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COMMENTARY

Transactive Memory Systems: A Microfoundation of Dynamic Capabilities

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A persistent puzzle in management research is competitive advantage and why certain firms excel in getting ahead while others falter (Knott, 2003). One explanation is the dynamic capability argument, which emphasizes a firm's superior ability in sensing new opportunities in its environment and seeking those opportunities by continuously adapting, integrating, and reconfiguring its key assets and competences (Teece et al., 1997). Researchers have called for more work to identify the micro-processes or mechanisms through which firms develop dynamic capabilities (Argote and Ingram, 2000; Spender and Grant, 1996; Teece, 2007). In this paper, we present transactive memory as a microfoundation of dynamic capabilities and describe how an organizational system for collectively encoding, storing, and retrieving knowledge can facilitate the combinative integration and renovation of an organization's knowledge assets.

DYNAMIC CAPABILITY AS A SOURCE FOR COMPETITIVE ADVANTAGE

In spite of the consensus that dynamic capabilities play a crucial role in competitive advantage, complete consensus in defining the term has not been achieved. Teece et al. (1997) defined dynamic capabilities as 'the firm's ability to *integrate*, *build*, and *reconfigure* internal and external competences to address rapidly changing environments' (p. 516). Zollo and Winter (2002) defined a dynamic capability as 'a learned and stable pattern of collective activity through which the organization systematically generates and modifies its operating routines in pursuit of improved effectiveness' (p. 340). Helfat et al. (2007) defined a dynamic capability as 'the capacity of an organization to purposefully

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create, extend, or modify its resource base' (p. 1). Dynamic capabilities concern an organization's ability to reallocate or reconfigure resources to adapt to changes in the future (Helfat et al., 2007). In the next section, we discuss how an organizational transactive memory – or a concept map of who knows what in an organization – facilitates capability-building processes.

TRANSACTIVE MEMORY SYSTEMS AND ORGANIZATIONAL PERFORMANCE

A transactive memory system refers to a shared system that individuals in groups and organizations develop to collectively encode, store, and retrieve information or knowledge in different domains (Lewis and Herndon, 2011; Wegner, 1987). Simply put, transactive memory refers to the knowledge of 'who knows what'. Experimental and field studies of transactive memory in dyads and small groups have linked the existence of transactive memory to improved performance in a variety of tasks such as consulting, product assembly, and software development (Faraj and Sproul, 2000; Hollingshead, 1998a, 1998b, 1998c; Lewis, 2004; Liang et al., 1995).

Researchers have identified three indicators of the existence of transactive memory systems (Lewis, 2003; Moreland et al., 1998): knowledge or memory specialization (the tendency for group members to remember different aspects of a task or to develop specialized and complementary expertise), task credibility (how much group members trust each other's knowledge), and task coordination (the ability of group members to work together smoothly and efficiently while performing a task). This meta knowledge of who knows what provides individuals with access to more knowledge than they individually possess. Further, the knowledge enables the group to specialize such that individuals with expertise in a specific domain take responsibility for remembering knowledge, performing tasks in the domain, and answering questions from other team members about that domain. Through performing tasks and answering questions, a member establishes credibility and expertise status. Thus, other members come to trust his or her expertise, which is another indicator of the operation of a transactive memory system. Other members, being aware of the person's expertise, direct new knowledge in the domain to him or her, which reinforces the person's specialization. Further, members know whom to count on for performing various tasks and whom to consult for information in particular domains, which improves coordination. Coordination is another indicator of the operation of a transactive memory system.

Not only are transactive memory systems beneficial in stable environments, they are also valuable in dynamic environments. Ren et al. (2006) demonstrated in a simulation that transactive memory systems were more valuable in environments where problems changed and knowledge became obsolete than when problems were stable. Similarly, Miller et al. (2012) showed in a computational model that transactive memory facilitates adaptation to novel problems in addition to enhancing efficiency. Transactive memory systems have also been found to facilitate group adaptation to new tasks (Lewis et al., 2005).

