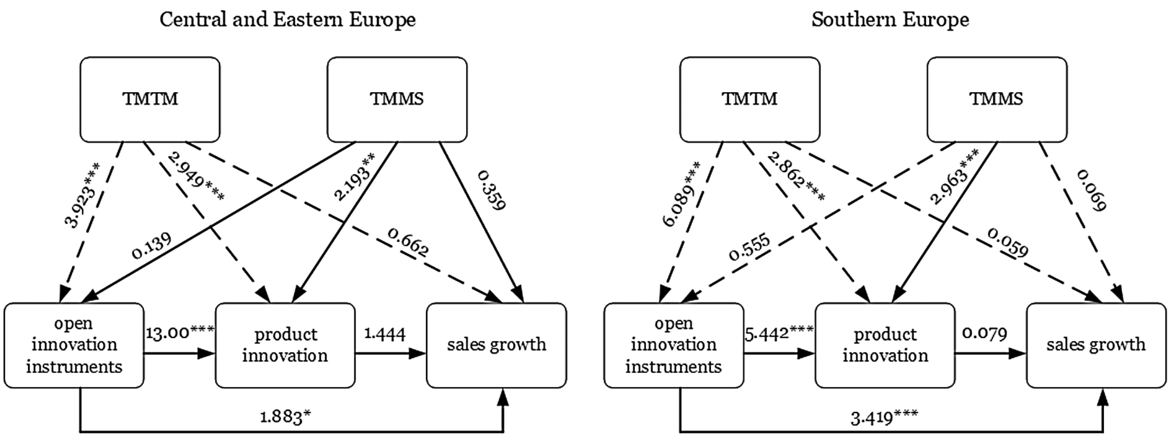

Figure 4. Results for SEM-MGA for the country categories. Solid lines indicate positive effects, dashed lines indicate negative effects; the values on the arrows represent *t*-statistics; ***significant at $P<0.01$; **significant at $P<0.05$; *significant at $P<0.10$.

the findings of Cuevas-Rodríguez et al. (2014) who compared the effects of internal and external relational capital on firms' radical product innovation, and showed that internal relational capital represents the most relevant predictor of radical product innovations. By contrast, Revilla and Villena (2012)

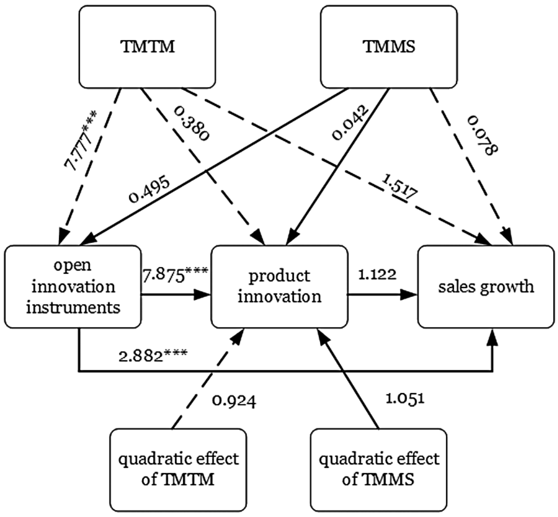

Figure 5. Results for the structural equation models with quadratic effects. Solid lines indicate positive effects, dashed lines indicate negative effects; the values on the arrows represent *t*-statistics; ***significant at $P<0.01$; **significant at $P<0.05$; *significant at $P<0.10$.

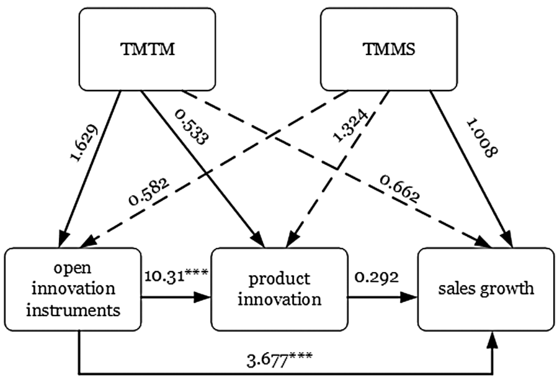

Figure 6. Results for the structural equation models for the inverted U-shaped effects of TMTMs and TMMSs. Solid lines indicate positive effects, dashed lines indicate negative effects; the values on the arrows represent *t*-statistics; ***significant at $P<0.01$; **significant at $P<0.05$; *significant at $P<0.10$.

showed that firms that built relationships with their suppliers showed improved efficiency and innovation simultaneously. When companies face rapidly changing environments requiring adaptation and improvements to stay competitive, they will also outsource a large share of supply chain-related activities and the importance of relationships with suppliers will be growing. This finding is also in accordance with Villena et al. (2011), confirming that building buyer–supplier relationships based on mutual cooperation positively influences buyer performance, but when taken to the extreme, it may decrease the buyer's capacity to be objective and take efficient decisions and also increase the opportunistic behavior of the supplier.

