



<https://doi.org/10.5559/di.28.1.06>

THE RELATIONSHIP BETWEEN INFORMAL KNOWLEDGE SHARING NETWORK AND INDIVIDUAL LEARNING IN ORGANIZATIONS: DOES THE STRUCTURING OF ACTIVITIES MATTER?

Aleša Saša SITAR
Faculty of Economics, Ljubljana

Sabina BOGILOVIĆ
Faculty of Administration, Ljubljana

Marko PAHOR
Faculty of Economics, Ljubljana

UDK: 005.72
Izvorni znanstveni rad

Priljeno: 16. 7. 2018.

Capitalizing on organizational network theory, we address the relationship between informal-knowledge-sharing-network characteristics (in-degree and out-degree centrality) and the level of internal and external learning. Specifically, the paper examines differences in the use of various relationships when employees are learning internally or externally and explores the moderating role of the perceived organic structuring of activities. The results show the employees resort to informal-knowledge-generating relationships (informal in-degree) to obtain knowledge internally, whereas, when learning externally, employees rely on informal-knowledge-sharing relationships (informal out-degree) to disseminate the knowledge they obtain from outside the organization. The anticipated moderating role of the organic structuring of activities is not confirmed, holding important implications for both theory and practice.

Keywords: informal knowledge sharing network, internal learning, external learning, organic structuring of activities



Sabina Bogilović, Faculty of Administration, University of Ljubljana, Gosarjeva ulica 5, 1000 Ljubljana, Slovenia.
E-mail: sabina.bogilovic@fu.uni-lj.si

Organizations are increasingly studied as networks (Reinholt, Pedersen, & Foss, 2011) to resolve organizational phenomena (Kilduff & Brass, 2010b) such as creativity, innovation, knowledge sharing (Burt, 2004; Reinholt et al., 2011; Tsai, 2001), and to explain behaviors closely related to employees' learning (Phelps, Heidl, & Wadhwa, 2012). To remain competitive, contemporary managers need insights into specific network characteristics that stimulate learning in organizations. However, literature on knowledge networks (Hollenbeck & Jamieson, 2015; Phelps et al., 2012) is scarce when it comes to findings about the relationship between the organizational network position and specific learning behaviors of individuals (such as internal and external learning). Although the impact of informal network structure on knowledge transfer among business units has been addressed (Reagans & McEvily, 2003), the specific role played by informal-knowledge-sharing networks for stimulating internal and external learning has yet to be adequately explained.

In addition, the way activities are structured as part of the broader organizational and work design (Mintzberg, 1979) and how they affect the building of informal relationships for internal and external learning has not been examined in the literature. Organizational design research offers some insight into how mechanistic organizational structures are detrimental to certain learning behaviors like idea generation (Keum & See, 2017) and knowledge exchange, external learning and double-loop learning (Sitar, Pahor, & Škerlavaj, 2018). Yet it is still not fully clear how organic organizational structures can enhance learning (i.e., internal or external learning) when employees hold a central position in the knowledge network.

In this paper, our aim is to add to the traditional social network theory claim that the advantages of social networks are embedded in social positions (Burt, 1986; Wellman & Berkowitz, 1988) by exploring how a central position (i.e., in-degree and out-degree centrality) in the knowledge network is associated with employees' internal or external learning. By using a social network approach, we also wish to examine how the structural characteristics of knowledge-sharing networks shape different learning behavior in conditions of organic work designs, specifically the organic structuring of activities (i.e. organic organization). We posit that structural characteristics which stimulate internal learning when activities are organically structured differ from those that support external learning. Applying an actor-level analysis (Borgatti & Foster, 2003) and by combining the structural and behavioral perspective on learning in organizations (Brass & Burkhardt, 1993), we consider how the organic structuring of activities as part

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of the work design modifies the relationship between network structure and employees' learning behavior. By bringing together literature on organizational networks, learning in organizations, and organizational/work design, we aim to contribute to better understanding of the differences in relationships that support internal and external learning.

