How transactive memory systems relate to organizational innovation: the mediating role of developmental leadership

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Abstract

Purpose – *The purpose of this paper is to explore the relationship between transactive memory systems and organizational innovation. Several recent studies have discussed the positive relationship between these two entities. Yet, very few studies have demonstrated how transactive memory systems are related to leadership and innovation. This study investigates this tripartite relationship, finding that developmental leadership exerts a mediating effect on the relationship between transactive memory systems and organizational innovation.*

Design/methodology/approach – *In examining this relationship, 224 participants from an electronics company in South Korea were surveyed. Structural equation modeling was used to enable the identification of simultaneous interactive relationships among the three research variables.*

Findings – *Contrary to previous research results, transactive memory systems were found not to be significantly related to organizational innovation. Results also indicated that transactive memory systems comprise a statistically significant variable that influences developmental leadership. Subsequently, developmental leadership can be considered to be a valid construct in predicting organizational innovation; it can also be seen to fully mediate the relationship between transactive memory systems and organizational innovation.*

Originality/value – *These results have theoretical and managerial implications. As transactive memory systems do not always precede organizational innovation, knowledge of "who knows what" is not enough to ensure innovative performances. To accelerate organizational innovation, intentional managerial interventions such as developmental leadership are accordingly necessary.*

Keywords *Knowledge driven organizations, Leadership, Knowledge sharing, Organizational innovation*

Paper type *Research paper*

Organizational knowledge is constantly changing: that is, yesterday's knowledge may not be valid at present, let alone tomorrow. In a knowledge economy in which the depreciation of knowledge happens more quickly than ever, recognizing how to learn, unlearn and relearn knowledge is critical for companies seeking to maintain their competitive advantages (Azmi, 2008; Villasalero, 2014; Zhao *et al.*, 2013). Yet, managing knowledge is a complicated practice because, unlike other tangible management resources, knowledge is diffused among numerous people, tasks, tools and routines, as well as in the linkages among these entities (Yuan *et al.*, 2010). Thus, the concept of transactive memory systems (TMS) has attracted significant interest among researchers as a mechanism for describing cognitive division of labor, including who possesses knowledge and how the knowledge is shared and coordinated (Wegner, 1986).

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Previous empirical studies have explored TMS's enhancement of group innovation, focusing particularly on how group members specialize in different types of knowledge and use each other as external cognitive aids (Akgün *et al.*, 2006; Fan *et al.*, 2016; Gino *et al.*,

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2010; Peltokorpi and Hasu, 2011, 2014, 2016). Appropriate knowledge retrieved from TMS is integrated into preexisting knowledge to generate novel ideas and encourage innovative solutions to challenging tasks (Cordery and Soo, 2008). However, the benefits of TMS may not be consistent due to various organizational dynamics. TMS is a socio-cognitive phenomenon, the development and extension of which is influenced by the nature of the social interactions present, such as team identification (Liao *et al.*, 2012), team affectivity (Hood *et al.*, 2015) and trust (Tang, 2015). As large organizations that are made up of multiple subgroups tend to be less cohesive than small work groups, employees in large organizations may lack the motivation to contribute to TMS (Moreland, 1999; Peltokorpi, 2012). Jarvenpaa and Majchrzak (2008) have assumed that within large organizations, TMS is able to classify the information that should be shared from the information that should not.

To increase TMS's impact in driving organizational innovation, leaders must work to coordinate TMS (e.g. as boundary spanners and knowledge catalysts; Hannah and Lester, 2009; Peltokorpi, 2012; Ren and Argote, 2011). As leaders are central for capturing, creating and sharing knowledge, Hannah and Lester (2009) have suggested that leaders should take more active roles in promoting the creation and diffusion of knowledge across large organizations. In particular, developmental leadership – the cognitive, emotional and behavioral processes of establishing synergistic relationships with employees – is said to mediate the relationship between TMS and organizational innovation by providing opportunities for employees to work and collaborate innovatively (Gilley *et al.*, 2011; Marks and Louis, 1999). This study accordingly investigates a tripartite relationship, with findings that have both theoretical and practical implications for understanding the relationship among knowledge management, leadership and innovation.

Research background and hypotheses

Transactive memory systems

The concept of TMS was first introduced to explain the behavior of dating couples in close relationships. Wegner *et al.* (1991) have found that intimate dyads showed better memory performance than impromptu pairs when recalling words in the laboratory setting. This finding suggests that if each partner focuses on remembering a certain piece of information and the two can subsequently retrieve and exchange the information by simply talking to each other, each partner is responsible for less information individually while having more information in total (Jackson and Moreland, 2009). This dynamic indicates that individuals in ongoing interactions are likely to use socially shared cognition that allows them to depend on their partners' cognitive domains as external aids (Wegner *et al.*, 1991). Many studies have since been conducted on couples and dyads, showing that people use other people as external memory storage for saving information that they themselves do not have (Hollingshead, 1998; Johansson *et al.*, 2000).

At the group level, members are able to share cognitive labor with those who work with them toward common goals; this facilitates better group performance (Liao *et al.*, 2012). Work groups need longer periods and greater communication density to develop TMS, unlike close couples who already know each other well. Brandon and Hollingshead (2004) have argued that group members can establish TMS by using iterative construction and evaluation processes to validate the credibility of group members' expertise while working

and training together. Through these processes, group members can depend on each other to be responsible for their particular domains of expertise, and this reciprocal interdependence gives the members the freedom to develop sophisticated expertise in their own specialty areas (Lewis, 2003). Numerous studies have corroborated the assertion that a well-tailored TMS enhances group performance within multiple work contexts (Austin, 2003; Choi *et al.*, 2010; Liang *et al.*, 1995; Pearsall and Ellis, 2006; Rulke and Rau, 2000; Yoo and Kanawattanachai, 2001).

