To Transfer or Not to Transfer Specialized Knowledge: The Decision-Making Process in the Context of Specialization

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Abstract

Knowledge specialization contributes to increased performance and innovation both within and across knowledge domains. However, designing an organization that is able to create more than the sum of its parts is especially challenging when specialization manifests on multiple levels of analysis. This study develops a conceptual model to suggest a decision-making process for deciding which specialized knowledge should be shared or not. We argue that this process depends on the benefits accruing from the strategic intent of the organization, and from the cost of learning and transferring knowledge in the context of specialization. The implications of this study are important for all firms that possess specialized knowledge by providing rationales and processes for managing knowledge creation and application in general.
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Abstract

Knowledge specialization contributes to increased performance and innovation both within and across knowledge domains. However, designing an organization that is able to create more than the sum of its parts is especially challenging when specialization manifests on multiple levels of analysis. This study develops a conceptual model to suggest a decision-making process for deciding which specialized knowledge should be shared or not. We argue that this process depends on the benefits accruing from the strategic intent of the organization, and from the cost of learning and transferring knowledge in the context of specialization. The implications of this study are important for all firms that possess specialized knowledge by providing rationales and processes for managing knowledge creation and application in general.

Keywords: innovation, experts, knowledge-intensive organizations, knowledge transfer, specialists, specialization

Specialization provides substantial benefits in terms of learning processes and performance for both individuals and organizations (Grant, 1996). However, while it is important to specialize to increase efficiency and the quality of work in organizations, it is also desirable to transfer knowledge and innovations across specialized units to improve organizational processes (Reagans & McEvily, 2003). Successful knowledge transfer manifests in changes in the recipient’s knowledge or performance (Argote & Ingram, 2000), which requires the ability to integrate knowledge. Even though knowledge creation is inevitably crucial, integration of knowledge has been identified as a primary challenge in organizations (Carlile & Rebentisch, 2003; Ruggles, 1998). Transfer and integration is especially difficult in the context of specialization as learning costs dominate the knowledge benefits (Postrel, 2002),
which makes it advantageous to maintain specialization within the organization (Barley, Treem, & Kuhn, 2018; Carlile, 2002).

Common knowledge serves as a key factor in knowledge integration as no integration can occur without it (Demsetz, 1988; Grant, 1996). Hence, its presence is essential for coordinating action, facilitating innovation processes, and contributing to organizational learning and adaptation (Barley et al., 2018). Specifically, commonality of specialized knowledge determines the ability of individuals to achieve higher levels of sophistication of knowledge integration (Grant, 1996), and is thus essential for knowledge transfer in specialized contexts. However, specialized knowledge is required for the efficient division of labor or differentiation, which is characterized by the “absence of shared knowledge outputs” (Barley et al., 2018, p. 285). While there is a need to value uncommon ground, organizations need to manage the tension between differentiation and integration and preserve the trajectories of both (Barley et al., 2018). This raises several important questions, such as: Which specialized knowledge needs to be transferred and integrated into organizational common knowledge? Which specialized knowledge should be kept differentiated for the efficient division of labor? Who can, or should, make the decision regarding these matters—and how can this be done effectively?

Our paper aims to contribute to a better understanding of knowledge transfer and integration in specialized organizations by conceptually analyzing how to make the decision of which specialized knowledge should be transferred across units in specialized organizations. More specifically, we offer discussion and perspectives on the following research questions (RQs):

**RQ1:** What are the basic factors that enable the effective transfer of specialized knowledge across specialized units or domains?
RQ2: What are the benefits and costs of creating the basic conditions for transferring specialized knowledge within organizations?

RQ3: What is the decision-making process for transferring specialized knowledge within specialized organizations?

The answers to these questions contribute to the literature on knowledge transfer and management by increasing understanding of the decision-making process related to the integration of specialized knowledge in specialized organizations.

The structure of the paper is as follows: First, the theoretical background elaborates on the need to integrate specialized knowledge, and the challenges that specialization create for knowledge transfer, by presenting a multi-level conceptualization of specialization. Second, we synthesize the literature to investigate the basic factors that enable the effective transfer of specialized knowledge across specialized domains. Based on this, we develop a conceptual model that analyzes the benefits and costs of creating the basic conditions for specialized organizations to transfer specialized knowledge. Third, we propose a related decision-making process for deciding whether to transfer specialized knowledge across units. Finally, the discussion offers our perspectives and suggestions for further research, followed by concluding remarks.

