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# Bridging the innovation gap: Why organizational climate matters for leveraging innovation from supply networks

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## Abstract

Recent studies have provided empirical evidence that innovation performance is related to the way a firm is embedded in its supply network, specifically the centrality of its network position, but it remains unclear why some firms can use inputs from suppliers better than others, despite having comparable structural characteristics in their supply networks. Drawing on theories of social networks and organizational climate, this study examines the role of buying firms' organizational climate for innovation. It uses several structured and unstructured datasets for S&P 500 firms and applies count regression models to test hypotheses. Supply network data from FactSet were analyzed to determine the degree centrality of a buying firm. Computer-aided content analysis was used to capture the organizational climate of buying firms based on online employee reviews collected from Glassdoor. The results suggest a positive relationship between the degree centrality and the innovation performance of buying firms. Moreover, certain facets of the organizational climate related to learning, including rewards and career progress, as well as work pressure management, affect the link between the degree centrality of a buying firm and its innovation performance. In conclusion, this study enhances the understanding of the connection between supply networks and innovation. It highlights the crucial role of a firm-level factor, specifically the influential facets of organizational climate for learning, in determining innovation performance.

## KEYWORDS

degree centrality, innovation, learning, organizational climate, supply network

## INTRODUCTION

External partners, especially suppliers, are increasingly expected to contribute to a buying firm's innovative capacity and innovation performance (Gößwein

et al., 2019; Graff & Smeets, 2019). The reliance of buying firms on other organizations within their supply networks to accelerate innovation performance has been researched extensively (Cousins et al., 2011; Henke & Zhang, 2010; Narasimhan & Narayanan, 2013;

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Wagner, 2012; Wagner & Bode, 2014). Recent studies have provided strong empirical evidence showing that the structural characteristics of a buying firm's supply network, especially in terms of centrality, substantially affect its innovation performance (Bellamy et al., 2014; Kim & Zhu, 2018; Sharma et al., 2020; Yang et al., 2022). However, it remains unclear why some firms are more effective than others at utilizing potential input from supply networks, despite having similar centrality within their respective supply networks.

This uneven exploitation of supplier input for innovation is widespread in many industries, including the pharmaceutical industry, which is characterized by a high degree of openness to innovation (Mazzola et al., 2015) and the importance of knowledge inputs derived from the supply network and other partnerships (Yang et al., 2022). According to the supply network data used in this study, pharmaceutical firms exhibited similar network structures in terms of degree centrality as of 2017. Despite having comparable potential for knowledge spillovers and access from the supply network as suggested in the literature (Bellamy et al., 2014), their subsequent innovation output varied distinctly (see Figure 1). This variation can be attributed to firm-level factors in the process of gathering, accumulating, and deploying knowledge for innovation creation. A recent case study examining the co-innovation process between Pfizer and Loccioni, an Italian supplier of industrial measurement solutions, highlights the relevance of these firm-level factors for successful innovation adoption at Pfizer (Ombrosi et al., 2019).

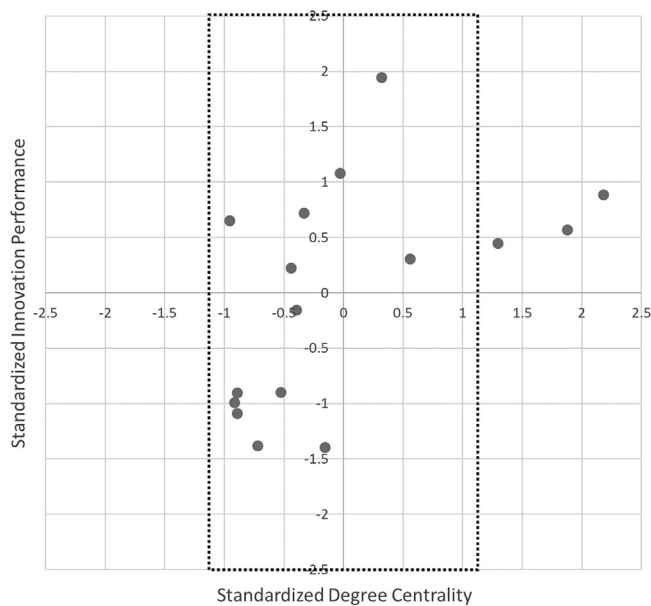


FIGURE 1 Pharmaceutical supply networks subsample ( $N = 16$ )

The present article examines the learning aspect of the organizational climate to elucidate the reasons behind this uneven exploitation of supplier input for innovation. As has been shown, innovation is a multifaceted social phenomenon that is context-dependent, path-dependent, locally specific, and institutionally shaped through a hybrid process. This process involves macro-level factors related to the socio-economic environment and requires a specific set of mindsets linked to firm-level factors that facilitate creativity and innovativeness (Dabic et al., 2019). An organizational climate appropriate for innovation can augment the firm's proficiency in utilizing supply network inputs for innovation creation (Van der Meer, 2007). In this context, organizational climate refers to members' shared perceptions of the way their organization functions and conveys information about expected, supported, and rewarded workplace behaviors (Anderson & West, 1998; Beus et al., 2010; Ehrhart & Raver, 2014).

A positive organizational climate can help an organization to better utilize supplier inputs in innovation creation by encouraging the learning behaviors of employees (Bock et al., 2005; Tohidinia & Mosakhani, 2010). For example, Pfizer Inc. has been characterized as one of the most innovative firms in the global pharmaceutical industry (Grom, 2023). It is known for its positive organizational climate, marked by openness, collegiality, inclusion, and work-life balance, which facilitates innovation adoption and continuous improvement (Pfizer, 2023; Standing & Kinti, 2011). This article argues that the organizational climate can explain why firms like Pfizer innovate better than their competitors with similar supply network structures and exposure to potential knowledge spillovers from suppliers.

Therefore, the aim of this study is to investigate the moderating effect of a buying firm's organizational climate on the relationship between supply network characteristics in terms of centrality and innovation performance. To this end, it utilizes multiple theoretical lenses. First, underpinned by social network theory, it postulates a relationship between a buying firm's degree centrality and its innovation performance (e.g., Bellamy et al., 2014; Kim & Zhu, 2018; Sharma et al., 2020; Yang et al., 2022). Then, utilizing organizational climate theory, the study proposes the moderating role of the buying firm's organizational climate in the learning context.

Multiple structured and unstructured data sets are used to test the hypotheses, including supply network data on S&P 500 firms from FactSet and employee online review data from Glassdoor. The assessment of innovation performance relies on patent data retrieved from the Orbis Intellectual Property database. Our findings support the moderating role of rewards and career progress and work pressure management in the positive

relationship between the degree centrality of a buying firm and its innovation performance. Contrary to our expectation, however, we find no evidence for a moderating effect of the social support of organizational climate.

This research makes two important contributions. First, it broadens the empirical understanding of the influence of structural supply network characteristics on a buying firm and its innovation performance by shedding light on the boundary condition of the organizational climate of the buying firm. The results clearly suggest that an organizational climate that supports employees' learning through rewards and career progress, as well as work pressure management, helps firms to leverage supplier inputs for their innovation creation better. These findings provide a potential explanation for the key question in this study, that is, why certain buying firms perform better than others in innovation creation despite having comparable supply network structures. Second, this research makes a methodological contribution by proposing a data-driven approach to measuring organizational climate using online reviews from rating and review platforms.

## THEORY AND HYPOTHESES

This article seeks to understand why buying firms with comparable supply network structures show varied performance in terms of innovation outcomes by examining a firm-level factor, the organizational climate for learning (see Figure 2). The hypotheses were formulated utilizing the theoretical lenses of social network theory and organizational climate theory.

### Supply network structure and firm innovation

Innovation creation is a multifaceted process that involves not only transforming and leveraging an organization's

existing knowledge assets (Jiménez-Jiménez & Sanz-Valle, 2011; Salavou & Lioukas, 2003) but also actively acquiring external knowledge and information (Chang & Lee, 2008). This is because fostering innovation solely within an organization has limitations, as the most promising ideas may emerge from outside the organization (Chesbrough, 2003; Huston & Sakkab, 2006). In this context, supply networks can play a crucial role, as they provide a valuable source of knowledge and that is information essential for driving innovation at the buying firm (Autry & Griffis, 2008; Bellamy et al., 2014; Cooper & Edgett, 2009; Henke & Zhang, 2010).

The accumulation of knowledge assets to foster innovation and stimulate growth primarily occurs through two sources: internal knowledge generated from research and development (R&D) activities and external knowledge originating from sources outside the organization (Cooper & Edgett, 2009; Huston & Sakkab, 2006; Kogut & Zander, 1992). In the presence of increasing market requirements, shorter product life cycles, and rising complexity, firms are progressively turning to external knowledge assets, especially their suppliers, to spur innovation (Gößwein et al., 2019; Graff & Smeets, 2019). Suppliers provide additional resources, complementary technology, business skills, and knowledge sharing to lower costs, reduce development times, and create new business opportunities (Ahuja, 2000; Gößwein et al., 2019). In recent years, the impact of (structural) supply network characteristics on innovation performance has been extensively investigated (Bellamy et al., 2014; Kim & Zhu, 2018; Sharma et al., 2020; Yang et al., 2022).