At the organizational level, Peltokorpi (2012) has defined TMS as "the networks of interdependent work groups that use each other as external cognitive aids to accomplish shared tasks" (p. 12). TMS at the organizational level may be formed by and function according to technological and interpersonal approaches (Peltokorpi, 2012, 2014). Peltokorpi (2014) has argued that the technological approach helps identify the location of knowledge and its sharing via direct (e.g. yellow pages) and indirect interactions (e.g. enterprise social networks; Ren and Argote, 2011) through information and communication technology. The interpersonal approach, on the other hand, depends on personal direct (knowing what other people know) and indirect (knowing who other people know) social networks to search for, identify, contact and retrieve appropriate information from parties beyond the group (Peltokorpi, 2014). However, Moreland (1999) has argued that because organizations are larger than groups and have more complicated structures, employees in organizations comprising subgroups have trouble locating knowledge and retrieving necessary information. Peltokorpi (2012) has suggested that members in inter-groups are sensitive about choosing which knowledge to share because of the members' hierarchical positions. Yuan *et al.* (2010) has indicated that if people with novel information do not share their individual knowledge directories, TMS will be inactive despite any gains in knowledge within the organization.

TMS in organizational learning literature has been explored through concepts of group learning as adaptive, generative and transformative (London and Sessa, 2006; London *et al.*, 2005). Adaptive learning originates from Argyris and Schön's (1996) theory of single-loop learning. When a group is involved in adaptive processes, the group takes advantage of existing shared behavior patterns and verified knowledge. Adaptive learning occurs primarily when members execute their jobs through relationships with other colleagues in the group (London and Sessa, 2007). Individual- and group-level TMS are related to adaptive learning because they are likely to use reactive adjustment in response to environmental changes. Generative and transformative learning, on the other hand, stem from double-loop learning (Argyris and Schön, 1996). In generative learning situations, when a group faces unprecedented challenges, it generates new knowledge, applies it in pioneering ways and finally adopts new routines while expanding its capabilities. Alternatively, when a group transforms the organization's core values, purposes and goals based on fundamental reflection and then formulates new ways of working, they are engaged in transformative learning (Henderson, 2002; London *et al.*, 2005; Mezirow, 1994). Organizational-level TMS may act as a communication structure bridging weak ties among multiple members and groups, thus triggering generative and transformative learning (Granovetter, 1973; Peltokorpi, 2012; Wildman *et al.*, 2012).

"It is time to consider not how much we learn, but how much less we learn while maintaining organizations' performance and innovation."

> **"It is necessary to encourage leadership development efforts alongside a knowledge-brokerage strategy that interconnects networks, organizations and employees while supporting an autonomous learning and development environment."**

Developmental leadership

One of the emerging roles of contemporary leaders is their critical responsibility for facilitating creative thinking and guiding the actualization of new ideas (Hunter and Cushenbery, 2011). Meeting these goals involves developing an employee-centered leadership style that creates synergistic relationships with employees, encourages followers to take initiative and supports employees' efforts while remaining non-judgmental (Gilley *et al.*, 2011; von Krogh *et al.*, 2012). Defined as the "process of equipping people with the knowledge, skills, and opportunities they need to grow, develop, change, and become more effective" (Gilley *et al.*, 2011, p. 388), developmental leadership has received attention in these broad areas, with studies on topics such as mentoring (Bokeno and Gantt, 2000), role-modeling (Eppler and Sukowski, 2000), knowledge leadership (Mabey *et al.*, 2012), shared leadership (Carson *et al.*, 2007) and leaders' learning supportive behavior (Chung and Hyun, 2007).

The most significant difference between developmental leadership and typical leader-centered leadership is that developmental leaders establish an employee-led platform for catalyzing knowledge creation (Hannah and Lester, 2009). In organizational cultures of autonomous and proactive learning and development, motivated work groups and employees welcome demanding challenges and solve complications innovatively by themselves (Gilley *et al.*, 2011). Developmental leaders act as boundary spanners, or key knowledge catalysts, who are tightly networked to sources of important information (Katz *et al.*, 1995). When employees in a given organization acquire access to information, each individual creates new knowledge, modifies or transforms existing knowledge and diffuses it again (Weick, 2001). To facilitate social interaction in their organizations, developmental leaders use easily understood language in a positive manner, thereby building employees' feelings of psychological safety during private communications (Edmondson, 1999); they also motivate employees to apply new knowledge to tasks without anxiety and allow time for reflection (Marquardt, 1999).

The emerging interest in developmental leadership within the area of knowledge management emphasizes the importance of learner-led informal learning. In the current knowledge economy, the knowledge that employees are required to have for better performances can often be obtained by informal learning experiences (Enos *et al.*, 2003). More particularly, Watkins and Marsick (1992) have suggested that informal learning takes place during the processes of action and reflection and incorporates "self-directed learning, networking, coaching, mentoring, performance planning [. . .] and trial-and-error" (pp. 290-291). Choi and Jacobs (2011) have described three principal factors of informal learning:

1. learning with others;
2. self-experimentation; and
3. external scanning.

Because these informal learning behaviors are likely to be strongly influenced by one's relationships with leaders, positive expectations and guidance from leaders are necessary for employees to be successful in their learning and subsequent innovation attempts.