**Theoretical Background**

This theoretical background elaborates on the need to integrate specialized knowledge and on how specialization creates barriers for knowledge transfer. In order to increase understanding of how specialization is associated with increased costs of transferring and integrating knowledge in organizations, we provide a conceptualization of specialization that involves the levels of specialized knowledge, the specialist, the specialized unit, and the specialized organization.
The need to integrate specialized knowledge

There is a paradox involved in the decision whether to keep specializing or to increase common ground in order to leverage the existing knowledge present in diverse specialized units. On the one hand, maintaining specialization is logically necessary (Barley et al., 2018)—we need to maintain and produce specialization by creating a division of labor, to avoid the overlapping of specialized knowledge across specialized units, and to improve overall efficiency and quality. Decreasing the common ground among groups in the face of increased specialization incurs less costs (Barley et al., 2018; Carlile, 2002). On the other hand, the current literature provides arguments for why integrating specialized knowledge is important for organizations, such as building organizational capability (Grant, 1996a) through strengthen their innovation capacity. This innovation capacity includes exploration capability, e.g. recombining different types of knowledge, exploitation capability, e.g. spreading best practice; and ambidexterity capability, e.g. establishing and updating common knowledge for building integration mechanism.

The ability to integrate available existing knowledge helps a firm to achieve capabilities that no other firm possesses (Drucker, 1985; Nonaka, 1994), or to predict the likelihood of innovative outcomes (Barley et al., 2018; Schumpeter, 1934). Organizations need to integrate specialized knowledge from different sources to create new knowledge, such as solutions to unfamiliar problems, new products, or new business models. Common knowledge allows individuals to communicate and assess one another’s domain-specific knowledge (Carlile, 2004). Specifically, commonality of specialized knowledge determines the ability to achieve higher levels of sophistication of knowledge integration (Grant, 1996), and is thus essential for the sharing of knowledge in specialized contexts. The existence of commonality of specialized knowledge is crucial for communication among specialists, and also allows for greater specialization. However, such common knowledge must be continuously built and updated over
time. This requires a knowledge repository which updates common knowledge in the specialized organization. Knowledge transfer is both prior process and subsequent process for a knowledge repository (Argote & Fahrenkopf, 2016). As a prior process, knowledge transfer concerns the movement of specialized knowledge to the repository. As a subsequent process, knowledge transfer helps distribute the new common knowledge to the relevant units. Integrating specialized knowledge within organizations is also important for spreading best practices to appropriate rents from scarce internal knowledge (Szulanski, 1996). Here, the transfer of such practices entails the organization’s “replication of an internal practice that is performed in a superior way in some part of the organization and is deemed superior to internal alternate practices and known alternatives outside the company” (Szulanski, 1996, p. 28).

Specialization creating barriers for knowledge transfer

While there are attractive benefits to integrating specialized knowledge across units, increased specialization creates knowledge transfer barriers that need to be overcome to be able to realize these benefits. Knowledge transfer in organizations is defined as “the process through which one unit (e.g., group, department, or division) is affected by the experience of another” (Argote & Ingram, 2000, p. 151). The problem of knowledge transfer exceeds the individual level, although this is where the transfer of knowledge actually occurs (Argote & Ingram, 2000). Lack of ability and willingness to transfer knowledge have been suggested as forming key explanations for why knowledge integration may be difficult in organizations (Szulanski, 2000). Szulanski (1996) demonstrates how knowledge transfer is affected by the characteristics of the knowledge transferred, of the source and the recipient of knowledge, and of the organizational context. Furthermore, we argue that specialization manifests itself at multiple levels of analysis in specialized organizations, creating costs that affect the ability to and efficacy of transfer. The next section discusses these levels in greater detail.