In this context, a supply network can be characterized by the connections between a firm and its (in-)direct suppliers, including the information and knowledge they possess (Borgatti & Li, 2009). For this reason, a firm's supply network is often considered as "capital" (Koka & Prescott, 2002; Lawson et al., 2008), which is regarded as a valuable and non-imitable resource (Nahapiet & Ghoshal, 1998) supporting competitiveness (Rowley

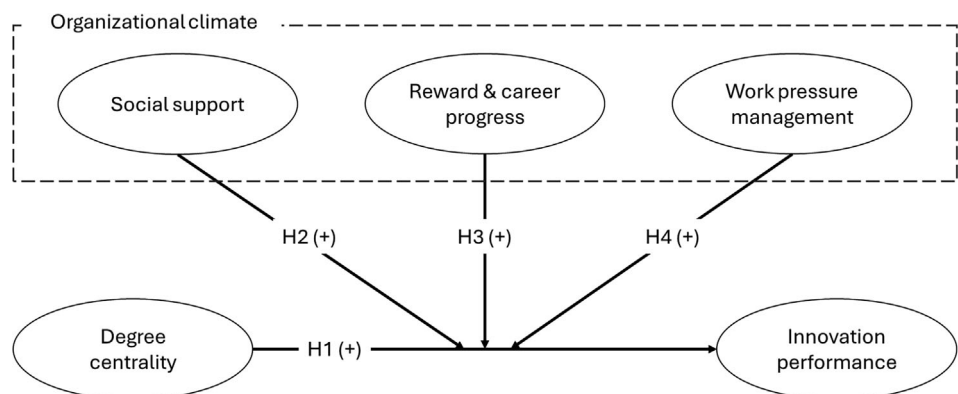


FIGURE 2 Conceptual model

et al., 2000; Son et al., 2016), including superior innovation performance. Such resources can provide a firm with the external information and knowledge necessary for generating innovations (Tsai, 2001) as well as an opportunity to combine knowledge for joint innovation creation (Ahuja, 2000; Cousins et al., 2011).

The structural characteristics of a buying firm's supply network, therefore, indicate the quantity and quality of knowledge and information held by its direct suppliers and beyond (Bellamy et al., 2014; Corbett et al., 1999; Dyer & Nobeoka, 2000; Greve, 2009; Tsai, 2001; Xie et al., 2015). The implications of supply network characteristics on the innovation creation of a firm have primarily been investigated from the perspective of the buying firm's centrality in its supply network, which reflects its relative importance in the network (Dong et al., 2015; Kim et al., 2011). A firm that occupies a central location can access information and knowledge more easily, enabling the development of knowledge assets to support innovation creation (Autry & Griffis, 2008; Bell, 2005; Bellamy et al., 2014; Greve, 2009; Tsai, 2001). Moreover, the level of a firm's centrality signals its reputation to suppliers (Borgatti & Foster, 2003; Podolny, 1993), alleviating the suppliers' fear of failing to protect their knowledge as a result of buyer opportunism (Mayer, 2006) and resulting in more information-sharing activities between them.

In summary, social network theory suggests that a firm's centrality within its supply network determines (1) the availability of diverse supplier knowledge for innovation creation and (2) the accessibility of such knowledge by the buyer (Autry & Griffis, 2008; Bell, 2005; Bellamy et al., 2014; Greve, 2009; Tsai, 2001). In this article, we measure centrality by in-degree centrality, which refers to the number of direct (tier 1) suppliers a firm has (Borgatti & Li, 2009; Kim et al., 2011). This can be interpreted as the amount of knowledge, resources, and information available to the firm in its upstream supply network (Borgatti & Li, 2009; Provan et al., 2007). A firm with higher in-degree centrality has access to a greater amount of knowledge held by its suppliers (Ahuja, 2000; Kim et al., 2011) and more influence over them to extract such knowledge from them (Ibarra, 1993; Kim et al., 2011). Moreover, Ahuja (2000) suggests that a higher number of direct ties would enhance innovation creation by enabling knowledge sharing and combining complementary knowledge with scaled resources for innovation. Given the discussion above, we posit the following baseline hypothesis:

**H1.** A buying firm's in-degree centrality in its supply network is positively related to its innovation performance.

## Organizational climate for leveraging supplier inputs for innovation

A buying firm's efforts to leverage its suppliers' inputs for innovation creation often involve capturing voluntary and involuntary spillovers of the knowledge they possess (Davenport & Prusak, 1998; Xie et al., 2015). Such external knowledge acquisition requires the organization's capacity to absorb new ideas (Cohen & Levinthal, 1990), and one important element of this absorptive capacity is an organization's ability to learn (Cohen & Levinthal, 1990; Jiménez-Jiménez & Sanz-Valle, 2011). Given that a large proportion of organizational learning occurs through the individual members of the organization (Fiol & Lyles, 1985), the learning behavior of the employees of a buying firm—the focus of this article—is closely related to the quantity and quality of knowledge captured from supplier spillovers (Lawson & Potter, 2012; Simonin, 2004). This means that knowledge that is held by individuals within an organization is also created in routines through which members cooperate with external partners (e.g., direct suppliers) in the supply network (Kogut & Zander, 1992).

Bock et al. (2005), however, point out that knowledge captured internally or externally by individuals is not easily transformed into organizational knowledge assets, as individuals tend to hoard knowledge. Therefore, another important aspect of learning behavior, sharing—which refers to the exchange of information, know-how, experience, and skills possessed by members of an organization (Bartol & Srivastava, 2002; Kogut & Zander, 1992; Lin, 2007)—is needed for innovation creation (Cabrera & Cabrera, 2002; Davenport & Prusak, 1998; Tohidinia & Mosakhani, 2010). Indeed, the extant literature illustrates the strong link between the collective learning behaviors of individuals and the innovation performance of the organization to which they belong (Hurley & Hult, 1998; Yli et al., 2001).

Such learning behaviors among members of an organization can be encouraged by fostering a specific type of organizational climate (Bock et al., 2005; Oke et al., 2013; Slater & Narver, 1995). Organizational climate refers to “the shared perceptions of and the meaning attached to the policies, practices, and procedures employees experience and the behaviors they observe getting rewarded, supported, and expected” (Ehrhart & Raver, 2014), p. 156). It determines the collective outcomes of sense-making in meaningful social settings (Beus et al., 2018) and is known to influence various aspects of members' behaviors and attitudes, such as job satisfaction (Schnake, 1983), health and safety behaviors (Beus et al., 2010; Clarke, 2006), and unethical behaviors (Son et al., 2019).

However, the term organizational climate has sometimes been used interchangeably with organizational culture (Patterson et al., 2005), as both create and influence the social context in an organization (Bock et al., 2005). While there are many conceptual similarities between organizational climate and culture (Denison, 1996), the key difference is their temporality. As previously discussed, while organizational climate refers to shared perceptions of observable aspects of organizational life at a point in time (Denison, 1996), organizational culture refers to patterns of shared assumptions and is manifested through artifacts, beliefs, and values (Schein, 1985). Therefore, organizational climate is seen as a snapshot of organizational life at a point in time, while organizational culture is more about the deep social or collective aspects of organizational interactions that evolve slowly over time (Ahmed, 1998; Bock et al., 2005; Denison, 1996). Patterson et al. (Patterson et al., 2005) illustrate this distinction through the example of safety climate versus safety culture. They argue that a safety climate is related to a set of current workplace safety practices and policies, while a safety culture involves shared values, common assumptions, and the patterns of belief that created them in the first place.

The link between organizational culture and innovation performance has been studied extensively (e.g., Amabile et al., 1996; Damanpour, 1991). The extant literature has identified specific traits of organizational culture that are associated with innovation performance, such as developmental traits (Amabile, 1988; Khazanchi et al., 2007; Quinn & McGrath, 1985) and group traits (Martins & Terblanche, 2003; Shipton et al., 2006). However, developing or shaping an organizational culture to achieve organizational goals can be challenging and time-consuming, as the organizational culture is deeply rooted in the history of the organization and is sufficiently complex to resist management's attempt at direct manipulation (Bock et al., 2005; Denison, 1996; Schneider et al., 2013).

Considering that organizational climate can be more easily shaped than organizational culture (Ancarani et al., 2011; Bock et al., 2005), a better understanding of the link between organizational climate and innovation performance provides researchers and managers with an additional means to improve innovation performance. In addition, as Schneider et al. (2013) note, the transformation of the organizational culture to achieve organizational goals can only be accomplished through accompanying changes in the related organizational climate, for instance, the implementation of new procedures and policies. Therefore, it is crucial to explore the role of organizational climate in innovation creation.

However, there is little research on the link between organization climate and innovation performance.

In this article, our primary focus is on the moderating role of the learning dimension of organizational climate in innovation. In addition to its role in encouraging the behaviors necessary for capturing knowledge spillovers, organizational climate plays a crucial role in encouraging various forms of direct and indirect (via boundary spanners) supplier engagement, such as the creation of social interaction ties (Cousins et al., 2006) to strengthen the quality of relationships with suppliers (Henke & Zhang, 2010). Given that knowledge spillovers sometimes occur beyond formal settings, for example, joint research initiatives with suppliers (Cousins et al., 2006), such an organizational climate would enhance both the opportunities for knowledge capture and the likelihood of success.