Organizational innovation

As innovative organizations are able to spearhead consumer trends and technological advancements that provide them unrivaled market positions, organizational innovation can be seen as providing a competitive edge to businesses (Armbruster *et al.*, 2008). Many of the definitions of organizational innovation emphasize four major types:

1. the adoption of an internally invented new device, product or service (Damanpour, 1991);
2. the adoption of an organizational structure or administrative process that affects the social systems of the organization (Ravichandran, 2000);
3. the application of new managerial interventions to encourage changes in employees' strategic executions and behaviors (Gibbons *et al.*, 1994); and
4. cultural preparedness caused by an organizational tendency to be involved in innovation (Hult *et al.*, 2004).

Frequently, these organizational innovations start with an organization's break from the past and, in particular, its traditional principles, routines and processes (Hamel, 2006). The new approach necessarily requires the substantive rearrangement of extant knowledge systems within a company (Meuer, 2013). Indeed, new applications and implementations always require the fusion of various forms of knowledge according to the distinctive heterogeneity possessed by each organization (Camisón and Villar-López, 2014). These organizational innovations require shifts in employees' collective knowledge, skills and attitudes, among other characteristics, as well as changes to already-embedded structures and routines in work processes (Sheehan *et al.*, 2013).

Transactive memory systems and organizational innovation

Cohen and Levithal (1990) have argued that a majority of innovations result from borrowing rather than inventing. A significant component of innovation is the capability to quickly absorb new knowledge and diffuse innovation without causing conflicts among subgroups and employees. Despite the importance of novel knowledge and its effective management, knowledge acquisition and diffusion is frequently inhibited both physically and psychologically in the organization. Anand *et al.* (1998) have pointed to the practical difficulty of distributing information effectively among multiple subgroups. Complicated group structures and processes might have negative effects on the accuracy of expertise recognition and knowledge diffusion. Hood *et al.* (2015) found that employees' unfavorable affective perception, such as low psychological safety, could discourage them from seeking novel information or accepting the risks of innovative attempts within their organization.

From this perspective, previous studies of individuals' innovative behavior and group innovation have highlighted the importance of TMS. Fan *et al.* (2016) have found that individuals who can access and receive required information based on a fully developed TMS are likely to have creative self-efficacy, as they gain the confidence necessary to take risks and the flexibility to handle failures in uncertain business situations. Akgün *et al.* (2006) have also argued that groups with higher TMS can enhance their capability to launch new products quickly. Gino *et al.* (2010) have found that TMS increases group creativity, as individuals can quickly absorb tacit knowledge from experts through team learning and then manipulate the knowledge to suit new tasks. Argote (2015) has identified TMS as being especially valuable in dynamic business environments in which task characteristics are frequently shifting and employees are less likely to be able to determine

how to handle a situation and more likely to need advice from experts external to their own organization. Therefore, the following hypothesis is drawn:

H1. TMS will be positively related to organizational innovation.

The mediating effect of developmental leadership

Due to the increasing complexities and ambiguities of workplace presently, it is difficult for a single leader to successfully conduct all necessary decision-making, given limitations on their technical information or work experiences. For example, the influence of a leader in a group is limited when individual members engage in intra-group and inter-groups practice contexts. In these contexts, TMS can provide leaders with the organizational resources to manage complicated tasks and situations that require high levels of knowledge interaction between organizations. Heavey and Simsek (2015) argued that a top management team (TMT) with well-developed TMS can reduce duplication of cognitive labor and help focus on pertinent information in their decision-making. Akgün *et al.* (2006) have suggested TMS can increase organizational memory by helping team leaders to recognize who possesses proper expertise and then to acquire knowledge from the right person. By using TMS, leaders are able to encourage interactions by establishing connections and translating different knowledge structures over different functions (Soekijad *et al.*, 2011). Leaders can also facilitate group members' enhancement of their own areas of specialized expertise and connect the right people with the right tasks (Peltokorpi and Manka, 2008). Therefore, a well-developed TMS can enhance developmental leadership by building more structured networks and collaborative alliances between organizations (Gilley *et al.*, 2011):

H2. TMS will be positively related to developmental leadership.

Many studies have shown that high-quality leadership impacts organizational innovation (Gumusluoglu and Ilsev, 2009; Jung *et al.*, 2008). On the one hand, developmental leaders steer organizations in more innovative directions by establishing environments that enable autonomous idea generation beyond organizational inertia and silo effects (Hunter and Cushenbery, 2011). Such leaders can also challenge the status quo and pursue appropriate knowledge networks that improve collaboration and results (Gilley *et al.*, 2011). On the other hand, the process of innovation is inherently "messy, reiterative, and often involves two steps forwards often one step backwards plus several side steps" (Anderson *et al.*, 2014, p. 3). Attempts at innovation are thus likely to meet with anxiety and failure during their implementation, causing employees to lose their intrinsic motivation. In this situation, developmental leaders may provide proper guidance so that their organizations can still achieve their innovative goals (Hunter and Cushenbery, 2011). Thus, the following research hypothesis is suggested:

H3. Developmental leadership will be positively related to organizational innovation.