CENTRAL POSITION IN INFORMAL INTRAORGANIZATIONAL NETWORKS

Organizations are today often conceptualized as networks in which different units (e.g., individual employees, teams, departments, or subsidiaries) represent nodes that are connected by some type of social relationship (Brass, Galaskiewicz, Greve, & Tsai, 2004; Cross & Cummings, 2004; Hansen, 2002; Ibarra, Kilduff, & Tsai, 2005; Reinholt et al., 2011; Tsai, 2001). Organizational social network research shows that different structural and relational properties (e.g., centrality, strong/weak ties, in/direct ties) can influence performance-related outcomes such as overall job performance ratings (Cross & Cummings, 2004), productivity (Hansen, 2002; Reagans & Zuckerman, 2001), and innovation (Tsai, 2001; Tsai & Ghoshal, 1998). Thus, managers of today's knowledge-intensive organizations need to know which specific network properties (e.g., centrality) among employees can enhance their individual learning in order to stay ahead of the competition.

In organizations, individuals are involved in multiple types of relationships and networks, impacting knowledge creation and transfer (Phelps et al., 2012) via informal (advice, friendship, affective) ties. Since the relationships appearing on organizational charts do not reflect the actual day-to-day practice of how work is accomplished (Han, 1996), informal networks coexist in organizations and can influence employees' individual work and learning. As such, work-related tasks are embedded within informal networks of communication, advice, and friendship relationships (Kilduff & Brass, 2010b). Informal networks offer better support for knowledge sharing in organizational settings. Particularly communities of practice, which are built mostly independently of the formal structure, provide support for knowledge exchange (Aljuwaiber, 2016). For example, Reagans and McEvily's (2003) research on knowledge-based theory recognized that the ability to transfer knowledge in organizations is critical for several organizational processes and outcomes, thus confirming the role of informal network structure in knowledge transfer where employees share knowledge with coworkers in the form of advice, on-the-job help, new knowledge and collaboration. Accordingly, in this paper we shall explore the importance of infor-

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mal relationships among employees and their link with individual learning behavior.

To explore the role played by informal relationships, degree centrality is a measure that is commonly used in organizational knowledge network research (Carpenter, Li, & Jiang, 2012). Degree centrality may be a good indicator of informal status in organizations (Krackhardt, 1992) because individuals in the central position of a knowledge network are 'in the thick of things' and are the focal points of communication (Freeman, 1978; Reinholt et al., 2011). They thus can have more access to information, innovation, stimulating creativity, and knowledge sharing (e.g., Baldwin, Bedell, & Johnson, 1997; Brass, 1984; Ibarra & Andrews, 1993; Burt, 2004; Reinholt et al., 2011; Tsai, 2001). As Freeman (1978) explains, degree centrality can be further broken down into two types: direct informal ties that a focal individual establishes with other individuals in the social network (i.e., out-degree centrality) and direct informal ties that a focal individual has with other individuals in the social network (i.e., in-degree centrality). As such, in-degree centrality is the number of other people who choose that person in a particular relationship; it is the number of incoming ties. Out-degree centrality is the number of people chosen by the person; hence, the number of outgoing ties. In-degree centrality vs. out-degree centrality in an informal-knowledge-sharing network are also defined as knowledge inflows vs. knowledge outflows representing knowledge-collecting vs. knowledge-donating behavior (Cavaliere, Lombardi, & Giustiniano, 2015). Taken together, in this paper we will explore how informal in-degree and out-degree centrality are connected to learning (i.e., external and internal).

In-degree centrality and internal learning

Employees of organizations learn by either accumulating internal knowledge in the organization or gathering and integrating external information (Shin, Picken, & Dess, 2017). The literature refers to these two types of organizational learning as internal or external learning (Huber, 1991; Levitt & March, 1988). Internal learning starts with individuals asking for knowledge and sharing the internal knowledge with their co-workers (Simon, 1991). It includes learning from sources of knowledge internal to the organization (Kessler, Bierly, & Gopalakrishnan, 2000) such as a personal or telephone conversation with co-workers, teamwork, intranet, emails among co-workers, internal seminars and training programs, internal meetings, internal documents, etc. (Davenport & Prusak, 1998). Thus, besides formal relationships, internal learning requires a large number of informal relationships in order for employees to obtain certain knowledge from their co-workers via different channels.