Unlike organizational culture, which has well-established dimensions, such as the Competing Values Framework (Quinn & Rohrbaugh, 1983), there is no consensus on the dimensions of organizational climate. This suggests that the operationalization of dimensions is contingent on the particular organizational outcomes being investigated (Schneider et al., 2013). Given this lack of consensus on the dimensions of organizational climate for learning, we use the following three facets that have been extracted from the literature review: (1) social support (Anderson & West, 1998; Ekvall, 1996; Patterson et al., 2005; West & Altink, 1996), (2) rewards and career progress (Abbey & Dickson, 1983; Ahmed, 1998; Zammuto & Krakower, 1991), and (3) work pressure management (Patterson et al., 2005).

## Social support

Social support refers to the employees' collective perception of the job resources, including support from colleagues and leadership, available to support specific behaviors like learning (Anderson & West, 1998; Ekvall, 1996; Patterson et al., 2005; West & Altink, 1996). This aspect of organizational climate is essential for promoting employees' learning behaviors by influencing their attitudes toward these activities. As previously mentioned, the initial stage in utilizing supplier input is to capture spillover knowledge. Accomplishing this requires some form of social interaction ties with suppliers (Cousins et al., 2006) alongside more structured engagements, such as formal knowledge-sharing routines (Cousins et al., 2006). Some employees, however, may be hesitant to establish such social ties, particularly informal ones outside the workplace (Cousins et al., 2006; Oh et al., 2004), as it may demand their time and resources.

Moreover, they may be concerned that engaging in such activities might be seen as a diversion from their primary responsibilities by their colleagues within the organization. This means employees of a buying firm require strong social support to succeed in social interactions with suppliers, providing them greater opportunities to capture spillover suppliers.

Once spillovers are captured, facilitating knowledge sharing among the employees of the buying firm is a crucial next step in creating innovation (Cabrera & Cabrera, 2002; Davenport & Prusak, 1998; Tohidinia & Mosakhani, 2010). Employees may be hesitant to share their acquired knowledge without sufficient social support from colleagues. This is because they may perceive such activities as psychologically risky, as peer rejection may endanger their self-image, status, and career outlook (Baer & Frese, 2003; Brown & Leigh, 1996). Thus, a lack of social support can impede the acquisition of new knowledge, particularly beyond the organizational boundary. Furthermore, implicit norms may emerge as a result which hinder employees' willingness to share ideas freely (Baer & Frese, 2003; Bock et al., 2005; Tohidinia & Mosakhani, 2010). Given this, we hypothesize the following:

**H2.** A buying firm's employees' perception of workplace social support positively moderates the association between the in-degree centrality of its supply network and its innovation performance.

## Rewards and career progress

Rewards and career progress at the workplace are the second facet of organizational climate considered in this study. It refers to an employee's collective perception of the workplace environment in terms of rewards like benefits, pay, and opportunities to fulfill career objectives (Abbey & Dickson, 1983; Ahmed, 1998; Zammuto & Krakower, 1991). From the employee's perspective, learning behaviors at work often require an individual's time and resource dedication. Measuring such dedication can be challenging for management, particularly if the learning occurs in voluntary or informal settings. For employees, this means that engaging in such behaviors could involve a risk of not being rewarded for their efforts by their firms. Hence, an organization with a climate of ensuring fair rewards and career progress would reduce employees' fear of such risk, giving them a more positive attitude toward learning behaviors (Abbey & Dickson, 1983; Ahmed, 1998; Patterson et al., 2005).

In addition, Olsson et al. (2019) explain that certain attributes related to rewards and career progress, such as dynamism and freedom, are essential for daily operations, including communications or coordination within and outside the organization. Therefore, such an organizational climate would motivate the employees of buying firms to interact with external partners to capture spillovers and to share the captured knowledge internally. Conversely, if employees perceive that the reward system and career perspective are opaque, temperamental, and arbitrary, their attitude toward learning would become less positive (Bock et al., 2005; Tohidinia & Mosakhani, 2010). This means that employees may be less motivated to spend the additional time and resources needed for better interaction with external partners and internal sharing, and this diminished effort makes it difficult for the buying firm to leverage input from suppliers to foster innovation creation. Therefore, we hypothesize the following:

**H3.** A buying firm's employees' perception of workplace rewards and career progress positively moderates the association between the in-degree centrality of its supply network and its innovation performance.

## Work pressure management

Work pressure is the third facet of the organizational climate examined in this study. It refers to the job-related expectations and demands placed on individuals by management or peers (Bakker & Demerouti, 2007; Koys & DeCotiis, 1991; Patterson et al., 2005; Vagg et al., 1998) and the collective perception of employees regarding how well they are managed in their workplace. As discussed earlier, employees' learning behaviors are sometimes voluntary and informal. Therefore, pursuing such learning may be outside of their usual job descriptions. This means that a climate of high pressure and related stress will impact employees' perceived behavioral control of these activities, causing them to be reluctant to engage in learning alongside their core roles (Ekvall, 1996). This is due to the work pressure caused by high job demands and low job control, which will eventually create job strain and resource depletion, including psychological and physical energy (Sok et al., 2014). Moreover, considering that the organizational climate is a collective perception of employees within the organization, such behaviors outside the usual job descriptions may elicit hostile or minimal reactions from stressed colleagues, negatively impacting their attitude toward such behaviors.

Therefore, when confronted with a high level of work pressure, the employees of buying firms may be less likely to have spare time for (in-)direct interactions with suppliers to create spillover capture opportunities. Undermined interactions may result in negative relational outcomes, such as conflicts, which, in turn, decrease spillover capture and internal knowledge sharing for innovation creation (Henke & Zhang, 2010; Olsson et al., 2019). However, when employees experience a pressure-controlled climate within the organization, the outcome may be different, as they could be able to allocate more time and energy for meaningful discussions with internal colleagues and external partners. Such increased communication and coordination make it more likely that the employees will be able to capture knowledge spillovers from the supply networks. In particular, Olsson et al (Olsson et al., 2019). emphasize that a conducive organizational climate that provides stress-free encouragement of risk-taking and engaging in constructive debates with suppliers can enhance a firm's ability to achieve radical innovation. This leads us to posit the following hypothesis:

**H4.** A buying firm's employees' perception of workplace work pressure management

positively moderates the association between the in-degree centrality of its supply network and its innovation performance.

## METHODS

### Data

Several forms of structured and unstructured data were used throughout this study. When constructing the sample, we excluded Global Industry Classification Standard (GICS) sectors that include predominantly service firms due to the lack of physical supply network flows (Figure 3). Based on their GICS classification, we excluded financial service and real estate firms, energy, and utility providers, as well as (tele)communication service providers. Information technology (IT), in contrast, was kept in the sample, as this GICS sector (aside from IT service firms) predominantly includes equipment manufacturers, such as Western Digital and Micron Technology, which were considered highly relevant for our study. In a first step, we thus selected 322 firms from the 2017 S&P 500 index constituents based on their GICS classification. Next (steps 2 and 3), the variables required

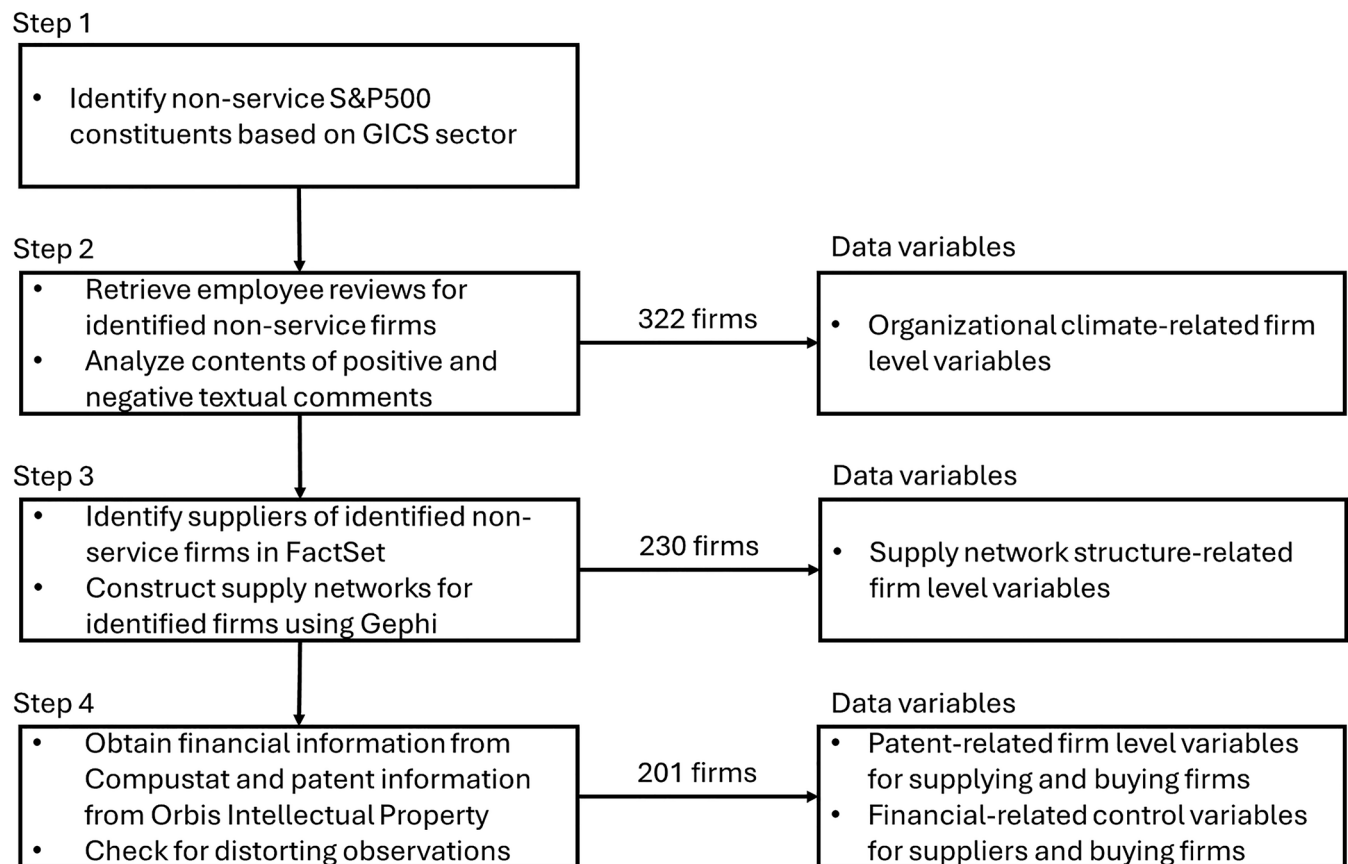


FIGURE 3 Data collection process (Adapted from Bellamy et al., 2014)