Specialization—a multilevel conceptualization
We relate the notion of specialization to the notion of complexity by interpreting specialization as an outcome of mechanisms designed to cope with the complexity of knowledge and to reduce confusing experiences in order to enhance learning within a specific knowledge domain. This conceptualization originates from theories of complexity (e.g., Simon, 1962) and knowledge (e.g., Nonaka, 1994; Postrel, 2002), and from Levinthal and March’s (1993) article that explains specialization as one of the key mechanisms of organizational learning. Specialization implies that organization is divided into different units that specialize in different domains. Being successful in one domain can help “relieves pressure for adaptation in another part” and develop “greater and greater adaptive competence” (Levinthal & March, 1993, p. 99). Learning at the unit level is more effective and replaces learning at higher levels, enhancing an organization’s position in the current situation and present environment (Levinthal & March, 1993). However, it might entail the problem of myopia of learning since “first-order learning cannot substitute for second-order learning of new routines and strategies” (Levinthal & March, 1993, p. 101). In this way, the conceptualization of specialization is also closely related to the concept of exploitation, which has been addressed widely in the literature (Benner & Tushman, 2003; He & Wong, 2004; March, 1991; Rosenkopf & Nerkar, 2001). In what follows, the levels of specialization—including the levels of specialized knowledge, the specialist, the specialized unit, and the specialized organization—are discussed.

**Specialized knowledge.** Before specialized knowledge is explained, there is a need to elaborate on what knowledge is. There is no unified understanding among researchers about the definition of knowledge. Some researchers differentiate between knowledge and information (e.g., Huber, 1991; Nonaka, 1994; Starbuck, 1992), whereas others consider knowledge to include all type of information and know-how (e.g., Bartol & Srivastava, 2002; Kogut & Zander, 1992). Some researchers assert that knowledge resides only within individuals (e.g., Nonaka, 1994), whereas others believe that it is the equipment, routines, and cultures that
constitute knowledge (e.g., Starbuck, 1992; Tsoukas, 1996). In this paper, we adopt the definition of knowledge of Nonaka (1994, p. 15) in which knowledge is referred to as a “justified true belief.” This definition emphasizes the justification of knowledge by either individual or collective understanding.

Knowledge exists in two forms, explicit and tacit. Explicit knowledge is knowledge that is easy to capture in writing and drawing, and is thus easy to communicate among individuals (Nonaka, 1994). In contrast, tacit knowledge refers to knowledge that is difficult to codify and communicate as it is “unarticulated and tied to the senses, movement skills, physical experiences, intuition, or implicit rules of thumb” (Nonaka & von Krogh, 2009, p. 635). However, there is no clear distinction between these forms because all knowledge has elements of tacitness (Polanyi, 1966), resulting in explicit and tacit knowledge interacting along a continuum (Nonaka & von Krogh, 2009).

Knowledge can also be distinguished as comprising two types—common and specialized knowledge. Common knowledge refers to “those elements of knowledge common to all organizational members: the intersection of their individual knowledge sets” (Grant, 1996, p. 115) or shared knowledge (Hoopes & Postrel, 1999). This includes language, different forms of symbolic communication, shared meaning, transactive memory (i.e., recognition of individual knowledge domains), and commonality of specialized knowledge. Common knowledge is essential to individuals’ ability to share and integrate knowledge (Grant, 1996). Specialized knowledge refers to knowledge that is domain-specific (Carlile, 2004). This domain-specific nature is essential, because individuals’ cognitive limitations restrain their ability to specialize in everything (Simon, 1991). Specialized knowledge has been referred to as “esoteric expertise”, which is further elaborated as being “unusual,” “exceptional and valuable expertise” (Starbuck, 1992, p. 716), or “idiosyncratic knowledge” (Hayek, 1945, p. 21), which is “knowledge of the particular circumstances of time and place,” or “specific
knowledge” (Sabherwal & Becerra-Fernandez, 2005) that is possessed by a limited number of people.

Another way of conceptualizing specialized knowledge, by Postrel (2002), stems from Demsetz’s (1988) argument regarding an economical viewpoint in acquiring certain patterns of knowledge. Our paper adopts this viewpoint and defines specialized knowledge as domain-specific knowledge, which forms a single interconnected cluster of knowledge items that are cheaper to learn together than to learn separately. Therefore, a degree of specialization of an individual’s knowledge refers to the size of his/her cluster of this specific domain. The cost of learning a new item in a larger cluster is lower than the cost of learning a new item in a smaller one. When one has “hit the frontier of one’s primary specialization, where new items of interest are hard to find, that it might be cheaper to learn items outside that specialty” (Postrel, 2002, p. 306).