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In-degree centrality, as part of the informal relationships among colleagues, is crucial for internal learning, while individuals with high in-degree centrality are sought after for their companionship and work-related input (Klein, Lim, Saltz, & Mayer, 2004). Moreover, coworkers often go to for advice (advice centrality) and consider as a friend (friendship centrality) individuals with high in-degree centrality (Klein et al., 2004). Closer friends are likely to have a larger number of conversations and disclose more information (Bhardwaj, Qureshi, Konrad, & Lee, 2016) and are therefore more likely to be engaged in learning behavior with each other. In addition, Lazega (1992) explains cognitive status as a special kind of status that is measured by in-degree centrality in advice networks, which is often treated as a proxy for learning networks. Hence, high in-degree centrality in a knowledge-sharing network will stimulate internal learning by enabling employees to source knowledge from colleagues based on their friendship centrality and advice centrality position in the intraorganizational knowledge network. In-degree centrality (Aljuwaiber, 2016) will also support internal learning by providing employees with on-the-job help and new knowledge from coworkers through an incoming relationship. Thus, the more the employee is a knowledge receiver with informal incoming relationships, the higher is their level of internal learning. We therefore expect that the higher the individual's in-degree in an informal-knowledge-sharing network, the more likely it is that employee will engage in internal learning, and thus propose:

H1: The in-degree centrality of an employee in an informal network is positively related to internal learning.

Out-degree centrality and external learning

External learning begins by identifying new knowledge from different outside sources such as customers, competitors, suppliers, universities, research centers, and other industries, which is then transferred across the organization (Dahlander, O'Mahony, & Gann, 2016; Kessler et al., 2000). It encompasses learning from external sources of knowledge found and derived from the organizational environment, along with knowledge sourced from different literature (e.g., books, journals, papers), the Internet (e.g., forums, online debates), etc. (Davenport & Prusak, 1998). External learning based on knowledge lying outside the organization is particularly valued in R&D organizations that are under constant pressure to provide innovation (Fey & Birkinshaw, 2005). It starts with sourcing outside knowledge and then transferring the acquired knowledge across the organization (Kessler et al., 2000). As

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such, we propose the role of informal intra-organizational networks might vary for external learning and for internal learning.

As mentioned, out-degree centrality is defined as the number of outgoing informal ties, more precisely direct informal ties, that a focal individual establishes with other individuals in the social network (Freeman, 1978). High out-degree centrality means employees are more likely to share external knowledge they obtain since they are more inclined to actively seek out members to discuss relevant work issues (Ho & Pollack, 2014). Ho and Pollack (2014) found that entrepreneurs' harmonious passion is positively related to their out-degree centrality, which indicates that individuals with a high out-degree are more likely to proactively embrace the opportunities in networking groups to share knowledge. In addition, a high out-degree position increases both the amount and diversity of resources an individual can obtain and share (Stam & Elfring, 2008). A high measure of out-degree centrality thus indicates external learning is supported by outgoing relationships used for sharing externally obtained knowledge in the form of advice, on-the-job help, or new knowledge with their co-workers. Furthermore, "employees high in network centrality are not only in a position to obtain access to a great amount of knowledge, but are also seen as attractive knowledge-sharing partners by others" (Reinholt et al., 2011, p. 1279). Thus, the more the employee is a knowledge sender via informal outgoing relationships, the higher is their level of external learning. We therefore expect that the higher the individual's out-degree centrality in an informal-knowledge-sharing network, the more likely they are to engage in external learning.

H2: The out-degree centrality of an individual in an informal network is positively related to external learning.