for this study were obtained using the following sources. We used the online reviews posted on Glassdoor in 2017 by both current and former employees of the sample firms to measure different facets of the organizational climate. Glassdoor is a US-based job search engine and company ranking site based on user-generated content that allows current and former employees to rate various aspects of their companies, such as leadership, work environment, and pay (Associated Press, 2013). Additionally, we used FactSet, which contains inter-firm relationship data for listed firms (Culot et al., 2023), to collect supplier relationship data for the year 2017 and obtain the normalized in-degree centrality for the buying firms. In a fourth step, we collected patent data for supplying and buying firms from the Orbis Intellectual Property database spanning the years 2014 to 2017 and 2018 to 2020 to assess the suppliers' prior innovation output and the buyers' innovation performance, respectively. Additionally, we obtained financial data for supplying and buying firms from Compustat for the year 2017 to construct several control variables.

One of our independent variables, buying firms' organizational climate, was measured using Glassdoor data, which included a total of 132,618 textual comments extracted from 66,309 online reviews with positive and negative comments from verified current or former employees of the sample firms. Glassdoor is one of the main job search engines and the largest firm ranking platform in terms of the number of firms and related employee reviews (Ji et al., 2017). Considering that organizational climate refers to shared perceptions among the employees of a firm (Anderson & West, 1998; Reichers & Schneider, 1990), Glassdoor provided an excellent opportunity to investigate this concept.

A potential issue with online review data is polarization bias, which refers to the fact that people with extreme opinions are more likely to post reviews than those with moderate opinions, creating a highly polarized distribution of reviews (Lee et al., 2014). Glassdoor, however, follows a give-to-get policy, which requires users to submit their own reviews before allowing them to see

additional content or search for job offers. This approach of using pro-social incentives reduces polarization bias and leads to more balanced and representative online reviews (Ji et al., 2017; Klein et al., 2018). This has been confirmed by recent research, providing statistical evidence that Glassdoor's policy reduces polarization bias by decreasing "the likelihood of extreme 1-star and 5-star reviews by 3.6 percentage points and 2.1 percentage points, respectively" and by increasing "the likelihood of more moderate 3-star and 4-star reviews by 2.6 percentage points and 2.9 percentage points, respectively, providing a more balanced view of jobs and companies than would otherwise be the case" (Chamberlain & Smart, 2017). As the website also allows users to leave detailed textual reviews on positive and negative aspects of organizational life separately, these positive and negative components concerning social support, rewards and progress, and work pressure management were also analyzed separately to circumvent the polarization of individual reviews.

## Measures

### Organizational climate

To measure the organizational climate of buying firms, a content analysis was performed to code the collected online employee reviews from Glassdoor (see Table 1 for sample statistics). Content analysis is "a research technique for making replicable and valid inferences from texts (or other meaningful matter) to the contexts of their use" (Krippendorff, 2018, p. 24). As mentioned previously, users can leave two separate textual comments about their current or former employers (see Table 2 for sample reviews), one for the positive and another for the negative aspects of their current or former employer. These unstructured parts of the online employee reviews were coded using content analysis. Due to the sheer volume of the textual data (132,618 reviews made up of 66,309 pairs, around 4.5 million words), computer-aided

TABLE 1 Glassdoor sample statistics.

GICS sector	Companies	Reviews	AVG	STDEV
Consumer discretionary	71	20,739	292.10	468.65
Industrials	69	8,767	127.06	156.42
Health care	61	6,861	112.48	152.31
Information technology	60	20,725	345.42	649.65
Consumer Staples	36	8,064	224.00	486.12
Materials	25	1,153	46.12	48.53
	322	66,309	205.93	416.63

TABLE 2 Sample reviews from Glassdoor.

Positive reviews	Negative reviews
The company prides itself on its emphasis on a great work/life balance. This is true. The general culture is one that values family time and allows you to more or less set your own schedule as long as it enables you and your team to work efficiently. If you need to cut out early because your kid is sick, that's fine. I like that nobody gives those with children a hard time.	Almost no opportunity to grow within the company. No communication, your work is not valued. Bad management interaction (managers are always in meetings and it is unsure what they are actually doing), high rotation of people coming and going, salary below market level, almost no chance of getting a permanent contract.
The people are great, co-workers and customers. Over three years I have had issues with two co-workers (not including management) and I love my regular customers!	Absolutely zero consideration for employee work-life balance. General consensus is if you do not like it leave. Yes, they pay OT without a time gate. However, it is only hourly not time and a half. Company claims to run a 9 × 80 flex. You will most likely work 10-12 × 120.
Achievement is recognized. Honesty among employees. Mutual trust and respect for others. Open communication at all levels	Silos, no collaboration, personal agendas, toxic managers, too many meetings, too much talking and not enough doing, lots of blowhards in management, management, and peers take credit for other people's ideas/work.

content analysis (CATA) was selected over manual coding and was implemented using WordStat 8.0 from Provalis Research, which has standardized features for analyzing textual data (i.e., automatic [Porter] stemming and substitution functionalities, categorization, and frequency counts).

CATA is based on a dictionary, which is the specification of words and phrases (i.e., keywords under various named categories), to create counts (Krippendorff, 2018). Due to the lack of a pre-made dictionary for organizational climate, a set of new dictionaries for the positive and negative reviews were created from scratch. A manual dictionary-building approach was selected. Manual dictionary building is a theory-driven approach rooted in

traditional content analysis and is similar to developing a coding schema (e.g., Weber, 1990).

We followed the dictionary-building method suggested by Sodhi and Son (2010). During the initial data screening, it came to our attention that there was a substantial difference in the words and phrases used in positive and negative reviews. For this reason, a pair of dictionaries, one for positive and one for negative reviews, were created for the different facets of organizational climate. Following the approach of Sodhi and Son (2010), as a first step, we extracted all words and phrases (N-grams) from the positive reviews using WordStat with the pre-built exclusion list. Then, any words and phrases occurring in less than 2% of the reviews were pruned. Similarly, phrases with more than five words were also discarded, as they were generic and uninformative. The remaining keywords and phrases were allocated to three facets of the learning aspect of the organizational climate for innovation: (1) social support, (2) rewards and career progress, and (3) work pressure management. This was done by investigating each of the keywords and phrases in the context of the sample of actual reviews (see Appendix A for the dictionaries). The same process was repeated to create the dictionary for the negative reviews.

After creating the dictionaries, we used WordStat 8.0 to convert the unstructured positive and negative employee reviews into structured variables that described the three facets of organizational climate. For each buying firm  $j$ , we initially retrieved the percentage of positive and negative reviews containing specific keywords and phrases related to each facet  $k$  of organizational climate (note that  $x_n^{pos/neg}$  is equal to 1 if at least one of the positive/negative keywords is included in review  $n$ , i.e., the term occurrence vector is different from zero, and equal to 0 otherwise). Subsequently, we calculated the strength of each climate facet  $OC_k$  by dividing the percentage of positive reviews by that of negative reviews:

$$OC_k(j) = \frac{\sum_n x_{j,n}^{pos} / N}{\sum_n x_{j,n}^{neg} / N} \quad (1)$$

A higher value of this ratio indicates a more positive organizational climate. Given that organizational climate refers to shared perceptions (Anderson & West, 1998; Reichers & Schneider, 1990), this approach enabled us to capture the collective perception of employees. Moreover, it reflected the magnitude of the gap between positive and negative reviews and alleviated potential biases as one very strong review containing many repeated words would distort the overall picture of the measure.

## Network structure

Following common practice (e.g., Potter & Wilhelm, 2020; Yang et al., 2022), we used the in-degree centrality measure as a proxy for the structural characteristic of a buying firm's supply network. In-degree centrality captures the size of a firm's tier-1 supply network (Kim et al., 2011) and is commonly defined as the number of direct ties between a firm and its supply network, that is:

$$DC(j) = \sum_i y_{ij} \quad (2)$$

where  $y_{ij}$  is equal to 1 if there is a direct tie between  $i$  and  $j$ , and equal to 0 otherwise (Freeman, 1979; Kim et al., 2011).