Sabherwal and Becerra-Fernandez (2005) divide specialized, or specific, knowledge into three types of knowledge based on the level of contextual knowledge specificity, technical knowledge specificity, or both (see Figure 1). Context-specific knowledge refers to knowledge “of particular circumstances of time and place in which work is performed,” whereas technology-specific knowledge is related to a specific theoretical or scientific discipline (Sabherwal & Becerra-Fernandez, 2005, p. 303). Knowledge that is high in both contextual and technical knowledge specificity is referred to as context-and-technology-specific knowledge, which is critical when tasks require simultaneous understanding of the particular context and of scientific knowledge (Sabherwal & Becerra-Fernandez, 2005). Sabherwal and Becerra-Fernandez (2005) exemplify three specific knowledge types in the context of National Aeronautics and Space Administration’s (NASA’s) John F. Kennedy Space Center (KSC). Context-specific knowledge is knowledge that is dependent on a particular context, for example, knowledge of the mechanisms involved in NASA-developed technology is patented
and licensed; technology-specific knowledge is related, for example, to project management
techniques that can be applied in general, without being specific to a context; whereas context-
and-technology-specific knowledge is knowledge of “how to plan and develop ground and
flight support systems” since “it depends on both principles of engineering and the design
context of the flight system at KSC” (Sabherwal & Becerra-Fernandez, 2005, p. 303). The
typology of specific knowledge is illustrated in Figure 1.

<table>
<thead>
<tr>
<th>Context-specific knowledge</th>
<th>Context-and-technology-specific knowledge</th>
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<tbody>
<tr>
<td>Example: knowledge of processes and routines within specialized organizations</td>
<td>Example: Process of decision-making regarding problems or failures</td>
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<table>
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<tr>
<th>General knowledge</th>
<th>Technology-specific knowledge</th>
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<tbody>
<tr>
<td>Example: common language and vocabulary</td>
<td>Example: procedures for testing space-station hardware and software</td>
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</table>

Figure 1. Types of specialized knowledge, with examples. Adapted from “Integrating specific knowledge: Insights from the Kennedy Space Center,” by R. Sabherwal and I. Becerra-Fernandez, 2005, IEEE Transactions on Engineering Management, 52(3), 301-315.

**Specialists.** A specialist is as an individual that possesses specialized knowledge and acquires the expertise related to that specialized knowledge, and is often referred to as an expert or a professional in the literature. Grant (1996, p. 112) asserts that “experts are (almost)
invariably specialists,” because bounded rationality (Simon, 1957) makes individuals specialize in specific areas of knowledge for the increased efficiency of knowledge production, that is, the creation, acquisition, and storage of knowledge (Grant, 1996).

Experts are distinguished from novices by their level of expertise. Expertise can be defined as “the possession of a large body of knowledge and procedural skill” (Chi, Glaser, & Rees, 1982, p. 2) within a specific domain (Sweller, 1988), resulting in exceptional performance (Ericsson, Krampe, & Tesch-Römer, 1993). The development of expertise entails the acquisition of both more, and more advanced, knowledge (Hinds, Patterson, & Pfeffer, 2001), and reduces the need for classic problem-solving because of the existence of developed cognitive schemas (Regehr & Norman, 1996; Sweller, 1988). The level of expertise is often reflected in an organization’s structure, as individuals with greater expertise often hold higher positions in the formal hierarchy.

Expertise and specialized knowledge are different concepts though they are closely related. Specialized knowledge refers to knowledge within a specific domain while expertise includes three dimensions: the esotericism of the knowledge domain, the accomplishment of the specialists, and the exposure of the specialist to tacit knowledge of the domain (Collins, 2018). This implies that specialists not only possess specialized knowledge but also need to pass through certain definable stages of accomplishment and have access to the tacit knowledge of the domain in order to gain fluency (Collins, 2018).

Professionals possess not only expertise, but also an “ethical code, cohesion, collegial enforcement of standards, and autonomy” (Kerr, Von Glinow, & Schriesheim, 1977, as cited in Starbuck, 1992, p. 717). Abbott (1988) has argued that professionalism is a means for societies to preserve and utilize expertise. Professionals identify themselves strongly with their professions. Professions have three key features: a skilled knowledge base, regulation and control, and ideology (Torres, 1991). Regulation and control relate to having autonomy to
regulate a monopoly of the use of that knowledge base. Ideology refers to professional and ethical codes that allow professionals to behave as community members (Goode, 1957). This social dimension of expertise as it concerns the formation of communities is important both in that it evolves around certain practices, referred to as communities of practice (Brown & Duguid, 1991; Wenger, 2000), and across specialized units through the creation of patterns of sense-making and behavior that may take the form of communities of knowing (Boland & Tenkasi, 1995).