Previous studies of the relationship between TMS and leadership have concentrated on transformational leadership (Chaoyan, 2011; Peltokorpi and Hasu, 2011, 2016), drawing on a leader-centered perspective that considers leadership to be the intellectual stimulation that occurs between leaders and employees. This approach assumes that a central leader can guide employees to achieve certain outcomes by shaping cognitive structures and coordinating the collective behaviors of an organization (Mehra *et al.*, 2006). However, some empirical studies have suggested that the influence of transformational leadership on creativity and innovation is likely to be null or negative (Basu and Green, 1997; Jaussi and Dionne, 2003; Lee, 2008) and that there is substantial variation in the aggregated correlations in a meta-analysis (Rosing *et al.*, 2011). These results suggest that employees' potential creativity and innovation may be hampered by charismatic leaders in certain workplace environments if the leaders try to articulate explicit work goals and then lead and control top-down and linear learning processes (Hannah and Lester, 2009; Qu *et al.*, 2015).

However, knowledge-intensive organizations, such as global R&D projects that start with uncertain information, no longer rely on this command-and-control mode of managing

(Gilley *et al.*, 2011; Kratzer *et al.*, 2006). Instead, these organizations require in-depth mastery of specific skills and allow talented employees to collaborate across organizations and around the world (Kratzer *et al.*, 2006). Developmental leaders are likely to boost collective learning and knowledge creation by such talented employees through cognitive, emotional and behavioral processes (Marks and Louis, 1999). Developmental leaders:

1. help form or refine flexible cognitive structures by letting dispersed information reach the organization from internal and outside sources by location, hierarchy or function (Peltokorpi, 2012);
2. provide emotional encouragement and increase employees' confidence and motivation to use novel knowledge while handling potential affective conflicts due to interactions among functionally heterogeneous individuals and organizations (Hmieleski and Ensley, 2007); and
3. establish optimal work environments for individuals, groups, networks and systems by facilitating employees' collaborative problem solving when creative friction develops from the transaction of different forms of expertise (Gilley *et al.*, 2011; Heavey and Simsek, 2014).

To sum up, the framework of this study connects TMS and organizational innovation through the mediating effect of developmental leadership. The research framework for this study is represented in Figure 1:

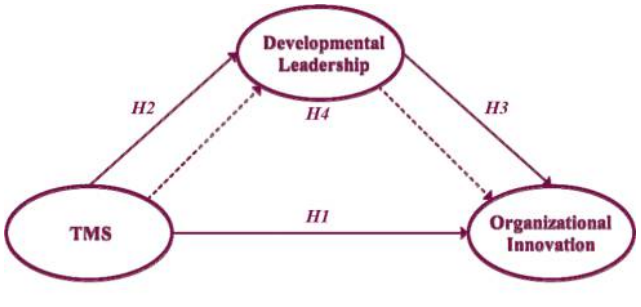
H4. The relationship between TMS and organizational innovation will be mediated by developmental leadership.

Research methods

Organization context

The setting for this study is a global electronics company in South Korea. In the two years preceding this study, the company was unexpectedly trapped by poor business performance, despite its cutting-edge business model. In the course of business reconstruction, this company developed a new business model to ensure a strategic turnaround. The company engaged in the vertical integration of its workforce; it also hired leading experts to address these business transformations. A core goal of this integration and hiring was to transfer the company's previous business model to the new business. To achieve this, the organization shifted its previous traditional manufacturing production system into the new knowledge-intensive business organization to satisfy the new requirements of new customers. Top executives expected an innovative performance from the new business as well as increased synergy between the new business development organization and other business functions.

Figure 1 Research conceptual framework



Note: Dotted lines indicate indirect paths between TMS and organizational innovation through developmental leadership

Data collection

The survey was distributed to two departments in the company that were responsible for handling new business development. Each department functioned as an independent business unit that engaged in its own business planning with multiple subgroups. The departments were geographically dispersed across the country and foreign subsidiaries.

The cross-sectional survey questionnaire was prepared using the survey implementation procedure devised by Dillman (2000). Initial contact with managers of companies' HR teams was made either by e-mail or by phone to explain the purpose of the study and to ask for the managers' permission to distribute the survey within their organizations. Upon agreement, the Web survey link was sent to the managers, who then distributed the link to potential participants on behalf of the researcher. The survey questionnaire included a cover letter and informed consent document explaining the purpose and significance of the study, the voluntary nature of participation and a statement of full anonymity and confidentiality. Any disclosure of the participants' responses outside of the study might put the participants' employability and reputations at risk. The statement thus assured all participants that the survey results would not be released or shared with their supervisors or anyone in their organizations. The questionnaire did not include any personal identifying information, and the gathered data were stored in a confidential manner.

Of approximately 1,200 employees involved in new business development and execution, 224 participated in this study (response rate = 19 per cent). The survey was designed so that if an individual left any items incomplete, he or she could not submit the survey; thus, there are no missing values. Respondents' demographic characteristics were represented by gender, age, education, position and job responsibility:

- 61 per cent of respondents were male and 39 per cent were female;
- 34 per cent of respondents were aged under 30 years, 48 per cent were aged between 30 and 40 years, 15 per cent were aged between 40 and 50 years and 3 per cent were in their 50s;
- the majority of respondents had graduated from four-year universities (57 per cent), while 31 per cent had master's and doctoral degrees, 7 per cent had community-college degrees and 5 per cent were high-school graduates;
- positions held were assistant (35 per cent), assistant manager (30 per cent), manager (12 per cent), senior manager (12 per cent) and director (11 per cent); and
- job responsibilities were sales (21 per cent), HR (21 per cent), general administration (15 per cent), research and development (R&D) (13 per cent), strategy/planning (8 per cent), advertising/marketing (7 per cent), finance/accounting (5 per cent) and production (2 per cent).

Instruments

All items were measured using a five-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*).