## Innovation performance

To measure a buying firm's innovation performance, we counted the number of patents granted to the firm, in line with prior studies in the literature (e.g., Isaksson et al., 2016; Potter & Wilhelm, 2020; Sharma et al., 2020). However, getting a patent takes a couple of years (Harhoff & Wagner, 2009). Considering this, we used the total number of patents granted to the firm over the three-year period 2018–2020. In our robustness check, we also used the number of patents granted as of 2018 to check whether our main results were unduly influenced by the choice of the longer time period.

## Control variables

To control for other possible effects, we considered the following control variables that may be associated with the level of innovation (Coad et al., 2016; Kim & Zhu, 2018; O'Brien, 2003): industry (GICS), firm size, firm age, past innovation performance (standardized within the industry), and capital structure. The type of industry, which is a crucial determinant of organizational innovation (Crossan & Apaydin, 2010), was measured as a set of dummy variables among six GICS sectors. Firm size, measured by the natural logarithm of total assets, was controlled because large firms tend to have more resources for innovation creation (Kim & Zhu, 2018). We further controlled the effect of firm age on innovation performance, which was measured as the number of years (plus one) elapsed since the first listing in Compustat. Past innovation performance was measured by the

number of patent applications in 2018, which was standardized within the industry. Firms' innovation can also be influenced by their financial health (O'Brien, 2003). Therefore, we controlled the capital structure (debt-to-equity ratio) of the buying firm.

Moreover, to capture the innovation characteristics of the sample firm's supply network, we added two suppliers innovation-related control variables: supplier financial slack and supplier prior innovation. We first identified the list of 12,025 suppliers (4,766 unique suppliers) from FactSet. Based on this list, we collected financial and innovation data for about 1,700 suppliers. Following common practice (e.g., Chae et al., 2020; Modi & Cantor, 2021), we measured supplier financial slack as the average ratio of supplier's current assets minus inventories divided by current liabilities. We further measured prior supplier innovation as the average number of patent applications of suppliers during the period 2014–2017.

## Analysis

To test the hypotheses, we conducted regression analyses with normalized independent variables for moderation analysis. Given the nature of our dependent variable, we used a count regression model with robust standard errors. Poisson regression was not appropriate because our data violated the assumption of the equal mean and variance of the dependent variable. In our data, we found a variance-to-mean ratio of over 15,000, which indicates significant overdispersion. Therefore, to account for such overdispersion, we used the negative binomial regression model.

The hypotheses were tested in four steps: (1) the base model with the control variables described above, (2) the main effect model with the independent variable (i.e., degree centrality), (3) the main effect model together with the three moderators (i.e., social support, rewards and career progress, and work pressure management), and (4) the interaction effect model of independent variable and moderators.

The average variance inflation factor (VIF) from all the models was 2.04, with a maximum value of 5.49. The typical recommended cut-off point of the maximum VIF for multicollinearity is 10 (Cohen et al., 2003), and some studies follow a stricter threshold such as 8 and 5 as reviewed by Kalinins (2018). In addition to these rules of thumb, multicollinearity was not a severe problem in our study given that the correlation coefficients (the highest one is 0.568) were far below 0.8, our sample size was large enough (more than 200), and the overall model fit

TABLE 3 Pairwise correlations and descriptive statistics.

Variables	Mean	SD	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1) innovation performance	3192.4	7005.3										
(2) firm size	3.62	1.20	0.209 (0.002)									
(3) firm age	40.28	16.92	0.182 (0.009)	0.227 (0.001)								
(4) sector innovation	0.08	1.12	0.546 (0.000)	0.249 (0.000)	0.284 (0.000)							
(5) capital structure	0.17	0.13	0.089 (0.205)	0.256 (0.000)	0.024 (0.733)	0.186 (0.008)						
(6) supplier financial slack	3.70	2.87	0.013 (0.845)	0.102 (0.147)	-0.020 (0.768)	0.034 (0.623)	0.108 (0.127)					
(7) supplier prior innovation	2118.8	6018.1	0.097 (0.168)	-0.026 (0.706)	0.001 (0.989)	-0.005 (0.934)	-0.022 (0.753)	0.034 (0.624)				
(8) degree centrality	41.4	62.7	0.391 (0.000)	0.568 (0.000)	0.261 (0.000)	0.397 (0.000)	0.168 (0.017)	0.041 (0.562)	0.019 (0.779)			
(9) social support	2.14	1.35	-0.186 (0.008)	0.066 (0.349)	-0.063 (0.372)	-0.187 (0.007)	-0.052 (0.461)	-0.035 (0.614)	-0.063 (0.373)	-0.072 (0.308)		
(10) reward and career progress	1.48	1.08	0.057 (0.420)	-0.173 (0.013)	0.054 (0.442)	0.088 (0.209)	-0.045 (0.525)	-0.030 (0.671)	-0.063 (0.371)	-0.085 (0.229)	0.037 (0.559)	
(11) work pressure management	0.56	0.81	-0.062 (0.376)	-0.104 (0.139)	0.060 (0.392)	-0.102 (0.146)	0.012 (0.857)	-0.085 (0.230)	-0.027 (0.696)	-0.133 (0.059)	0.070 (0.319)	-0.112 (0.111)

Note: Observation = 201; *p*-values are in parentheses.

was strong ( $R^2 = 51\%$ ) (Mason & Perreault, 1991). Table 3 presents the descriptive statistics and pairwise correlations among the variables used in this study.

## RESULTS

### Test of main models

The main model tested Hypothesis 1, which postulates a positive relationship between a buying firm's in-degree centrality and its innovation performance. Table 4 (Model 2) summarizes the corresponding regression results. Overall, our results suggest that the in-degree centrality of a buying firm is positively and significantly related to its innovation performance (H1:  $b = 0.008$ ,  $p = 0.001$ ), thus providing support for Hypotheses 1. This significance persisted when we used the number of patents for 2018 (Model 5 of Table 5) as an alternative to the three-year time innovation and when the zero-inflated negative binomial regression, which is proper for count data modes with excessive zeros, was used instead (Model 8 of Table 5). The results of the robustness tests further support the main finding.

### Test of interaction models

In the interaction models, we hypothesized that three facets of the organizational climate for learning behavior in a buying firm moderate the effect of degree centrality on innovation performance (H2–H4). The results in Table 4 (Model 4) show that coefficients of the interaction terms for rewards and career progress (H3:  $b = 0.008$ ,  $p = 0.05$ ) and work pressure management (H4:  $b = 0.012$ ,  $p = 0.01$ ) were positive and significant, with a  $\chi^2$  value of 108.00, which was substantially larger than that of the main effect model (Model 2). These findings were robust to using an alternative measure (i.e., patents in 2018) for innovation performance (Models 7) and an alternative model, zero-inflated negative binomial regression (Model 10), as shown in Table 5. Contrary to our expectation, however, we found no significant coefficients for the moderating role of social support in the relationship of in-degree centrality with innovation performance, thus rejecting H2. The results of the simple slope analysis, which plotted innovation performance against degree centrality for the high versus low level of moderators, also support the interaction effect finding. Specifically, as shown in Figures 4 and 5, the two moderators, rewards and career progress and work pressure management increase the positive relationship between degree centrality and innovation

performance. These illustrations provide further strong support for H3 and H4.

### Correcting for endogeneity

Prior studies show that the supply network structure is likely exogenous (e.g., Phelps, 2010; Yang et al., 2022). As a type of network structure, our independent variable, in-degree centrality, is therefore also likely to be exogenous. However, due to the nature of the cross-sectional design, we still tested for endogeneity to ensure our main results. Specifically, we verified this possibility by using the two-stage residual inclusion approach, also known as the control function approach (Wooldridge, 2015). This approach is particularly appropriate for nonlinear regression models including count data models, which are often utilized in recent supply chain management (SCM) research (e.g., Liu et al., 2021; Palit et al., 2022).

The first stage regresses the independent variable on two instrumental variables (IVs). We identified the IV candidates that were correlated with the independent variable (at the 1% level) but not correlated with the disturbance term, which were closeness centrality (CC) and betweenness centrality (BC). Kim et al. (2014) document that, unlike degree centrality, CC cannot be considered in materials flow but only in contractual relationships in supply networks. They also note that BC differs from the degree centrality of inbound networks (i.e., in-degree centrality) in that it can affect the downstream firms' operations. In that sense, CC and BC may refer to supply network phenomena that are part of our unit of analysis but are still somewhat external to our analysis scope, which can be used as IVs (Sande & Ghosh, 2018). Accordingly, choosing IV closure as the analysis unit is not uncommon in the literature (e.g., Bellamy et al., 2014; Potter & Wilhelm, 2020).

Indeed, after taking a log-transformation of innovation outputs, we found that the  $F$ -value of the Cragg–Donald statistics was 20.082, which was greater than all the Stock–Yogo weak identification test critical values of 10% (Stock & Yogo, 2005). This led to the rejection of the null hypothesis that the IVs chosen are weak, supporting the strength of the IVs. We also found that the Sargan statistic ( $\chi^2 = 3.493$ ,  $p = 0.06$ ) for overidentification restrictions supports the validity of the IVs.

The predicted residuals generated from the first-stage were then added to the second-stage regression. The results are shown in Models 11–13 in Table 5. We found a significant coefficient for degree centrality ( $b = 0.011$ ,  $p = 0.02$ ) and its interaction effects with rewards and career progress ( $b = 0.008$ ,  $p = 0.05$ ) and work pressure management ( $b = 0.014$ ,  $p = 0.04$ ). These results provide

TABLE 4 Regression results for the number of patents (2018–2020).