Table 7. Decision on the hypotheses

Hypothesis	Decision
H1a: Top management team meetings negatively influence product innovation	Accepted
H1b: Top management meetings with suppliers positively influence product innovation	Accepted
H2a: Top management team meetings negatively influence sales growth	Partially accepted
H2b: Top management meetings with suppliers positively influence sales growth	Rejected
H3a: Top management team meetings negatively influence firms' open innovation instruments	Accepted
H3b: Top management meetings with suppliers positively influence firms' open innovation instruments	Partially accepted

The results also showed the significant positive influence of open innovation instruments on a firm's product innovation but also on firm performance expressed in terms of sales growth, consistent with Artz et al. (2010) who confirmed that R&D spending is positively related to patents and that product announcements are found to be positively related to performance measures.

We also confirm that the creation of a suitable innovation climate by choosing proper open innovation instruments can subsequently affect the creation of product innovations (Cai et al., 2019). The use of open innovation instruments organizations also benefits enhanced organizational performance (Singh et al., 2021). Moreover, unlike (Lee et al., 2019; Ramadani et al., 2019), there is no significant influence of product innovation on firm performance (sales growth). However, some studies show that firm innovation could even negatively influence firm performance, because the margins related to the incremental innovation might not have been sufficient to cover the costs of the innovation activity (Na and Kang, 2019).

We show that social connections can positively influence innovation behavior; however, creation of wide networks may put pressure on individual actors in terms of having to consider more information and having to balance potential conflicts of interest. Another reason might be that among the decision-making processes of top management teams, there exists the risk of interpersonal conflict that can result in internal fighting among team members (Camelo-Ordaz et al., 2005).

6.2. *Theoretical contributions*

From the resource-based and intellectual capital-based views (Newbert, 2008), we confirmed the crucial role of TMTMs and TMMSs for open innovation

Table 8. Configuration paths leading to sales growth

Configuration	Path 1	Path 2	Path 3	Path 4	Path 5
TMTM	●			●	
TMMS			●	●	●
CV	○	●	○	●	●
OI	●	○	●		
INNO					●
Raw coverage	0.218	0.224	0.383	0.570	0.358
Unique coverage	0.068	0.066	0.067	0.038	0.000
Consistency	0.251	0.252	0.258	0.279	0.265
Overall solution coverage	0.806				
Overall solution consistency	0.237				

● and ○ indicate presence and negation, respectively, blank space indicates absence.

instruments that can spur firm product innovation and performance. While previous studies have focused primarily on top management characteristics (Peachey et al., 2014), we introduced TMTMs and TMMSs as an important micro level factor linked to upper echelons theory.

While there remains a lack of theoretical literature on the links between top management teams, innovation, and firm growth, we investigated the influence of TMTMs and TMMSs on firms' open innovation instruments, product innovation, and sales growth. Following Chen et al. (2016) and Pucci et al. (2020), we enriched the understanding of these effects by investigating the separate effects of different typologies of top management meetings.

From the perspective of the effective effort and decision paralysis hypotheses, we showed that both hypotheses occur within firms. The effective effort effect occurs when links between firms and their suppliers are developed, a finding that corroborates the earlier results (Nieto and Santamaría, 2007). By contrast, creating external relationships *via* personal meetings with suppliers is seen as a key element when generating knowledge to accelerate product innovation and support the use of open innovation instruments. Our results suggest that TMMSs do not promote firm performance. Surprisingly, and conversely to Bendig et al. (2020), TMTMs did not foster organizational knowledge creation and exchange and instead negatively influenced the firms' open innovation instruments, product innovation, and sales growth. This can be attributed to the fact that costs and time spent on maintaining relationships, inertia, and myopia often outweigh the benefits generated (García-Villaverde et al., 2017).