Transactive memory systems. TMS was measured using a 15-item scale (α = 0.737) provided by Lewis (2003). The scale took into account three dimensions: specialization, credibility and coordination. Specialization refers to the differentiated structure of experts' knowledge and experiences. Credibility is employees' beliefs about other experts' knowledge. Finally, coordination is orchestrated knowledge distribution while working together (Lewis, 2003). The sample items were:

- I have knowledge about an aspect of the project that no other member has.
- I trust the knowledge of other members in our department about the project.
- I think members in our department work together in a well-coordinated fashion.

To decrease the number of parameters in the structural equation modeling (SEM) and maintain a reasonable degree of freedom, the item-parceling method was used on the variables (Bandalos, 2002). Outcomes of confirmatory factor analysis (CFA) confirmed the three-factor structure of TMS [χ^2 (87) = 120.482, $p < 0.05$; comparative fit index (CFI) = 0.987; Tucker–Lewis index (TLI) = 0.984; root mean square error of approximation (RMSEA) = 0.042; standardized root mean square residual (SRMR) = 0.067].

Developmental leadership. Developmental leadership was measured using a six-item scale (α = 0.942) developed by Cho *et al.* (2013) to address the cognitive, affective and behavioral aspects of developmental leadership in high-performing organizations (Marks and Louis, 1999). These three aspects were captured by the following statements:

1. My department boss provides employees with necessary information.
2. My department boss acts as a facilitator to encourage employee learning.
3. My department boss provides for employees an environment in which they are able to work efficiently and smoothly.

Organizational innovation. This study adopted the five-item firm innovativeness scale (α = 0.832) developed by Calantone *et al.* (2002). The scale captured organizational innovation in a balanced way by assessing new product launches, administrative processes and innovative organizational cultures. Sample measurement items included:

1. Our new product introduction has increased over the last five years.
2. Our company is creative in its methods of operation.
3. Our company frequently tries out new ideas.

Data analysis strategy

The objectives of this empirical study were to examine the relationship between the three constructs and evaluate the mediating effect of developmental leadership. SEM enables the identification of simultaneous interactive relationships via SPSS 18.0 and LISREL 8.8 software. To represent the research hypotheses, a fully latent structural regression (SR) model with both measurement and structural parts was specified. Every latent variable in the structural model is measured by multiple indicators. All the observed variables have measurement error terms. Effects for the endogenous latent variables are all estimated, controlling for measurement error in the observed variables (Kline, 2011). The SR model was identified according to the two-step rule, which was subsequently applied to assess the validity of the SR model. This is because the measurement part of the model met the three-indicator rule for a standard CFA, while the structural part was a recursive model.

The measurement part of the model was used to verify whether the scales were adequate indicators of the underlying constructs. For robust maximum likelihood (ML) estimation to treat non-normality of the data, a covariance and asymptotic covariance matrix with a Satorra–Bentler (SB) scaled chi-square was used (Hu and Bentler, 1999; Kline, 2011; Lei and Wu, 2007). The model-fit of the structural model was examined using the CFI, TLI, RMSEA and SRMR with cutoff criteria CFI > 0.95, TLI > 0.95, RMSEA < 0.06 and SRMR < 0.08 (Hong, 2000; Hu and Bentler, 1999; Kline, 2011; Lei and Wu, 2007). In the structural part of the model, the model estimation using a robust ML and model-fit indices was repeated. A standardized-path coefficient (SPC) was estimated with *t*-values to assess the overall magnitude of the interactive influential relationship among the constructs.

Results

To check the reliability of the survey instrument, Cronbach's α, which represents internal consistency, was measured. Kline (2011) has argued that if .the value of Cronbach's α is around 0.70, then the reliability of the measurement is adequate. Every case in this study was considered to demonstrate acceptable score reliability. With regard to convergent

validity, two of the factor loadings were higher than 0.50, while one factor loading nearly reached the threshold. The composite reliability value and the average variance extracted (AVE) value were measured, and all the constructs were, respectively, more than or equal to 0.7 and to 0.5 (Hair *et al.*, 2006). In terms of discriminant validity, the square root of AVE for each construct is higher than the correlation coefficients among the constructs. Pearson's product-moment correlation analysis showed that all correlations were statistically significant at $p < 0.01$ and that every pair of measures had correlations below 0.7. This means that there was no multicollinearity among the variables (Hair *et al.*, 2006).

To examine the univariate and multivariate normality of all responses, skewness and kurtosis were evaluated with PRELIS. All skewness values were significant ($p < 0.05$) between −1.5 and 1.5, and all kurtosis values were between −1.3 and 7 (Schumacker and Lomax, 2004). Thus, the gathered data exhibited a mild form of univariate non-normality. Relative multivariate kurtosis also demonstrated that the data were inflated by 25.6 per cent compared to a perfectly normal distribution. The results for multivariate normality showed that the data did not have multivariate normality – all *p*-values for skewness and kurtosis were significant ($p < 0.05$). In sum, data showed a mild form of non-normality according to both the univariate and multivariate normality tests (Table I).