**Specialized organizations.** Specialized organizations are organizations that possess the core competence built by their specialists and their specialized infrastructure. Specialized infrastructure is capital intensive, which offers economics of scale and competitive advantages. Specialized organizations are known to the customers by their core competence, which is difficult to imitate due to the high level of expertise and their professional workforces. Examples of specialized organizations include professional campuses such as hospitals, technology developers such as biotechnologists, and research and development (R&D) labs (von Nordenflycht, 2010).

Specialized organizations, due to their characteristic of having high capital intensity, do not possess one but many specific domains of knowledge, which are related to their core competence in order to take advantage of the economics of scale. This entails a complex structure for organizing activities inside the specialized organizations. One way to simplify this complexity is to effect departmentalization (Levinthal & March, 1993) to help enhance learning in each part of the system and reduce the confusing interaction effects of simultaneous learning. The outcome of departmentalization is *specialized units*. Specialized organizations are unique relative to other organizations in terms of the extent of their specialist capability and trans-specialist understanding because the level of specialist capability is high in the whole organization, whereas trans-specialist understanding is lower across these specialized units.
**Specialized units.** A specialized unit comprises individuals with specialized expertise within the same specific domains of knowledge. These specialized units are coordinated using authority relations and hierarchies in complex organizations (Grant, 1996; Simon, 1962). Each of the specialized units “tends to develop particular attributes in relation to the requirements posed by its external environment” (Lawrence & Lorsch, 1967, p. 4). These units focus attention on a narrow realm of experience to reduce the need for simultaneous and interactive adaptations related to other units in the organization. This is a mechanism that develops specialization of learning competence in units (Levinthal & March, 1993).

**Summary of the conceptualization of specialization.** The conceptualization of specialization, which include the levels of specialized knowledge, the specialist, the specialized unit, and the specialized organization, is summarized in Table 1.

Table 1
*Conceptualization of specialization.*

<table>
<thead>
<tr>
<th>Concepts</th>
<th>Explanation</th>
<th>Theory used to conceptualize</th>
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<tbody>
<tr>
<td>Specialized organization</td>
<td>Possesses core competences built by its specialists and specialized infrastructure.</td>
<td>Hierarchy (Simon, 1962) Departmentalization (Levinthal &amp; March, 1993)</td>
</tr>
<tr>
<td>Specialized unit</td>
<td>Comprises individuals with specialized expertise within the same specific domain of knowledge.</td>
<td>Specialization of learning competence (Levinthal &amp; March, 1993)(Levinthal, 1997) Community of practice (Brown &amp; Duguid, 1991)</td>
</tr>
<tr>
<td>Specialist</td>
<td>An individual that possesses specialized knowledge and acquires the expertise related to that specialized knowledge, often referred to as an expert or a professional.</td>
<td>Expert (e.g., Grant, 1996; Teece, 2003) Professional (e.g., Starbuck, 1992; Torres, 1991)</td>
</tr>
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</table>
**Basic Factors for Transferring Knowledge Effectively Across Specialized Units**

We have elaborated on the benefits of integrating knowledge within specialized organizations and discussed specialization at multiple levels as a hindrance to the realization of these benefits as it reduces the ability and efficacy of knowledge transfer across specialized domains. This leads to our first research question: *What are the basic factors that enable the effective transfer of specialized knowledge across specialized units or domains?* Effectiveness has been referred to as “the lack of productivity loss due to the distortion of knowledge (e.g., loss of content or reduction of accuracy) or time delay in the process of knowledge transfer” (Zhao & Anand, 2013, p. 1517). The literature points to two important factors that support the effective transfer of specialized knowledge—the individual capability to transfer knowledge across specialized domains and the use of appropriate transfer mechanisms.