	Model 1	Model 2	Model 3	Model 4
Constant	5.269 (0.000)	5.907 (0.000)	5.919 (0.000)	5.984 (0.000)
Consumer discretionary	−0.970 (0.027)	−1.096 (0.015)	−0.943 (0.030)	−1.098 (0.014)
Consumer staples	−0.391 (0.411)	−0.128 (0.815)	−0.136 (0.812)	−0.094 (0.868)
Health care	1.369 (0.000)	1.441 (0.000)	1.385 (0.000)	1.382 (0.000)
Information technology	1.721 (0.000)	1.696 (0.000)	1.635 (0.000)	1.534 (0.000)
Materials	0.126 (0.786)	0.236 (0.598)	0.240 (0.631)	0.203 (0.674)
Firm size	0.428 (0.001)	0.198 (0.170)	0.162 (0.260)	0.133 (0.418)
Firm age	0.010 (0.198)	0.007 (0.343)	0.008 (0.311)	0.009 (0.266)
Sector innovation	0.957 (0.016)	0.888 (0.020)	0.733 (0.029)	0.693 (0.043)
Capital structure	−0.723 (0.493)	−1.482 (0.103)	−1.298 (0.190)	−1.740 (0.106)
Supplier financial slack	−0.085 (0.070)	−0.071 (0.217)	−0.082 (0.144)	−0.074 (0.241)
Supplier prior innovation	0.000 (0.626)	0.000 (0.693)	0.000 (0.661)	0.000 (0.690)
Degree centrality (DC)		0.008 (0.001)	0.008 (0.001)	0.006 (0.047)
Social support (SS)			−0.124 (0.138)	−0.150 (0.069)
Reward career progress (RCP)			0.262 (0.122)	0.379 (0.011)
Work pressure management (WPM)			−0.089 (0.720)	0.148 (0.509)
DC × SS				−0.002 (0.106)
DC × RCP				0.008 (0.050)
DC × WPM				0.012 (0.012)
Observation	208	208	201	201
Log-likelihood	−1596.5517	−1592.5737	−1545.5405	−1542.7778
$\chi^2$	99.59	90.41	108.00	125.56

Note: For all models, *p*-values are in parentheses, while robust standard errors are included.

TABLE 5 Robustness checks.

	NB model with no. of patents 2018			Zero-inflated NB model <sup>a</sup>			NB model with control function <sup>b</sup>		
	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11	Model 12	Model 13
Constant	4.863 (0.000)	4.905 (0.000)	4.983 (0.000)	6.034 (0.000)	6.114 (0.000)	6.143 (0.000)	6.071 (0.000)	6.067 (0.000)	5.905 (0.000)
Consumer discretionary	-1.138 (0.011)	-1.008 (0.020)	-1.174 (0.009)	-0.961 (0.048)	-0.821 (0.074)	-0.967 (0.042)	-1.116 (0.013)	-0.960 (0.029)	-1.142 (0.010)
Consumer staples	-0.170 (0.756)	-0.192 (0.737)	-0.144 (0.799)	-0.206 (0.702)	-0.238 (0.670)	-0.176 (0.744)	-0.166 (0.771)	-0.158 (0.791)	-0.045 (0.937)
Health care	1.343 (0.000)	1.284 (0.001)	1.264 (0.001)	1.382 (0.000)	1.293 (0.000)	1.307 (0.000)	1.514 (0.000)	1.446 (0.000)	1.378 (0.000)
Information technology	1.559 (0.000)	1.499 (0.000)	1.394 (0.000)	1.606 (0.000)	1.509 (0.000)	1.418 (0.000)	1.717 (0.000)	1.658 (0.000)	1.511 (0.000)
Materials	0.248 (0.580)	0.261 (0.602)	0.219 (0.653)	0.056 (0.896)	0.009 (0.985)	-0.006 (0.990)	0.308 (0.504)	0.306 (0.552)	0.164 (0.743)
Firm size	0.219 (0.137)	0.180 (0.230)	0.146 (0.387)	0.208 (0.143)	0.166 (0.242)	0.150 (0.363)	0.115 (0.565)	0.096 (0.631)	0.177 (0.358)
Firm age	0.006 (0.448)	0.007 (0.423)	0.007 (0.387)	0.007 (0.370)	0.007 (0.348)	0.008 (0.313)	0.006 (0.435)	0.007 (0.394)	0.010 (0.241)
Standardized innovation	0.896 (0.019)	0.744 (0.028)	0.702 (0.040)	0.788 (0.027)	0.646 (0.027)	0.592 (0.045)	0.924 (0.028)	0.764 (0.047)	0.741 (0.034)
Capital structure	-1.199 (0.207)	-1.016 (0.318)	-1.484 (0.188)	-1.481 (0.102)	-1.340 (0.167)	-1.915 (0.066)	-1.298 (0.193)	-1.147 (0.289)	-1.766 (0.100)
Supplier financial slack	-0.058 (0.332)	-0.069 (0.250)	-0.059 (0.393)	-0.081 (0.115)	-0.091 (0.075)	-0.083 (0.144)	-0.068 (0.212)	-0.079 (0.157)	-0.074 (0.260)
Supplier prior innovation	0.000 (0.662)	0.000 (0.645)	0.000 (0.677)	0.000 (0.435)	0.000 (0.415)	0.000 (0.425)	0.000 (0.806)	0.000 (0.748)	0.000 (0.686)
Degree centrality (DC)	0.008 (0.002)	0.008 (0.002)	0.006 (0.034)	0.007 (0.002)	0.007 (0.003)	0.006 (0.048)	0.011 (0.016)	0.010 (0.025)	0.003 (0.665)
Social support (SS)		-0.112 (0.177)	-0.131 (0.111)		-0.137 (0.092)	-0.160 (0.042)		-0.116 (0.175)	-0.153 (0.065)
Reward career progress (RCP)		0.244 (0.134)	0.355 (0.017)		0.258 (0.119)	0.368 (0.011)		0.254 (0.138)	0.387 (0.013)
Work pressure management (WPM)		-0.096 (0.693)	0.113 (0.610)		-0.046 (0.859)	0.175 (0.455)		-0.122 (0.627)	0.184 (0.437)

TABLE 5 (Continued)

	NB model with no. of patents 2018			Zero-inflated NB model <sup>a</sup>			NB model with control function <sup>b</sup>		
	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11	Model 12	Model 13
DC × SS			-0.001 (0.161)			-0.002 (0.062)			-0.002 (0.104)
DC × RCP			0.007 (0.073)			0.008 (0.045)			0.008 (0.050)
DC × WPM			0.011 (0.024)			0.011 (0.032)			0.014 (0.036)
Observations	208	201	201	208	201	201	206	199	199
Log-likelihood	-1390.0779	-1349.9445	-1347.7145	-1590.221	-1542.559	-1539.361	-1574.3438	-1527.5257	-1524.8694
$\chi^2$	87.20	102.29	120.25	94.22	112.34	128.52	94.27	106.60	134.87

Note: For all models, *p*-values are in parentheses, while robust standard errors are included.

<sup>a</sup>cost of goods sold (COGS) is included as an inflation component.

<sup>b</sup>residual term for degree centrality ( $p > 0.10$ ) is included in Model 11–13.

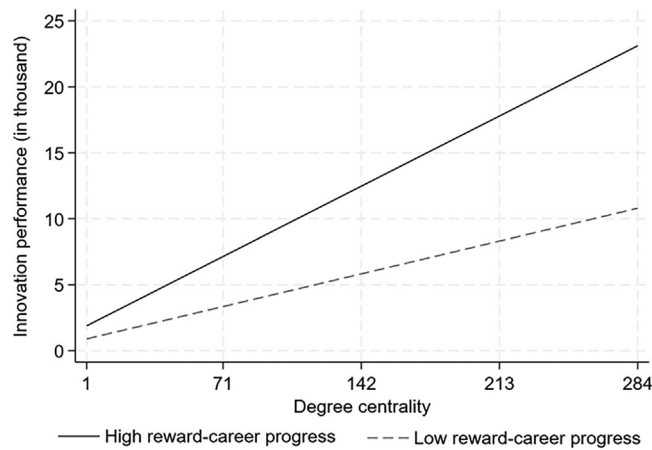


FIGURE 4 Interaction effect of reward and career

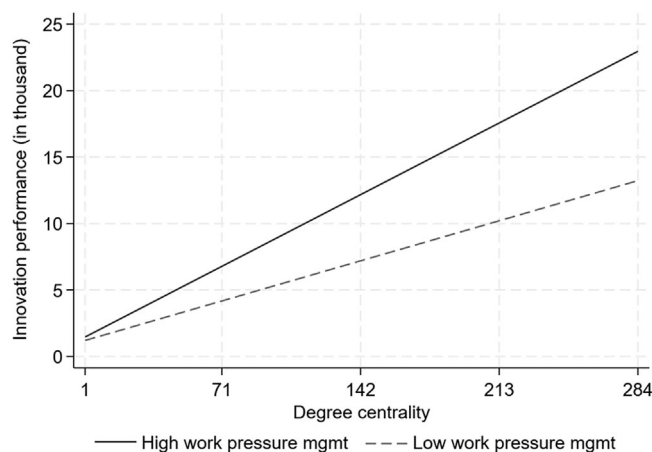


FIGURE 5 Interaction effect of work pressure management

some evidence indicating that our main results were not unduly influenced by endogeneity.