Measurement part of the model

To demonstrate the construct validity of the measurement model, CFA was conducted between the latent variables and their subscale variables. Because multivariate non-normality negatively affects results when ML estimation is performed, robust ML estimation (Satorra and Bentler, 1994) was used to handle the mild form of non-normality. This approach includes an asymptotic covariance matrix as a treatment for high levels of skewness and kurtosis (Kline, 2011). The SB scaled chi-square of the model is just barely statistically significant at the 95 per cent level (χ^2 (74) = 95.285, $p = 0.049$) so the exact-fit hypothesis was rejected. However, as the chi-square test is extremely sensitive to sample size, the exact-fit hypothesis can often be rejected (Lei and Wu, 2007). Other fit statistics are acceptable (CFI = 0.995; TLI = 0.994; RMSEA = 0.036; SRMR = 0.058). Thus, even though the model failed the SB scaled chi-square test, it can be assumed that the model adequately fit the data.

To check the common method bias of the gathered data, Harman's single factor analysis was performed (Podsakoff *et al.*, 2003). To compare the model fit of a single-factor (common method) with the proposed measurement model, CFA was performed. The model fit of the single-factor was not acceptable (χ^2 (299) = 1,221.850, $p < 0.01$; CFI = 0.895; TLI = 0.886; RMSEA = 0.118; SRMR = 0.104). As the proposed measurement model indicated a better fit than the one-factor model, no critical common method bias issue could be said to be found in the observed data.

Structural part of the model

In line with the acceptance of the measurement part of the model, the structural part of the model was examined to demonstrate the relationship among the proposed research constructs and the magnitudes of the paths between the research variables. To ascertain the magnitudes of the paths, estimations of SPC were performed – these were considered

Table I Descriptive statistics, reliability, validity and correlation statistics

Variables	*M*	*SD*	*α*	*Item loadings*	*Composite reliability*	*AVE*	*1*	*2*	*3*
TMS	3.692	0.474	0.737	0.494-0.924	0.760	0.529	0.725		
Developmental leadership	3.296	0.901	0.942	0.801-0.890	0.942	0.732	0.538**	0.856	
Organizational innovation	3.150	0.754	0.832	0.502-0.831	0.834	0.511	0.615**	0.385**	0.714

Notes: M = mean; SD = standard deviation; α = cronbach's alpha; **all correlations are significant at the 0.01 level; diagonal value is the square root of the AVE

statistically significant when the hypothesized paths had significant SPCs and their *t*-values were over |1.96| (Byrne, 1998; Kline, 2011). The results showed that all hypothesized paths, except for the path from TMS to organizational innovation ($t = 0.535$, $p > 0.05$), had significant SPCs and *t*-values greater than |1.96|.

Because the direct path between TMS and organizational innovation was not statistically significant, an alternative model was produced to improve the initial model by model re-specification. This alternative model fixed the direct path between TMS and organizational innovation to zero. The alternative model was then compared with the initial model. As shown in Table II, a comparison of the two models was conducted by looking at the chi-square difference and changes in the model-fit indices.

This comparison of the two models shows that the difference between the models is not statistically significant ($\Delta df = 1$, $\Delta\chi^2 = 0.400 \leq 3.84$, $p = 0.527$). The alternative model was finally selected because the alternative model fit suggested a better fit to the data (χ^2 (75) = 95.685, $p = 0.054$) and was more parsimonious than the initial model (Kline, 2011).

Hypotheses testing

With the results of model fit evaluation, all hypotheses were tested using SPC estimates between the three research variables as shown in Figure 2.

The first result suggested that TMS was not significantly related to organizational innovation in the initial model (SPC = 0.056, $t = 0.535 < |1.96|$). This provides evidence for the belief that the existence of TMS is not a valid variable in predicting organizational innovation; thus, *H1* was rejected. Next, the alternative model's results showed that TMS positively influences developmental leadership (SPC = 0.705, $t = 4.911$); in turn, developmental leadership positively contributes to organizational innovation (SPC = 0.623, $t = 7.598$), thereby supporting *H2* and *H3*. The results in Table III show that the indirect effect of TMS on organizational innovation through developmental leadership was estimated. The estimated indirect effect of TMS on organizational innovation is 0.439, which means that one standard deviation change in TMS is expected to result in a 0.439 change in organizational innovation. Taken together, these results suggest that developmental leadership has a full mediation effect on the relationship between TMS and organizational innovation. Thus, *H4* was supported.

Discussion

This study aims to corroborate the causal relationship among TMS, developmental leadership and organizational innovation alongside the mediating effect of developmental leadership. This study found that TMS is not related to organizational innovation; TMS exerts a statistically significant influence on developmental leadership; developmental leadership significantly impacts organizational innovation; finally, developmental leadership fully mediates the relationship between TMS and organizational innovation.

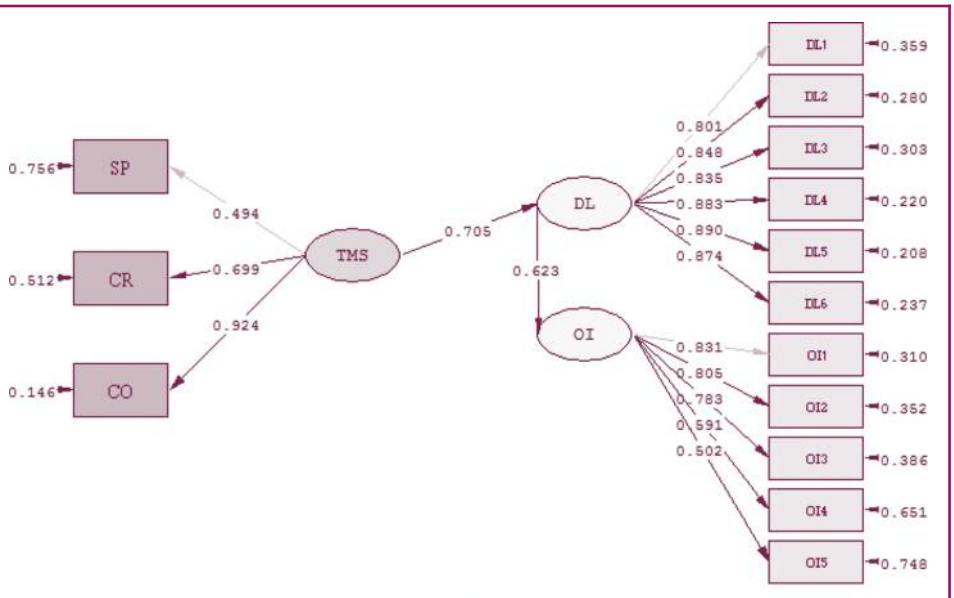
Unlike previous research, the results of this study challenge the belief that TMS positively influences organizational innovation. TMS is typically established and executed over a substantial amount of time via collective work and learning activities (Moreland and Argote, 2003). Specialized expertise is assessed through communication and observations that