Regarding the upper echelons theory, we confirmed that social context, where managerial ties are rooted, is a critical factor in firms' success, consistent with Peng and Luo (2000). Top managers can heavily influence a firm's open innovation instruments and product innovation *via* the choices they make (Hiebl, 2014). Here, it becomes a decision whether to support TMTMs or TMMSs. This choice can lead to overcoming the previously explained "not invented here" syndrome (Antons et al., 2017), according to which, external sources and ideas are often perceived negatively. In this case, internal employees tend to reject external knowledge during inbound open innovation even when it could be beneficial (Hannen et al., 2019). Further, while Heavey and Simsek (2013) drew on the upper echelons theory and examined the influences of top management team size and diversity on corporate entrepreneurship, we add to this discussion by introducing top management meetings and their impacts on firms' outputs.

Finally, we contribute to the research on open innovation. While prior studies' attention to the individual mechanisms of open innovation has not always fully described managerial practices (Stanko et al., 2017; Tsai, 2018), we considered firms' access to internal and external knowledge. We confirmed the previous findings that top management meetings are a vital stimulator for the functioning knowledge activities of innovation, but only for TMMSs. This distinction can be attributed to the fact that top management knowledge can consequently (indirectly) influence firm performance through open innovation instruments (Singh, Gupta, et al., 2021). Surprisingly, TMMSs clearly predominated TMTMs as a determinant of firm innovation. We, therefore, reaffirm the role of networking, cooperation, and building of trust in buyer–supplier relationships as a key when moving from closed to open innovation (Chesbrough et al., 2018; Dragsdahl Lauritzen and Karafyllia, 2019; Zheng et al., 2019) by considering the critical role of top management teams.

6.3. Practical implications of the study

As TMMSs have proven to be an important factor that influences firms' product innovation, we recommend building external ties, based on mutual trust, and to do so primarily *via* personal meetings that seem to be effective. We recommend networking activities providing top management with access to new and diverse knowledge that can increase awareness of supply and demand side conditions (Heavey and Simsek, 2013). Several types of partners are recommended, for example, cooperation and building relationships with suppliers that possess more thorough application knowledge and practical experience of specific business tasks (Brink, 2017). It can have a significant impact on firms' innovation performance, as the stronger the dyadic relations are, the higher the innovation success that can be reached (Weber and Heidenreich, 2018). Involvement of suppliers can facilitate the quality and rate of development of new products and cut production costs (Jean et al., 2014). To increase its efficiency, it is necessary to consider characteristics of firms (such as its science and knowledge bases, De Marco et al., 2020). We also recommend policy efforts to increase willingness to cooperate within inactive firms (Dooley et al., 2016).

We also recommend participation in the enterprise group enabling greater awareness of the activities of other group members and potential partners. This knowledge subsequently increases their innovation capacity, primarily within SMEs (Andersson and Lööf, 2012). Firms have opportunity to cooperate with other partners, for example competitors, leading to notable horizontal coverage (Ritala and Hurmelinna-Laukkanen, 2009).

Regarding TMTMs, there is need to increase top management team's efficiency and clearly define the roles of the various actors. Work meetings can usually be characterized by the presence or absence of an agenda, whether the meeting started at the exact scheduled time, and whether it was obvious who the chairperson was (Leach et al., 2009). Too many directors may have a negative influence on these meetings and their effectiveness (Chen et al., 2015). These questions must be answered clearly before the meetings begin. Firms should also avoid any emergence of affective conflict that stems from personal disagreements and emotional clashes, that can decrease the efficiency of decision-making. Affective conflict weakens the ability of the team to work as a whole and also limits the joint reflection on the strategy to be chosen (Camelo-Ordaz et al., 2005). Moreover, it is also crucial to focus on the antecedents of Over Featuring and innovation failure, specifically those called "cognitive drivers", connected with behavior and emotions of managers (not only top managers, but also, for example, project or R&D managers, Marzi, 2022).

As a response to the Covid-19 pandemic, where it is not possible to hold personal meetings, online meetings have become crucial. Firms should not close themselves off from the outside world, but on the contrary, promote their firms' renewal and growth through innovation, internationalization, networking, and creation of new multi-actor innovation hubs (Lee and Trimi, 2021).

7. Conclusion

Innovation process is influenced by the interactions between individual actors, such as top managers, employees and suppliers, who then significantly affect a firm's performance by their behavior (Scuotto et al., 2020). While several previous studies have addressed the issue of top management behavior, the research on the role of top management teams is still underdeveloped. Therefore, this study focused on the role of top management teams in this process.

From the one perspective, our results show that TMMSs significantly and positively influence open innovation instruments and product innovation. From another perspective, surprisingly, we showed that firm TMTMs negatively influence firms' open innovation instruments, product innovation, and sales performance. These results allow for the design of several interesting directions for further research (see below).