Groups with well-developed transactive memories have also been found to be more creative than their counterparts with less developed transactive memory systems (Gino

et al., 2010). When members know who is good at what, they are able to reconfigure their knowledge to create new products and services. For example, a member of a product development team with expertise in material engineering and a member with expertise in health care might put their knowledge together to create a new material that is ideal for particular kinds of surgery. In this example, the ability to reconfigure knowledge was enabled by the knowledge team members possessed of who knew what – by their transactive memory system. Thus, not only do transactive memory systems provide a base for zero-level capabilities that enable a firm to 'make a living' (Winter, 2003), transactive memory systems also provide a foundation for dynamic capabilities that create new capabilities or reconfigure existing ones.

TRANSACTIVE MEMORY SYSTEMS AS A SOURCE OF COMPETITIVE ADVANTAGE

Three characteristics of an organizational transactive memory system make it a valuable source for sustainable competitive advantage (Dierickx and Cool, 1989): path dependency, tacitness and social complexity, and context dependency. First, a transactive memory system takes time to develop and the process of developing a transactive memory system is recursive. As members perform tasks, others develop more differentiated perceptions of expertise – learning more about tasks that team members are and are not adept at doing. Factors that have consistently been shown to predict the development of a transactive memory system are experience working together and team training (Ren and Argote, 2011). Communication, especially during the early phases of group development, has also been shown to positively affect the development of transactive memory systems. A transactive memory system is an invisible asset that is hard to develop in a short period of time (Itami and Roehl, 1987) yet can benefit the organization in many ways.

Second, an organizational transactive memory system is complex and socially embedded (Schreyogg and Kliesch-Eberl, 2007). Transactive memory systems have many components that fit each other (Rivkin, 2000), which is a barrier to imitation. Further, transactive memory systems are developed by social interactions and represent a collective way of problem solving by matching problems to individuals with the right expertise. The social complexity makes it hard for rivals to discern the specific source of the competitive advantage and thus hard to imitate.

A transactive memory system can be conceived as a form of 'cospecialized asset'. According to Teece (2007), cospecialized assets are a class of complementary assets where the value of one asset depends on its use in conjunction with another. For example, a marketing research team with a well-developed transactive memory system might have someone who is especially adept at sampling and data analysis and specializes in both areas, another person who specializes in question writing, and a third person who specializes in survey administration and client contact. Team members know each other's areas of expertise and rely on each other to accomplish the team's task. The value of one asset (in this example a person's expertise) depends on its use in conjunction with the other assets. If one person were to move to another three-person team, the value of his or her expertise might decrease. For example, the person who was good at question

writing might discover, after moving to a new team, that the new team took it for granted that she would also take care of sampling issues. She would be less effective in that team than in the previous configuration, which better fitted her skills and knowledge. If the person who specialized in sampling and data analysis were to move to a new team, she might find that there was already someone on the new team who handled sampling, which could cause coordination problems.

This simple example illustrates that the specialization that occurs when team members develop a transactive memory system is somewhat idiosyncratic to a particular team. Hiring away individuals with specialized expertise may not lead to the acquisition of the advantage associated with the expertise unless complementary skills and the necessary conditions for effective coordination are in place as well. Consistent with this conjecture, Wezel et al. (2006) found that mobility of individuals across firms had the greatest effect when collectives rather than individuals moved. Similarly, Huckman and Pisano (2006) found dramatic differences in the performance of surgeons who performed the same operation in different hospitals. When individuals moved from one organization to another, a transactive memory system developed with one set of colleagues would not be relevant for another. On the other hand, the movement of individuals into a new team can be facilitated by hiring other members of their previous team (Groysberg and Lee, 2009) and by sensitivity on the part of the hiring team to the skills and knowledge of the departing member and his or her replacement (Lewis et al., 2007). Achieving an exact fit between the expertise of the new and departing members is challenging due to the tacit nature of some knowledge.

Third, because transactive memory systems develop as individuals learn each other's skills and expertise through experience working together, transactive memory systems are specific to the particular context of an organization and its members. Different organizations have different members with different skills and expertise and thereby different transactive memory systems. Thus, transactive memory systems are idiosyncratic to organizations and meet important criteria for competitive advantage: they are developed or built (Dierickx and Cool, 1989) inside the organization and are difficult for competitors to imitate (Barney, 1986; Lippman and Rumelt, 1982).