Table II Models comparison between initial model and alternative model

Model	*SB scaled χ^2 (df)*	*CFI*	*TLI*	*RMSEA*	*SRMR*
Initial model[a]	χ^2 (74) = 95.285, $p = 0.049$	0.995	0.994	0.036	0.058
Alternative model	χ^2 (75) = 95.685, $p = 0.054$	0.995	0.994	0.035	0.058

Notes: [a]Fit indices of the initial model were identical to those of the measurement model as these models are equivalent; the same covariances are predicted statistically, but they have different theoretical decompositions

Figure 2 The significant paths with the standardized estimates in the re-specified model



Notes: SP = specialization; CR = credibility; CO = coordination; DL = developmental leadership; OI = organizational innovation

Table III Decomposition of estimated effects among variables in the re-specified model

Path coefficient			*Direct effect*	*Indirect effect*	*Total effect*
TMS	→	Developmental leadership	0.705	–	0.705
	→	Organizational innovation		0.439	0.439
Developmental leadership	→	Organizational innovation	0.623	–	0.623

Note: All direct and indirect effects are statistically significant ($t > 1.96$)

allow employees to realize precisely who knows what (Peltokorpi, 2012). However, in organizations with multiple subgroups, TMS itself is less likely to convey to employees the appropriate knowledge as a component of innovation. As knowledge seekers and retainers are not involved in interdependent tasks and the retrieval of knowledge rarely occurs, employees may have more difficulty determining who knows what in complex organizations than they do in small group settings (Jackson and Klobas, 2008; Ren and Argote, 2011). They may also be more likely to rely on explicit expertise indicators such as diplomas, statements of self-disclosure and stereotypes, which do not guarantee accurate perceptions of expertise in knowledge-intensive tasks (Peltokorpi, 2012; Wegner, 1986).

Moreover, sharing tacit knowledge, which is "intuitive, non-verbalized, and yet unarticulated" (Hedlund and Nonaka, 1993, p. 118), intra-group is relatively easy, but transferring tacit knowledge inter-groups is more difficult because of the weak ties (Ren and Argote, 2011). Granovetter (1983) has argued that experts connected via strong ties have easier access to one another than those connected via weak ties; they are also more motivated to participate in two-way interactions in which they try, err and provide instruction and feedback. These strong-tie interactions serve as opportunities to articulate and assimilate tacit knowledge, allowing the knowledge to transfer quickly and promote group innovation (Hansen, 1999). On the other hand, communication between those connected by weak ties occurs more infrequently, and contingency problems that require inter-group collaboration are less likely to be efficiently solved than problems within a group. Naturally,

the transfer of tacit knowledge and work progress may be delayed in the current competitive business environment that highlights the importance of innovation speed (Kessler and Chakrabarti, 1996).

To explain this phenomenon, Rogers (2003) has indicated that "one of the distinctive problems in the diffusion of innovation is that the participants are usually quite heterophilous" (p. 19). In other words, a common language and shared cultural understanding are likely to have a more productive impact on knowledge gain, attitude formation and behavioral change. In this study, each department in the selected company operated as a separate division, meaning that each had a completely different history, culture and set of workplace norms. Due to these varied backgrounds, or heightened heterophily, there was a greater potential for invisible barriers to exist among employees in other departments.

It is also possible to explain the problem of outdated TMS via the concept of the threat-rigidity effect (Staw *et al.*, 1981). Constant threats in the current business environment restrict knowledge adoptions by narrowing collaborative channels to avoid unexpected communication costs; steps taken to address these issues influence how new approaches are viewed and attempted. Frequent business threats in the electronics industry may cause knowledge distribution to become less flexible and the source of knowledge less reputable. TMS may become outdated when it does not adapt to changes in knowledge. Employees may encounter a narrower picture of the world within less-connected networks, limiting active exterior intercourse and opportunities to update their repertoires (Zuckerman, 2013). Finally, depending on the inaccurate knowledge obtained via an outdated TMS may lead ultimately to a lack of innovation. In conclusion, TMS can function according to a knowledge catalyst's inter-group interactions to provide employees with opportunities to establish cognitive interdependence and develop shared vision and work goals (Peltokorpi, 2012).