### Qualitative triangulation

In order to ensure the validity of our findings, a qualitative triangulation was conducted by interviewing five procurement managers from large public pharmaceutical firms. We asked whether the facets of organizational climate investigated in this study encourage them to engage more with their suppliers and provide the possibility of knowledge capture for the buying firms' innovation. All five respondents agreed that a pro-learning climate fosters engagement with suppliers and spurs innovations. An interviewee from a leading global pharmaceutical contract research firm noted that, in addition to formal meetings with suppliers, there are various opportunities to engage suppliers in an informal setting such as trade shows. He noted that during the pandemic, his firm had

to switch to decentralized trials due to COVID-19 lockdowns that required them to develop new pre-conditioned shipping boxes for temperature-sensitive drugs. The success in such boxes' rapid design and development was attributed to an idea from one of his suppliers, picked up at a trade show before the pandemic. He felt that the firm's organizational climate, which rewards the introduction of outside ideas for developing innovative products and services, enabled this success.

A contrasting example came from a procurement manager at an S&P 500 pharmaceutical firm who deals with international suppliers. In her firm, close interactions with suppliers in informal settings are often viewed with suspicion, as such interactions are frequently seen internally as indicative of unethical practices, such as "under-the-table payments". Because of this organizational climate, she pointed out that interacting with suppliers to capture and share knowledge is seen as a risky and time-consuming activity by her colleagues. Another interviewee from a multinational pharmaceutical firm pointed out that frequent (informal) interactions with suppliers require time and resources that might not be available in a climate of high work pressure. In summary, the interviewed procurement managers acknowledged the importance of an organizational climate appropriate for innovation to encourage supplier engagement and foster knowledge acquisition and sharing. However, an unfavorable organizational climate was seen as an impediment to learning and sharing behaviors within the buying organization.

## DISCUSSION AND CONCLUSION

Given the rising demand for innovative products and services across sectors, firms are increasingly reconsidering internal capabilities and turning to supply networks to systematically leverage external inputs to improve their innovation performance (Gößwein et al., 2019). P&G, for example, changed its R&D strategy from being 100% internally focused to acquiring 50% of innovations from outside the firm, which has led to substantial productivity and time-to-market improvements (Huston & Sakkab, 2006). Across sectors, the reliance on supplier networks for innovation creation is on the rise (Cousins et al., 2011; Narasimhan & Narayanan, 2013), especially in industries with a decreasing vertical range of integration. A recent stream of research has shown that buying firms' innovation performance is closely related to the structural characteristics of the supply network. These studies emphasize the important role of a supply network as an external knowledge source supporting buying firms' innovation creation (Bellamy et al., 2014; De Stefano &

Montes-Sancho, 2018; Kim & Zhu, 2018; Mazzola et al., 2015; Sharma et al., 2020; Yang et al., 2022).

The results of this study also show that the in-degree centrality of a buying firm is positively associated with its innovation performance, as it reflects (1) the amount of knowledge and information obtained from direct (tier 1) suppliers (Borgatti & Li, 2009; Kim et al., 2011), (2) the influence it has over suppliers to engage them in its innovation creation (Ibarra, 1993; Kim et al., 2011), and (3) the opportunity to combine complementary knowledge (Ahuja, 2000). However, there is a limited understanding of the boundary conditions that determine the extent of the supply network's influence on innovation creation. Our examples from the pharmaceutical industry have shown that it remains unclear why certain firms are superior in innovation creation despite having structurally similar supply networks. Therefore, this article aims to contribute to the intersection of the supply network and innovation management literature by initiating an important discussion on the boundary conditions that determine the extent of the impact of supply chain structures on a buying firm's innovation by examining the moderating role of organizational climate.

## Theoretical contributions

This article focuses on the learning aspect of the organizational climate for innovation, which was operationalized as a three-faceted concept: (1) social support, (2) rewards and career progress, and (3) work pressure management. The results indicate that rewards and career progress and work pressure management moderate the relationship between a buying firm's in-degree centrality and its innovation performance.

As discussed earlier, learning behaviors in an organization can be informal and voluntary, but they often require individuals to invest their time and resources. Our findings suggest that when employees in a buying firm collectively perceive the compensation and career progression practices to be fair or when their work-related pressure is managed well, the organizational climate enhances employees' attitudes toward learning behaviors. This includes the acquisition of knowledge spillovers from suppliers and the internal sharing of captured knowledge, thereby stimulating innovation creation within the buying firm.

However, in contrast to our initial hypothesis, our findings suggest that there is no moderating effect of social support on the relationship between in-degree centrality and innovation performance. One plausible explanation for this is that stimulating learning behaviors, both for knowledge spillover and internal sharing,

requires more specific incentives to be provided by the organization. In other words, employees might perceive a high level of risk and cost associated with engaging in learning activities (especially informal ones), and thus motivating them to engage in such activities requires more substantial forms of support, such as monetary rewards. For managers, this means they should consider adding more learning activities into the core responsibilities of employees, particularly for those in boundary-spanning roles. By doing so, managers could make tangible rewards for learning more feasible and justifiable, and, in turn, employees may be more inclined to participate in learning activities, ultimately contributing to improved innovation performance within the organization.

This leads us to the main theoretical contribution of this article, which lies in identifying a specific organizational climate as a critical boundary condition for better-leveraging supplier inputs to support buying firms' innovation. Indeed, a specific type of organizational climate holds the key to explaining the variation in the innovation performance of firms with structurally similar supply networks. The supply network literature investigating the link between network structure and firms' innovation has often overlooked the importance of firm-level factors. Therefore, our study contributes to the supply network literature by advancing the understanding of the pivotal role of organizational climate in promoting learning behaviors that foster innovation creation.

Another contribution of this study is the introduction of a novel concept, organizational climate, to SCM research. Unlike organizational culture, organizational climate is often unfamiliar to SCM researchers, and it has sometimes even been used interchangeably with organizational culture (Patterson et al., 2005). As discussed earlier, these two constructs are distinctive in their temporality (Denison, 1996), and we believe that organizational climate has its own merits as a firm-level factor for advancing SCM research. In the context of this article, for example, developing or modifying an organizational culture that is supportive of innovation can be challenging, as the culture is deeply rooted in the history of the organization and is sufficiently complex to resist management's direct manipulation attempts (Ahmed, 1998). Moreover, it takes time to develop a different culture, and is difficult to induce a quick cultural change (Bock et al., 2005; Denison, 1996; Schneider et al., 2013). At the same time, the organizational climate is more about the current life of the organization and therefore actionable. Modifying the organizational climate to support innovation-fostering behaviors would be much easier and possible (Ancarani et al., 2011; Bock et al., 2005). Its

current, actionable nature provides new avenues for the investigation of firm-level factors in SCM research. Currently, the consideration of the organizational climate is limited to research streams, mainly focussed on quality (e.g., Boyer et al., 2012; Das et al., 2008) and workplace safety (e.g., Brown et al., 2000).

## Methodological contributions

Our study also provides a methodological contribution due to its novel approach to measuring organizational climate using text computer-aided content analysis (text mining) of online reviews. Traditionally, constructs, such as organizational climate and culture, have been measured using survey instruments which, however, are not suitable for constructs that capture collective dynamics and have a high level of inscrutability (Tucker et al., 1990). Moreover, such surveys are subject to biases, particularly socially desirable response bias when the respondents are asked about "social norms and standards" (Zerbe & Paulhus, 1987) such as social support, rewards and career progress, or work pressure. Our approach to measuring such constructs relied on secondary data using content analysis of rich open-ended questions for multiple respondents from a firm. This approach enables the development of a cross-organizational dataset for assessing firm-level constructs that are difficult to curate through the use of employee surveys. By employing online review data, our approach can help SCM researchers better measure firm-level attitude constructs with a high level of inscrutability. This could provide academics with an opportunity to investigate previously difficult-to-measure constructs more effectively and efficiently.

## Managerial implications

From an SCM perspective, the study highlights the importance of organizational climate in promoting learning and harnessing knowledge within and across organizational boundaries to gain a competitive advantage. Our findings provide managers of buying firms a potential way to enhance their efforts to boost innovation performance. In fact, a substantial amount of research has focused on linking organizational culture to innovation performance. However, developing an organizational culture that is supportive of innovation is challenging, as it is a deeply held belief and value of organizations (Ahmed, 1998) that takes time to develop, and it is difficult to induce a quick cultural change (Bock et al., 2005). At the same time, the organizational climate, which is

the focus of this study, is more temporal and actionable and thus can be more easily manipulated (Ancarani et al., 2011; Bock et al., 2005). It is also known to influence the behaviors of organizational members (Cole et al., 1997; Hofmann & Stetzer, 1996; Son et al., 2019) toward learning more from external suppliers, which in turn facilitates innovation creation.

Therefore, our findings suggest that managers should reconsider policies and procedures related to two facets of organizational climate: rewards and career progress and work pressure management. These adjustments could enhance learning behaviors, making buying firms unique compared to competitors. Implementing the findings of this research, however, would require buying firms to establish a climate management system involving the periodic monitoring of their organizational climates. Our study shows the potential for firms to use online review platforms, such as Glassdoor, as an alternative way to complete this challenging task. Our approach of analyzing perception data through an anonymous online employee review platform represents a cost-effective method for effectively measuring organizational climate. This approach could also be useful when checking the status of the firm's attractiveness to talented employees, who could be a basis for future innovation driven by the interaction between organizational climate and supply network centrality.