The moderating role of the organic structuring of activities

Work design can be explained as the content of how organizations design tasks, activities, relationships, and responsibilities of an individual's work (Parker, 2014). It is strongly related to the structuring of activities (formalization, specialization, standardization of activities) where different organizational designs are found to influence external learning. Accordingly, the structuring of activities represents part of work design on the individual level as an element of broader organization and work design (Mintzberg, 1979). Doreian and Conti's (2012) research shows that work design impacts the social relations formed in organizations. When work design defines tasks well and is more formalized, it can be organized serially, with lim-

ited communication, whereas if work is ambiguous and less formalized, it requires interaction and is organized collaboratively (Repenning, Kieffer, & Repenning, 2018). Furthermore, research on work design acknowledges that certain work designs, especially a less centralized organizational structure, can stimulate greater knowledge sharing (Wang & Noe, 2010) and thus intensive employees' learning (Parker, 2014). We therefore predict that work design based on the extent to which activities at work are structured (e.g., organic structure of activities) might influence how informal social relationships (i.e., in-degree centrality and out-degree centrality) stimulate certain employees' learning behavior (i.e., internal learning and external learning).

Organically designed jobs and working activities indicate that decision-making is decentralized; employees pay greater attention to developing informal relationships, multidirectional communication and integration processes to coordinate work activities (Aiken & Hage, 1971; Bruns & Stalker, 1961). We thus predict that an organic structuring of work activities will stimulate informal social relationships (i.e., in-degree centrality and out-degree centrality). Organic structures namely allow employees to establish more efficient communication between different management levels (Winter, 1994) and are more suitable for socialization based on Nonaka and Takeuchi's (1995) model of knowledge conversions. Informal social relationships are also more enhanced in an organic structuring of work activities. The increased emphasis on decentralized decision-making "allows employees closest to internal tacit knowledge greater participation in decision-making processes, highlighting their roles in improving products and processes through facts and knowledge" (Huang, Rode, & Schroeder, 2011, p. 1106). Second, learning occurs more easily within organic structures while employees recognize their interdependence and are thus willing to share information to achieve the firm's vision and sustain its effectiveness (Fiol & Lyles, 1985; Slater & Narver, 1995; Vera & Crossan, 2004). In addition, empirical evidence shows that an organic organizational structure stimulates learning (Huang et al., 2011; Martínez-León & Martínez-García, 2011). We therefore predict that if employees perceive the structuring of activities as more organic, they will rely more on informal relationships (i.e., in-degree centrality and out-degree centrality) to communicate, socialize, and share their knowledge, with this then stimulating their internal learning behavior. Thus, we hypothesize:

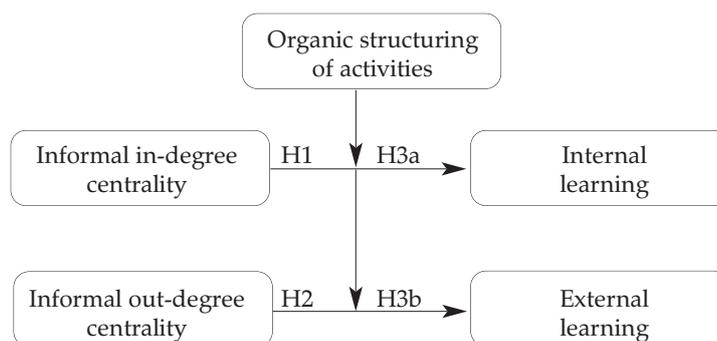
H3a: The organic structuring of activities moderates the positive relationship between an individual's in-degree centrality in an informal network and internal learning such that it strengthens the relationship.

We predict the same mechanism will emerge in the out-degree and external learning relationship. In conditions of less formalized work, enhanced informal channels may also be useful for employees to share externally obtained knowledge across the organization (Huang et al., 2011) because an organic structure is not only suitable for socialization but also for externalization (Martínez-León & Martínez-García, 2011). On this basis, we propose the positive relationship between out-degree centrality in an informal network and external learning will strengthen if employees perceive the structuring of activities is more organic. We thus hypothesize:

H3b: The organic structuring of activities moderates the positive relationship between an individual's out-degree centrality in an informal network and external learning such that it strengthens the relationship.

Figure 1 presents our proposed hypotheses.