**Capability of transferring knowledge across specialized domains**

The existence of different knowledge domains does not imply that the barriers for transferring knowledge across these are impossible to overcome. Knowledge overlap facilitates the acquisition of knowledge (Cohen & Levinthal, 1990; Simon, 1991), and thus also the transfer of knowledge (Nonaka & Takeuchi, 1995; Reagans & McEvily, 2003), making the
individual capability to integrate knowledge important for knowledge transfer across specialized domains. This capability requires individuals to possess both expertise within their own disciplinary knowledge domain and knowledge in several other knowledge domains, in order to create a certain level of common knowledge (Tell, Berggren, Brusoni, & Van de Ven, 2017). The literature has discussed concepts that contribute to this capability, such as trans-specialist understanding, interactional expertise, and T-shaped and M-shaped skills.

**Trans-specialist understanding.** With a grounding in the fundamental tension in the division of knowledge, of integration being inferior to the superior learning efficiency of specialization, Postrel (2002) separates knowledge into specialist capability and trans-specialist understanding. Specialist capability is the ability of experts to assess and solve problems within their own knowledge domain, whereas trans-specialist understanding refers to the ability to assess the effectiveness of another member’s specialist capability (Postrel, 2002). In other words, the latter refers to knowing both what the other party knows and what they can do with that knowledge. Hence, trans-specialist understanding positively affects the transfer of knowledge between specialists (Postrel, 2002). A group with perfect trans-specialist understanding would have “no differentiation of knowledge among its members, but little ability to solve domain-specific problems.” A group with zero trans-specialist understanding “would have complete mutual ignorance” about others’ specialties, while each of the members would possess a strong ability to solve problems in their own domains (Postrel, 2002, p. 306). Specialized and trans-specialized knowledge are substitutable, which implies that the nature of learning costs is more critical than the knowledge benefits when mutual ignorance (i.e., differentiation) is decided (Postrel, 2002). Developing trans-specialist understanding involves learning about others through education or the codification of knowledge constraints (Tell et al., 2017). It is sufficient for this learning to be interactional rather than contributory.
**Interactional expertise.** Collins (2018) divides specialist expertise into contributory expertise and interactional expertise. Contributory experts are “people who exercise their expertise by contributing to their specialist domain” (Collins, 2018, p. 72), while interactional experts are “capable of framing their communication with cross-boundary peers in a manner that fosters exchange without producing overlap” (Barley et al., 2018, p. 293), because they have “the ability to master the language of a specialist domain in the absence of practical competence” (Collins & Evans, 2008, p. 14). Hence, they are not passive receivers of information, but able to be active in a conversation with a specialist from the other specialized domain. In other words, the boundaries of specialization can be traversed by the use of individuals who have acquired interactional expertise (Collins, 2018). These individuals can therefore play an important role when organizations need to assess how much knowledge needs to be shared across specialized domains at specific moments (Barley et al., 2018).

Collins (2011) asserts that interactional expertise is acquired by “linguistic socialization” only. Interactional experts thus possess “an in-depth understanding of the subject matter without the capacity necessary to practice it” (Tell et al., 2017, p. 249). Hence, this differentiates interactional expertise from trans-specialist understanding, as the former does not involve the ability to solve domain-specific problems while trans-specialist understanding does.

Research has also referred to specific levels of the breadth and depth of knowledge as “T-shaped” and “M-shaped” skills. These skills can be interpreted as variations of a combination of interactional and contributory forms of expertise within a project team. T-shaped skills include the specific cognitive skill of knowing how specialist tasks will have an effect in other specialized domains. The vertical stroke of “T” reflects depth of knowledge in one area, while the horizontal top-stroke reflects breadth across many areas (Iansiti, 1993). Thus, “T-shaped” refers to the combination of contributory expertise in one discipline and interactional expertise. Building on this, Bredin, Enberg, Niss, and Söderlund (2017) suggest
another kind of skill that represents both depth of knowledge (i.e., contributory expertise) and breadth of knowledge (i.e., interactional expertise) in several areas, which they refer to as an M-shaped skill. “M-shaped” refers to the combination of contributory expertise in several disciplines and interactional expertise. Bredin et al. (2017) found that T-shaped knowledge profiles suit traditional project contexts, while M-shaped knowledge profiles are crucial for agile project contexts.