Limited number of variables expressing top management behavior and "the human side of openness" (see Ahn et al., 2017) could be seen as the main limitation of our study because recent open innovation research call for studies analyzing, for example, what motivates managers and how to incentivize managers to explore and exploit knowledge (Shaikh and Randhawa, 2022). However, we devise an approach for evaluating the effects of top management meetings on innovation and firm performance that can inspire other authors to expand our research in the future. For this reason, we primarily propose examining the creation of top management meetings with other partners, such as customers, government, universities, and competitors. For future research, we also suggest other potential manifest variables, such as the intensity of top management team meetings, or the effects of TMT orientation (Saemundsson et al., 2022). In line with Wu et al. (2022), the perspective of gender diversity in TMT and/or in the board of directors, and its effects on firm innovation and performance, seems to be another important channel for further research.

Next, since we were limited by predefined variables not allowing us to test specific characteristics of innovation projects (e.g., size or length), we recommend considering those additional variables. Moreover, to better understand the relationship between firm innovations and performance, but also barriers to the effective transfer of innovation activities to performance, we recommend analyzing additional specific aspects of innovation processes, such as costs, speed, quality, or customer satisfaction (Marzi, 2022).

We also recommend verifying our results in other countries and other specific industries. The question to ask is whether the effective effort and decision paralysis hypotheses depend on country and industry profiles. Further consideration also needs to be given to the risks associated with top management meetings, primarily TMTMs. Finally, the COVID-19 pandemic, which hinders effective top management meetings, needs to be considered fully in this additional research for how adequate tools like video-conferencing for personal meetings with internal and external partners actually are and what they can accomplish positively for all firms.

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Conflict of interest statement

None.

Data availability statement

The data that support the findings of this study are openly available in The World Bank data at https://www.enterprisesurveys.org/en/data.

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APPENDIX A
Statistical description of the variables

$TMTM_1$: In a typical week, how often does the top manager meet with one or more of the following: Chief operating officer (COO), chief administrative officer (CAO), chief marketing officer (CMO), board members, business unit managers, or managers from a parent company?	
(1) never	4.8%
(2) Once a week	37.5%
(3) Between 2 and 4 times a week	26.3%
(4) Daily	24.8%
(5) More than once a day	6.6%
$TMTM_2$: In a typical week, how often does the top manager meet with employees involved in production activities (e.g. plant managers, front line production workers)?	
(1) Never	9.39%
(2) Once a week	41.63%
(3) Between 2 and 4 times a week	19.89%
(4) Daily	24.49%
(5) More than once a day	4.60%
$TMMS_1$: In a typical week, how often does the top manager meet with suppliers?	
(1) Never	32.63%
(2) Once a week	49.24%
(3) Between 2 and 4 times a week	14.31%
(4) Daily	3.43%
(5) More than once a day	0.39%
OI_1: Over the last three years, did this establishment spend on the acquisition of external knowledge? This includes the purchase or licensing of patents and non-patented inventions, know-how, and other types of knowledge from other businesses or organizations	
(1) Yes	19.30%
(0) No	80.70%
OI_2: Over the last three years, did this establishment spend on research and development activities contracted with other companies?	
(1) Yes	18.19%
(0) No	81.81%
OI_3: Does this establishment at present use technology licensed from a foreign-owned company, excluding office software?	
(1) Yes	27.51%
(0) No	72.49%
OI_4: In fiscal year, did this establishment purchase or acquire any trademarks, copyrights, patents, licenses, service contracts, franchise agreements, or other intangible assets?	
(1) Yes	11.88%
(0) No	88.12%

APPENDIX B
Correlation matrix

	OI_1	OI_2	OI_4	$TMTM_1$	$TMMS_1$	$TMTM_2$	FP	CV	OI_3	PI
OI_1	1.000									
OI_2	0.336	1.000								
OI_4	0.202	0.300	1.000							
$TMTM_1$	−0.122	−0.135	−0.113	1.000						
$TMMS_1$	−0.019	−0.060	−0.112	0.169	1.000					
$TMTM_2$	−0.131	−0.112	−0.058	0.506	0.326	1.000				
FP	0.070	0.084	0.056	−0.026	−0.037	−0.050	1.000			
CV	−0.169	−0.252	−0.108	0.185	−0.015	0.112	−0.031	1.000		
OI_3	0.206	0.272	0.235	−0.078	−0.004	−0.062	0.013	−0.200	1.000	
PI	0.210	0.215	0.138	−0.210	0.037	−0.149	0.055	−0.092	0.121	1.000