FIGURE 1
Relationships between
the focal constructs



METHODS

Data collection and procedures

A large Slovenian company from the coatings industry known for investing in R&D and employee learning was selected for the research site. Preliminary interviews with company representatives (human resource manager, total quality manager, and R&D manager) confirmed that the company and employees spend a considerable amount of time on knowledge-related activities (creating, searching, sharing, using knowledge). We therefore developed and sent out a questionnaire to 157 employees in 12 different departments (6 R&D units, 4 production units, technology and quality control). The departments were chosen together with company representatives due to the expected differences in the various employees' learning behavior (R&D involved in external learning, production in internal learning) and work design (R&D with

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a less structured work design and production with a more structured work design). The questionnaire was distributed online and on paper for those employees without access to a computer. Overall, 100 employees responded to the questionnaire, making the response rate 64%.

All variables were self-reported, a common approach to this type of research. As suggested in the literature (Kilduff & Krackhardt, 1994), we relied on individuals' perceptions of social networks as a measure of social ties. Perceptual measures were applied for internal and external learning as they are found to provide important evidence that learning/knowledge transfer has occurred within or between organizations (Easterby-Smith, Lyles, & Tsang, 2008). Regarding the respondents, 63% were male and the average age was 42 years. Individual measures obtained from organizational network analysis were used in regression models following Ibarra (1992). The assumptions of regression analysis about the linearity of the dependent variable, a normal distribution of errors, and non-significant multicollinearity among the independent variables were checked.

Measures

Given that implicit and explicit knowledge were obtained in different ways, we included items to account for learning both types of knowledge.

Internal learning. We asked employees how often they obtain knowledge through a face-to-face conversation or a phone call with a co-worker, in internal project and other documents, when they solve problems together during team meetings, when attending internal seminars, training, and education programs and while discussing problems at internal meetings. Five items were derived from the literature to reflect different internal sources of knowledge (Davenport & Prusak, 1998). The items were measured on a five-point scale, where 0 = "never," 1 = "a few times per year," 2 = "a few times per month," 3 = "a few times per week," and 4 = "daily." A sample item is "Face-to-face conversation or a phone call with a co-worker". Factor analysis confirmed a single measure for internal learning ($\alpha = 0.77$).

External learning. The employees were asked how often they obtain knowledge on the Internet, by asking a supplier, buyer, or competitor, when searching for knowledge in different literature (books, journals, papers, etc.) and while following discussions on forums and debates on the Internet. Four items were used to reflect different external knowledge sources (Davenport & Prusak, 1998). These items were measured on the same five-point scale as above. A sample item is "I search for knowledge on the Internet". Factor analysis confirmed a single measure for external learning ($\alpha = 0.90$).

In-degree was calculated from the number of individuals from whom a certain person receives advice, on-the-job help, and new knowledge, hence, from the number of a certain individual's incoming informal relationships, representing the level of support they receive from co-workers in the form of knowledge. The higher the number of incoming informal relationships, the higher the in-degree measure.

Out-degree was calculated from the number of outgoing relationships, indicating to whom a certain person gives advice, on-the-job help and new knowledge, representing that person's level of influence on their co-workers through knowledge sharing. The higher the number of outgoing informal relationships, the higher the out-degree measure.

Organic structuring of activities was measured on the individual employee level with a four-item scale ($\alpha = 0.90$) relating to three structural characteristics of the formalization, standardization, and specialization of work (Pugh, 2003; Pugh, Hickson, Hinings, & Turner, 1968). Response options ranged from 1 = "completely disagree" to 5 = "completely agree". We used a reverse scale to measure the organic structuring of activities. A sample item is "My work is specified in detail".

We also controlled for gender, age, and two department dummies (R&D, production) to control for the impact of social proximity.

RESULTS

TABLE 1
Descriptive statistics
and correlations
among variables used
in the research ^{a, b}

Variable	M	SD	1	2	3	6	7	8	9	10	11
1 Gender	0.349	0.479	-								
2 R&D unit	0.547	0.500	0.388**	-							
3 Production unit	0.340	0.476	-0.525**	-0.788**	-						
6 Age	42.160	8.590	-0.053	-0.194*	0.154	-					
7 Organic	3.017	1.009	-0.007	0.253**	-0.291**	0.040	(0.90)				
8 In-degree centrality	0.234	0.139	-0.182	-0.372**	0.425**	0.061	-0.546**	-			
9 Out-degree centrality	0.237	0.192	-0.113	-0.188	0.132	0.194*	-0.193	0.635**	-		
10 Internal learning	1.390	0.764	0.007	-0.219*	0.094	0.185	0.089	0.298**	0.368**	(0.77)	
11 External learning	1.058	0.868	0.085	0.325**	-0.344**	-0.104	0.421**	-0.124	0.163	0.495**	(0.90)