**Mechanisms for the effective transfer of specialized knowledge**

Prior research has shown that knowledge transfer is affected by the transfer methods that organizations use (cf. Szulanski, Ringov, & Jensen, 2016). Using Sabherwal and Becerra-Fernandez (2005), we discuss the appropriate mechanisms for the effective transfer of each type of specialized knowledge. Sabherwal and Becerra-Fernandez (2005) argue that the different types of specialized knowledge are related to different levels of common knowledge and that this affects the appropriate integration mechanisms to be used for each type of specialized knowledge—as they rely on different amounts of common knowledge. The mechanisms that were found to affect integration are exchange, socialization, and internalization (Sabherwal & Becerra-Fernandez, 2005). Exchange involves the transfer of codified knowledge (Nonaka, 1994; Sabherwal & Becerra-Fernandez, 2005), socialization is the transfer of tacit knowledge or the synthesizing of two areas of tacit knowledge by joint interaction, while internalization refers to the acquisition of direct experience (Nonaka, 1994). Exchange is preferred for context-specific knowledge because the availability of common knowledge for integration is expected to be high within the organization (Sabherwal & Becerra-Fernandez, 2005). Exchange involves the externalization of tacit knowledge (Nonaka, 1994), and is more beneficial with an increased presence of common knowledge. Socialization requires physical proximity and is thus not as efficient as exchange of knowledge (Nonaka, 1994), but is preferred for technology-specific knowledge because it relies less on the presence of common knowledge and does not depend
on the communication of explicit information through a common language (Sabherwal & Becerra-Fernandez, 2005). Only individuals with similar educational or experiential backgrounds are likely to have the common knowledge required for the integration of technology-specific knowledge (Sabherwal & Becerra-Fernandez, 2005). The common knowledge that is relevant for the integration of context-and-technology-specific knowledge is likely to be low in the organization, because it is only present among specialists having both similar educational backgrounds and who work on similar tasks. However, new learning is necessary. Hence, internalization is more appropriate for the integration of context-and-technology-specific knowledge, because internalization mechanisms produce learning and rely minimally on common knowledge. The preferred mechanisms for transferring specialized knowledge is show in Table 2.

Table 2

*Preferred mechanisms for transferring specialized knowledge.*

<table>
<thead>
<tr>
<th>Type of specialized knowledge</th>
<th>Context-specific knowledge</th>
<th>Technology-specific knowledge</th>
<th>Context-and-technology-specific knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preferred transfer mechanism</td>
<td>Exchange (including externalization, or the conversion of tacit knowledge into explicit form)</td>
<td>Socialization (transfer of tacit knowledge or the synthesis of two different areas of tacit knowledge, usually through joint activities)</td>
<td>Internalization (tacit knowledge is transferred in action and practice, learning by doing, on-the-job training, observation, etc.)</td>
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</table>

**Benefits and Costs of Creating the Basic Conditions for Transferring Knowledge**

Based on this understanding of the basic factors that are required for effective knowledge transfer in the context of specialization, we discuss the benefits and costs of creating the basic conditions for transferring knowledge, that is, of enabling the basic factors at the organizational level. This leads us to answer our second research question: *What are the benefits*
and costs of creating the basic conditions for transferring specialized knowledge across specialized units in the context of specialization? The basic conditions refer to what organizations need to prepare to overcome the barriers created by multiple levels of specialization when transferring specific types of knowledge. They include codifying and decontextualizing knowledge, creating the necessary mechanisms for the effective transfer of specialized knowledge, and creating individual capability for sending, receiving, and integrating specialized knowledge. The section that follows discusses how the different types of specialized knowledge create benefits and costs when they are transferred and integrated across specialized units.

The benefits of transferring and integrating specialized knowledge

The transferring and integration of specialized knowledge across specialized units can lead to the building of innovative capacity, including exploration, exploitation, and ambidexterity capabilities (March, 1991; O'Reilly & Tushman, 2008; Tushman & O'Reilly, 1996). Each of these is related to the need to integrate knowledge in the organization as presented in the theoretical background—recombining different types of knowledge, spreading best practices, and establishing and updating common knowledge.

Exploration capability refers to the ability to recombine differentiated knowledge to create a new product, a new process, or a new business model. This recombination activity requires specialized knowledge to be transferred and integrated in a new way (Galunic & Rodan, 1998), which is handled by the R&D unit. Therefore, the recipient of transferring and integrating activities is the R&D unit, which might be referred to as an innovation unit in some organizations, while the sources are some selected units that possess the relevant specialized knowledge required by the R&D unit.