Routines, recurring patterns of activity among interdependent organization members, also develop from experience (Bapuji et al., 2012; Turner and Fern, 2012). Routines, however, are less dependent on the skills and expertise of particular members than transactive memory systems. For example, a firm might have a production routine that specifies the steps to assemble a product or an acquisition routine that specifies the processes for acquiring other firms. The processes or steps in the routines are specified independently of the members who perform them. Indeed an advantage of relying on routines is that organizations are less affected by turnover when they rely on routines than when they do not (Rao and Argote, 2006; Ton and Huckman, 2008). By contrast, transactive memory systems depend on the knowledge and skills of particular members. Their effectiveness is negatively affected by turnover (Lewis et al., 2007; Moreland et al., 1998). Thus, the value of a transactive memory system in a new setting would depend more on the number of members of the system who move to the new context than the value of a routine would.

TRANSACTIVE MEMORY SYSTEMS AS A SOURCE OF DYNAMIC CAPABILITY

According to Teece et al. (1997), dynamic capabilities capture an organization's ability to *build*, *integrate*, and *reconfigure* its knowledge assets to address changing environments. A well-developed transactive memory at the organizational level thus should achieve three goals to enhance dynamic or combinative capabilities, as identified by Kogut and Zander (1992): efficiency (the extent to which the capability accesses and utilizes the *specialist* knowledge held by individual organizational members), scope (the *breadth* of specialized knowledge the organizational capability draws upon), and flexibility of integration (the extent to which a capability can access *additional* knowledge and reconfigure existing knowledge).

Building New Knowledge Assets

Building new knowledge assets to respond to environmental changes requires timely access to information and the ability to filter information from various sources to recognize trends in technologies, customer needs, and marketplace responses (Teece, 2007). An organizational transactive memory system, by providing information about who is an expert in certain domains, can facilitate the collective filtering of information about new opportunities and the flow of information to those who can make sense of it (Teece, 2007). In addition, as organizations explore new opportunities, an organizational transactive memory system can shed light on fruitful directions to pursue by identifying areas in which the organization has absorptive capacity (Cohen and Levinthal, 1990) and by connecting people with others who have complementary expertise. Organizations with well-developed transactive memory systems are able to combine members' expertise in new ways to develop new products or services that respond to changing environmental demands.

Reconfiguring Existing Knowledge Assets

After a new opportunity is identified, the development of a new capability usually resides within one or several teams. Helfat and Peteraf (2003) suggested that capabilities include two types of routines: those for performing individual tasks and those for coordinating tasks. An organizational transactive memory system facilitates the building and staffing of these teams by providing the knowledge needed to locate members with required expertise. An organizational transactive memory system is also important to the functioning of these teams in terms of internal coordination and external coordination with the rest of the organization. Exploration and experimentation in these teams are social learning processes that require common codes of communication and collective application of specialized knowledge to a complex problem. An organizational transactive memory system showing individual expertise can increase the efficiency of the team's external activities and its access to knowledge repositories outside of the team.

Integrating Existing Knowledge Assets

If a firm is successful at pursuing a new opportunity, the knowledge and routines generated during the exploration process need to be incorporated into organizational operations, which often requires coordination among functional groups or business units. An organizational transactive memory system, if properly developed and supported, can lubricate inter-group interaction through boundary-spanning networks, high levels of trust, timely sharing of information, and smooth coordination.

CONCLUDING REMARKS

A transactive memory system is a microfoundation of an organization's dynamic capability. Because an organization's transactive memory system develops through experience, is idiosyncratic to a particular organization and hard for outsiders to discern, it is a source of competitive advantage. Organizations with well-developed transactive memory systems are able to build, integrate and reconfigure knowledge more effectively than their counterparts with less developed transactive memory systems. Thus, transactive memory systems facilitate the development of dynamic capabilities in organizations.

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