^a n = 100

^b Coefficient alphas are on the diagonal in parentheses
Statistical significance levels: ** $p < 0.01$, * $p < 0.05$

First, we conducted a hierarchical ordinary least squares (OLS) regression to test whether informal in-degree is positively related to informal learning (H1) and whether the organic structuring of activities (H3a) moderates this relation-

TABLE 2
Regression analyses
results for internal
learning as the
dependent variable

Variables	Step 1				Step 2				Step 3			
	<i>b</i>	<i>SE</i>	β	<i>t</i>	<i>b</i>	<i>SE</i>	β	<i>t</i>	<i>b</i>	<i>SE</i>	β	<i>t</i>
Gender	0.13	0.17	0.08	0.78	0.11	0.17	0.07	0.63	0.15	0.18	0.10	0.86
R&D department	-0.38†	0.22	-0.25	-1.69	-0.41†	0.22	-0.27	-1.82	-0.43†	0.22	-0.28	-1.90
Production unit	-0.10	0.25	-0.06	-0.38	-0.23	0.27	-0.14	-0.86	-0.25	0.27	-0.16	-0.94
Age	0.01	0.01	0.06	0.63	0.01	0.01	0.08	0.81	0.01	0.01	0.08	0.82
Out-degree centrality	4.54**	1.08	0.39	4.20	2.24	1.57	0.19	1.43	2.27	1.57	0.20	1.45
Organic					0.04	0.07	0.05	0.52	0.17	0.15	0.22	1.09
<i>In-degree centrality</i>					4.88†	2.49	0.26	1.96	10.47†	6.34	0.56	1.65
<i>In-degree centrality*organic</i>									-1.65	1.72	-0.37	-0.96
<i>R</i> ²		0.23				0.26				0.27		
ΔR^2		0.23				0.03				0.01		
<i>F</i> (<i>df</i>)		5.59** (96)				4.66** (93)				4.18** (92)		

****p* < 0.001, ***p* < 0.01, **p* < 0.05, †*p* < 0.1

Variables	Step 1				Step 2				Step 3			
	<i>b</i>	<i>SE</i>	β	<i>t</i>	<i>b</i>	<i>SE</i>	β	<i>t</i>	<i>b</i>	<i>SE</i>	β	<i>t</i>
Gender	-0.23	0.20	-0.13	-1.18	-0.05	0.19	-0.03	-0.29	-0.03	0.19	-0.02	-0.15
R&D department	0.26	0.26	0.15	1.00	0.30	0.24	0.17	1.23	0.26	0.24	0.15	1.08
Production unit	-0.62*	0.29	-0.34	-2.11	-0.19	0.29	-0.11	-0.67	-0.23	0.29	-0.13	-0.78
Age	-0.01	0.01	-0.06	-0.64	-0.01	0.01	-0.14	1.52	-0.01	0.01	-0.13	-1.51
In-degree centrality	4.77*	2.02	0.23	2.36	-0.76	2.69	-0.04	-0.28	-0.19	2.75	-0.01	-0.07
Organic					0.24**	0.08	0.28	2.98	0.34**	0.13	0.39	2.69
<i>Out-degree centrality</i>					4.11*	1.71	0.31	2.40	7.73†	3.95	0.59	1.96
<i>Out-degree centrality*organic</i>									-1.20	1.18	-0.35	-1.02
<i>R</i> ²		0.19				0.32				0.33		
<i>D R</i> ²		0.19				0.13				0.01		
<i>F</i> (<i>df</i>)		4.37** (96)				6.30** (94)				5.64** (93)		