Taking into account the characteristics of TMS in organizations, this study corroborates the finding that developmental leadership has a mediating effect between TMS and organizational innovation. This mediating effect manifests in a more proactive and interpersonal approach to the TMS process (Moreland, 1999). In the TMS process, group members without precise information regarding knowledge locations or without access to certain knowledge must depend on the people who are at the center of or otherwise linked to the network (Peltokorpi, 2012). Leaders who have relatively stronger knowledge networks may better aid in the process of knowledge creation. Because developmental leadership aims to establish a platform for organizational learning that facilitates social interactions between people, developmental leaders can coordinate the handling of issues such as invisible obstacles and hierarchical positions and can connect people who are initially disconnected. Therefore, to accelerate organizational innovation, intentional interactions between people and groups are needed, making developmental leadership very important to the diffusion of knowledge and the connection of isolated networks.

Practical implications

Eric Schmidt, the former CEO of Google, once said that the volume of data produced every two days is equivalent to the volume of data that accumulated from the advent of civilization to 2003 (Siegler, 2010). In the current rapidly developing knowledge economy, the challenge of such increased cognitive labor has been experienced by companies as a total information input that overwhelms the cognitive capacity of employees and organizations who lack adequate time to process it all (Whelan and Teigland, 2013). Knowledge management needs a new strategy due to this circumstance and other related changes in society. It is time to consider not how much we learn, but how much less we learn while maintaining organizations' performances and innovation.

Despite a long-term emphasis on the importance of knowledge, effective knowledge management systems are far from being appropriately institutionalized in large organizations (Pfeffer and Sutton, 2000). Still, there is a belief that well-developed information technology automatically leads to proactive knowledge-sharing and subsequently guarantees some innovative results without additional efforts or interventions. In fact, even though information technology is now being deployed to facilitate the use of appropriate knowledge, obtaining relevant information in optimized and economical ways still depends on individuals' abilities to know how and where to acquire it. The outcomes for the first hypothesis in this study show that even though there may be well-developed TMS, it is difficult to ensure organizational innovation. This suggests that knowledge distributed in multiple places requires management involvement to integrate and institutionalize scattered individuals into a shared organizational knowledge system (Soekijad *et al.*, 2011). Hence, it is necessary to encourage leadership development efforts alongside a knowledge-brokerage strategy that interconnects networks, organizations and employees while supporting an autonomous learning and development environment.

TMS inevitably develops over time when there is collaboration to secure the requisite specialized expertise, credibility based on mutual beliefs and smooth coordination. However, modern organizations face ongoing restructuring according to external changes. Group membership changes, mass layoffs and constant reorganizations may disrupt TMS (Ren and Argote, 2011). Suddenly severed TMS networks should not affect experts' knowledge, however. In these situations, active communication among employees is critical. It is therefore crucial to consider how best to increase the quantity and quality of communication among employees and subgroups by using various training interventions. Many studies have shown that groups of employees who are trained together achieve more productive results with task-related information than groups that do not have this mutual training (Lewis *et al.*, 2005; Michinov and Michinov, 2009). Training interventions could thus increase meta-knowledge and decrease cognitive labor, making organizations more effective overall.

Limitations and future research

The most critical limitation of this study is the extent to which it relies upon self-reporting: that is, all variables were measured by respondents' self-reporting rather than via more objective measurements. Self-reporting is known to inflate parameter estimates (Podsakoff and Organ, 1986). Nevertheless, this study is more interested in capturing self-perceptions of knowledge-workers during the process of business transformation than in indirectly developing causal inferences from a set of objective measures (Chan, 2009). Additionally, Harman's single-factor test was used as a statistical remedy for socially desirable responses to issues (Podsakoff and Organ, 1986). For future studies looking to corroborate the results of this study, considering the actual magnitudes of impacts on organizational variables is recommended. For example, TMS may be measured using social-network analysis or experimental design (Peltokorpi, 2012; Ren and Argote, 2011). Organizational innovation may also be measured according to numbers of patents received or innovative products developed (Hagedoorn and Cloodt, 2003).

A further limitation of this study is that it was conducted in a South Korean company. Given this distinct sampling, any generalizations regarding the implications may not apply to other knowledge-intensive organizations with different national/organizational cultures or industry/business environments. Thus, the purposive sampling is limited in its ability to enable researchers to generalize from the results.

The concept of TMS can generate many critical insights regarding organizational learning and knowledge management in the modern company, ultimately showing a dynamic relationship among knowledge, networks and innovation. Even though numerous studies have been done on TMS, including in specific areas such as organizational behavior, information systems, communication and social psychology, few empirical studies thus far have connected TMS to

the field of knowledge diffusion. Further research is needed to better understand the relationship between TMS and knowledge diffusion. TMS can provide information about those who possess the right information in the course of knowledge diffusion. Thus, practice-based studies of TMS in knowledge diffusion interventions may provide an understanding of how to best coordinate the relationship among group members by using the meta-cognitive concept of knowledge.

Furthermore, in geographically dispersed organizations such as multinational corporations (MNCs), how organizations learn and manage knowledge without face-to-face meetings among experts is an increasingly important topic as competition increases in foreign markets (Soekijad *et al.*, 2011). TMS can be an effective tool in informing employees of the locations of expertise and in coordinating smooth collaborations, as well as improving informal inter-group learning. Moreover, because leaders working in other countries are required to act as effective links between headquarters and local subsidiaries, developmental leadership based on TMS is important to ensure the satisfactory interpretation of needs and requirements and stimulate bottom-up ideas for discussions related to local issues. Thus, significant attention to learning and knowledge management in MNCs based on TMS and developmental leadership is required.

Likewise, there are many critical points among these variables that necessitate further investigation. Continuous attempts to identify and characterize the dynamics among TMS, developmental leaders and subsequent organizational innovations will be valuable to knowledge management.

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