## Societal implications

It is evident from previous studies that innovation leads to economic enhancements, including revenue stability, increased tax contributions to the government, a higher payroll, improved profitability, and increased investments, and exports (Farfan & Breyer, 2017). Several studies have shown that aligning a firm's internal processes is essential for achieving superior social performance (Matos & Silvestre, 2013; Silvestre & Țircă, 2019). Recent studies have also indicated that innovation can address broader societal challenges at the macro level, such as poverty reduction, social inclusion, corruption prevention, human rights promotion, and immigration issues (Kuzma et al., 2020). At the firm level, innovation can enhance occupational safety and health, provide training opportunities, ensure compliance with labor practices, protect human rights, and promote cultural diversity (Kuzma et al., 2020). Our study demonstrates how various initiatives, implemented through management practices, technology, and policies, encourage employee learning and contribute to micro-level improvements, ultimately yielding combined social benefits that drive the development of new products and processes.

## Limitations and future research

Our study opens up several avenues for future research. First, while this study enabled us to investigate the moderating role of organizational climate on a buying firm's innovation creation, we were not able to provide a deeper explanation regarding why social support does not moderate the link between firm innovation and the way a firm is embedded in its supply network, requiring further research.

Second, the interaction between organizational culture and climate from the context of innovation needs further investigation. As discussed, organizational culture is regarded as a key determinant of organizational climate (Moran & Volkwein, 1992). Future studies could examine how the organizational culture influences the way the organizational climate moderates the relationship between structural embeddedness and innovation, which is beyond the scope of this study.

Third, this study examined three major dimensions of the organizational climate related to creativity and innovation, including social support, rewards and career progress, and work pressure management. However, there are several other constructs, including trust/openness, dynamism, liveliness, debates, conflicts, and idea support, that require further exploration.

Fourth, we categorized only positive and negative reviews, but within each category, we did not further sub-classify the reviews, including slightly positive and extremely positive reviews. Future studies could delve into additional sub-classifications to explore moderation effects on the relationship between supplier networks and the innovation performance of focal firms.

Fifth, from the focal firm's perspective, we gathered collective reviews from employees. Future studies could extract data specifically from boundary spanners, in our case, reviews from only the purchase managers in Glassdoor.

Finally, we were able to identify instruments for our independent variable, degree centrality, thereby minimizing potential endogeneity concerns. However, endogeneity issues cannot be fully ruled out, and the cross-sectional nature of our analysis implies that the empirical results should be interpreted with caution. Future studies are encouraged to validate and extend our findings by investigating the causal effects of changes in the relationships between supply network centrality, organizational climate, and innovation performance.

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## APPENDIX A: DICTIONARIES FOR ORGANIZATIONAL CLIMATE

	Dictionary for positive comments about	Dictionary for negative comments about
Social support	ATMOSPHERE	BAD BEHAVIOR
	CARE	CARE
	COLLEAGUES	CARE ABOUT EMPLOYEES
	COMMUNITY	CORPORATE POLITICS
	COMPANY CULTURE	DEAF EARS
	CORE VALUES	FAVORITISM
	CORPORATE CULTURE	FEEL APPRECIATED
	COWORKERS	FINGER POINTING
	CULTURE	LACK OF COMMUNICATION
	ENVIRONMENT	LOTS OF POLITICS
	ENVIRONMENT TO WORK	MORALE
	FAIR	OFFICE POLITICS
	FRIENDLY ENVIRONMENT	PERFORMANCE REVIEWS
	GOOD CARE	PLAY FAVORITES
	GOOD CO-WORKERS	POLITICAL
	GOOD CULTURE	POLITICS
	GOOD ENVIRONMENT	POOR COMMUNICATION
	GOOD JOB	SAFETY CULTURE
	GOOD PEOPLE	SECURITY
	GOOD WORK ENVIRONMENT	SUPPORT
	GREAT ATMOSPHERE	TEAM MEMBERS
	GREAT CO WORKERS	TOXIC
	GREAT COLLEAGUES	UNFAIR
	GREAT COWORKERS	WORK ETHICS
	GREAT CULTURE	

(Continues)

	<b>Dictionary for positive comments about</b>	<b>Dictionary for negative comments about</b>
	GREAT PEOPLE	
	GREAT PEOPLE TO WORK	
	GREAT TEAM	
	GREAT WORKING ENVIRONMENT	
	HELPFUL	
	NICE PEOPLE	
	PEOPLE ARE GREAT	
	PEOPLE I WORKED	
	PEOPLE TO WORK	
	PEOPLE WHO WORK	
	SAFETY	
	STABLE COMPANY	
	TEAM ENVIRONMENT	
	TEAM MEMBERS	
	VALUES	
	WORK CULTURE	
	WORK ENVIRONMENT	
	WORKERS	
	WORKING ENVIRONMENT	
Rewards and career progress	ADVANCE	ADVANCE
	ADVANCEMENT	ADVANCEMENT
	ADVANCEMENT OPPORTUNITIES	ADVANCEMENT OPPORTUNITIES
	BENEFIT	BASE PAY
	BONUS	BASE SALARY
	COMPENSATION	BENEFITS
	COMPETITIVE BENEFITS	BONUS
	COMPETITIVE PAY	CAREER
	COMPETITIVE SALARY	CAREER DEVELOPMENT
	DECENT BENEFITS	CAREER GOALS
	DECENT PAY	CAREER GROWTH
	FLIGHT BENEFITS	CAREER LIMITING QUESTIONS
	GOOD BENEFITS	CAREER OPPORTUNITIES
	GOOD PAY	CAREER PATH
	GOOD PAY AND BENEFITS	COMMISSION
	GOOD PEOPLE TO WORK	COMPENSATION
	GOOD SALARY	DEVELOPMENT
	GREAT BENEFITS	DIFFICULT TO ADVANCE
	GREAT COMPENSATION	DIFFICULT TO MOVE
	GREAT OPPORTUNITIES	GROWTH OPPORTUNITIES
	GREAT PAY	HEALTH CARE
	GREAT PAY AND BENEFITS	HEALTH INSURANCE
	GROWTH	HIGH DEDUCTIBLE
	GROWTH OPPORTUNITIES	HORRIBLE PAY
	GYM	LOW PAY
	HEALTH BENEFITS	OPPORTUNITIES FOR GROWTH

**Dictionary for positive comments about**

HEALTH INSURANCE  
 LOTS OF OPPORTUNITIES  
 NICE BENEFITS  
 OPPORTUNITIES FOR GROWTH  
 OPPORTUNITY TO GROW  
 PAY  
 PAY AND BENEFITS  
 PAY IS DECENT  
 PERKS  
 PLENTY OF OPPORTUNITIES  
 PROFESSIONAL DEVELOPMENT  
 PROFIT SHARING  
 ROOM FOR ADVANCEMENT  
 SALARY  
 SALARY AND BENEFITS  
 STARTING PAY  
 TRAVEL BENEFITS  
 VACATION

**Dictionary for negative comments about**

OPPORTUNITY  
 OPPORTUNITY FOR ADVANCEMENT  
 OPPORTUNITY FOR GROWTH  
 PAY IS LOW  
 PAY IS VERY LOW  
 PAY SCALE  
 PERSONAL GROWTH  
 POOR PAY  
 PROFESSIONAL DEVELOPMENT  
 PROMOTED  
 PROMOTION  
 PROMOTIONAL OPPORTUNITIES  
 ROOM FOR ADVANCEMENT  
 ROOM FOR GROWTH  
 SALARY  
 UPWARD MOBILITY  
 VACATION

**Work pressure management**

BALANCE  
 FAMILY  
 FAMILY ORIENTED  
 FLEXIBILITY  
 FLEXIBLE  
 FLEXIBLE HOURS  
 FLEXIBLE SCHEDULE  
 FLEXIBLE WORK  
 FLEXIBLE WORK HOURS  
 FLEXIBLE WORK SCHEDULE  
 GOOD WORK-LIFE BALANCE  
 GREAT WORK-LIFE BALANCE  
 HOME  
 HOURS  
 LIFE  
 LIFE BALANCE  
 MAKE YOUR OWN SCHEDULE  
 NWORK LIFE BALANCE  
 WORK AT HOME  
 WORK FROM HOME  
 WORK HOURS  
 WORK-LIFE BALANCE  
 WORKLOAD  
 WORK SCHEDULE  
 WORKING FROM HOME

BALANCE  
 FAMILY  
 HOUR  
 HOUR DAYS  
 HOURS  
 LIFE  
 LIFE BALANCE  
 LONG  
 LONG COMMUTE  
 LONG HOURS  
 LONG WORK HOURS  
 LOTS OF OVERTIME  
 MANDATORY OVERTIME  
 NWORK LIFE BALANCE  
 OVERTIME  
 POOR WORK-LIFE BALANCE  
 STRESSFUL  
 VACATION  
 VACATION TIME  
 WORK FROM HOME  
 WORK HOURS  
 WORK HOURS A WEEK  
 WORK-LIFE BALANCE  
 WORK WEEK  
 WORKING HOURS  
 WORKLOAD