****p* < 0.001, ***p* < 0.01, **p* < 0.05, †*p* < 0.1

TABLE 3
Regression analyses
results for external
learning as the
dependent variable

ship. In step 1, we entered the control variable (i.e., gender, R&D department, production department, age, informal out-degree); in step 2, we added informal in-degree and the organic structuring of activities. In-degree was found to be positively related to internal learning ($\beta = 0.26, se = 2.49, p < 0.10$), marginally supporting Hypothesis 1 (see Table 2, step 2). In step 3, we added the interaction between informal in-degree and the organic structuring of activities ($\beta = -1.65, se = 1.72, ns.g.$), although the interaction had no statistical significance. Thus, Hypothesis 3a is rejected. Moreover, from Table 2 step 3 we can see that in-degree was still marginally positively related to internal learning ($\beta = 0.26, se = 2.49, p < 0.10$) even though we put the interaction between informal in-degree and the organic structuring of activities.

We were then interested in analyzing whether informal out-degree is positively related to external learning (H2) and if the organic structuring of activities (H3b) moderates this relationship. Thus, we conducted separate hierarchical ordinary least squares (OLS) regression by entering the control

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variable (i.e., gender, R&D department, production department, age, informal in-degree) in step 1 and in step 2 adding in informal out-degree and the organic structuring of activities. The results given in Table 3 show that informal out-degree was found to be positively related to external learning ($\beta = 0.31, se = 1.71, p < 0.05$), providing support for Hypothesis 2. In step 3, we further tested the interaction between informal out-degree and the organic structuring of activities on external learning (see Table 3). The results reveal that the organic structuring of activities does not have a moderating impact on the informal out-degree and external learning relationship ($\beta = -1.20, se = 1.18, p > 0.10$). Accordingly, Hypothesis 3b is rejected.

DISCUSSION

Theoretical contributions

Organizational network research, specifically research into knowledge networks (Phelps et al., 2012), recognizes that employees need to establish relationships with their colleagues if they wish to utilize each other's knowledge (Borgatti & Cross, 2003). However, previous research does not provide sufficient information concerning the relationship between the network characteristics of employees and internal and external learning, the two crucial behaviors in learning organizations contributing to competitive advantage (Shin et al., 2017). Moreover, by combining the structural and behavioral perspective (Brass & Burkhardt, 1993), we acknowledge that particular learning behaviors are associated with a specific structural position. Our research shows there are substantial differences in network utilization when it comes to internal and external learning. The results also demonstrate that employee internal learning is stimulated by the relevant internal knowledge relationships that they have with their co-workers, whereas external learning is related to informal relationships that distribute knowledge obtained externally within the organization. As such, we first add to the social network literature and organizational learning literature by researching which specific informal network properties (i.e., in-degree and out-degree centrality) commonly used in the organizational-knowledge-sharing-network literature (Carpenter et al., 2012) determine specific learning behavior (i.e., external and internal learning).

Second, we advance the social network literature and its traditional social network theory by claiming that the advantages of social networks are embedded in social positions (Burt, 1986; Wellman & Berkowitz, 1988). We show that employees can only learn from their internal or external environment if they hold a strong central position (i.e., in-degree

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and out-degree centrality) in the knowledge network. We also add to the social network literature by highlighting the importance of informal relationships and of separately exploring the impacts of in-degree and out-degree centrality. We thus answer a call by Porter and Woo (2015) to explore in more detail how colleagues' perceptions of one another shape informal dyadic relationships.

Third, we contribute to the organizational learning theory by showing that not only strong ties with a more capable peer (Holley, Santos, Cook, & Kerr, 2016) and participation in internal and external networks (Van Der Heijden, Boon, Van der Klink, & Meijs, 2009) can stimulate employees' learning, but that holding a central position in knowledge networks is the key to learning behavior. Moreover, with this research we add to previous team-level research on the relationship between centrality and organizational learning (Murray & Moses, 2005). We show that on the individual level in-degree centrality relates to internal learning and out-degree centrality to external learning. By dividing learning into internal and external employee learning behavior, we further advance the organizational learning theory by providing greater insight into the network properties that support specific employee learning behavior.

Fourth, although our research indicates that the organic structuring of activities does not moderate the proposed relationships, suggesting that informal relationships for sharing externally and internally obtained knowledge are beyond managers' reach, we add to the work design literature which has neglected the fact that network interactions can be a source of learning behavior (Kilduff & Brass, 2010a). Due to the fact that the structuring of activities represents the design of work on the individual level as part of broader organization and work design (Mintzberg, 1979), this research may be seen as a first step towards exploring how structural properties on the organizational or departmental level (e.g., size, centralization, formalization, number of levels) impact the ways work is designed (Oldham & Fried, 2016).

Managerial implications

This paper examines how structural characteristics shape different employee learning behaviors and thus provides managers with a better understanding of the differences in relationships and how they stimulate employees' internal and external learning. As both types of learning are required in learning organizations, managers must implement distinct practices to support each of them by supporting employees in building informal relationships. In particular, supporting commu-

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nities of practice to enable informal knowledge sharing and creating good working environments for employees (Aljuwaiber, 2016) will benefit internal and external learning by obtaining knowledge from co-workers, and by sharing knowledge obtained externally throughout the organization. Managers might also benefit from the finding that the way activities are formally structured does not influence the relationship between one's position in the informal-knowledge-sharing network and the learning behavior of employees.

LIMITATIONS, FUTURE RESEARCH, AND CONCLUSION

Our research has some important limitations due to the research design, use of cross-sectional data and a single data source, causing common method bias. The first limitation relates to generalizability given that the research was performed in a single organization. We recommend repeating the research in various organizations from different industries for the purpose of comparative analysis. Second, although we incorporated informal relationship and organizational structure as boundary conditions for employee learning (i.e., internal and external), we suggest future research also explore other important network characteristics (ex. structural holes, weak/strong ties) to provide further insights into the social knowledge network's relationship with employee learning.

The third limitation relates to our research approach. In line with Klein and Kozlowski (2000), we suspect that a top-down multilevel approach would provide a better understanding of the higher-level characteristics influencing lower levels. Moreover, because the competitive environment today means work is constantly shifting between routine and complex tasks, demanding high levels of formalization at certain times and of collaboration at others (Repenning et al., 2018), it would be valuable to investigate how patterns of relationships change over time due to this dynamic work design. We thus encourage future studies to use a multilevel approach (Klein & Kozlowski, 2000) and/or investigate the proposed relationships longitudinally. It would also be beneficial if research were to tackle the employees' perspective and how they themselves can change their job design to create better outcomes such as learning without changing formal policies and job descriptions (Oldham & Fried, 2016; Oldham & Hackman, 2010). Employees' jobs could be redesigned to balance the motivational and organic organizational structure and thereby enhance both satisfaction/learning and efficiency outcomes (Morgeson & Campion, 2002). Namely, future research that incorporates the employees' perception of their job's design and learning behavior is needed.

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Odnos između neformalne mreže dijeljenja znanja i individualnog učenja u organizacijama: koliko je važno strukturiranje aktivnosti?

Aleša Saša SITAR
Ekonomski fakultet, Ljubljana

Sabina BOGILOVIĆ
Fakultet za upravu, Ljubljana

Marko PAHOR
Ekonomski fakultet, Ljubljana

Na temelju teorije organizacijskih mreža istražen je odnos između obilježja neformalne mreže dijeljenja znanja (unutarnji i vanjski stupanj centralnosti) i stupnja unutarnjeg i vanjskog učenja kod zaposlenika. Specifično, rad ispituje razlike u upotrebi mreže dijeljenja znanja u situaciji kad zaposlenici uče iz unutarnjeg ili vanjskog izvora te istražuje moderatorski utjecaj percipiranoga organskog strukturiranja aktivnosti. Rezultati pokazuju da se zaposlenici koriste neformalnim unutarnjim vezama za interno učenje, odnosno oslanjaju se na neformalne vanjske veze za vanjsko učenje i diseminaciju znanja. Očekivana moderirajuća uloga organskoga strukturiranja aktivnosti nije potvrđena, što nudi važne implikacije za teoriju i praksu.

Ključne riječi: neformalna mreža dijeljenja znanja, unutarnje učenje, vanjsko učenje, organsko strukturirane aktivnosti



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