Exploitation capability refers to the ability to increase the efficiency and effectiveness of current products, processes, or the business model. Integrating knowledge such as best
practices and standard procedures from one unit to the rest of organization contributes to this capability (Szulanski, 1996). The sources of the transfer are high-performance units that possess such best practices and standard procedures, while the recipients are the relevant units that have similar functions or characteristics as the source in order for them to benefit from such practices and procedures.

Ambidexterity refers to the ability to simultaneously explore and exploit at the organizational level. This requires a structural division between exploitation units and autonomous exploration units (O'Reilly & Tushman, 2008). For ambidexterity to be successful, both differentiation mechanisms and integration mechanisms are crucial (Raisch, Birkinshaw, Probst, & Tushman, 2009). Although there is a structural separation between exploration and exploitation units, they should be connected and integrated at the top level of management in terms of strategy and at the bottom level in terms of collaboration (O'Reilly & Tushman, 2013). In this sense, transferring and integrating knowledge in order to establish and update common knowledge across organizations is essential. The recipients of this shared knowledge are all of the individuals and units in the organization, while the source can be a central knowledge repository system or a neighboring unit, or any individual in the organization.

**How much specialized knowledge should be shared, and how widely**

How much knowledge should be shared and how widely this should occur depends on the type of specialized knowledge to be transferred and integrated and the desired strategic outcomes of integrating such knowledge, as illustrated in Table 3. Regarding how much knowledge should be shared, we refer to a high degree, medium degree, and low degree. A high degree means that the full content of such knowledge should be shared, whereas a low degree means that the sharing of such knowledge should be limited. A medium degree is located somewhere between a high degree and a low degree. Regarding how widely knowledge should be shared, we refer to a great extent, medium extent, and small extent. A great extent means
that such knowledge should be shared across as many units as possible in the organization. A small extent means that such knowledge should be shared with only a small number of carefully chosen units. A medium extent means that such knowledge should be selected for transfer and integration among only selected units based on its relevance.

Table 3

*How much specialized knowledge should be shared, and how widely it should be shared, based on the strategic purpose (benefit).*

<table>
<thead>
<tr>
<th>Type of specialized knowledge</th>
<th>Strategic purpose (benefit)</th>
<th>Source and recipient</th>
<th>To what extent should specialized knowledge be integrated?</th>
<th>How widely should knowledge be shared?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Context-specific knowledge</td>
<td>Source: Selected units</td>
<td><strong>Medium degree</strong></td>
<td><strong>High degree</strong></td>
<td><strong>To a great extent</strong></td>
</tr>
<tr>
<td>Technology-specific knowledge</td>
<td>Recipients: R&amp;D units, innovation units</td>
<td><strong>Medium</strong>-<strong>Low degree</strong></td>
<td><strong>Medium</strong>-<strong>Low degree</strong></td>
<td><strong>To a medium extent</strong></td>
</tr>
<tr>
<td>Context-and-technology-specific knowledge</td>
<td>Source: All</td>
<td><strong>High degree</strong></td>
<td><strong>Low degree</strong></td>
<td><strong>To a small extent</strong></td>
</tr>
<tr>
<td>Strategic purpose (benefit)</td>
<td>Source: High performance units</td>
<td><strong>Medium-High degree</strong></td>
<td><strong>High degree</strong></td>
<td><strong>Not relevant</strong></td>
</tr>
<tr>
<td>Building exploration capacity (e.g., recombining differentiated knowledge)</td>
<td>Recipients: Relevant units</td>
<td><strong>Medium-High degree</strong></td>
<td><strong>High degree</strong></td>
<td><strong>Not relevant</strong></td>
</tr>
<tr>
<td>Building exploitation capacity (e.g., spreading best practice)</td>
<td>Source: Relevant units</td>
<td><strong>High degree</strong></td>
<td><strong>Low degree</strong></td>
<td><strong>Not relevant</strong></td>
</tr>
<tr>
<td>Building an integration mechanism for ambidexterity (e.g., establishing and updating common knowledge)</td>
<td>Source: All</td>
<td><strong>High degree</strong></td>
<td><strong>Low degree</strong></td>
<td><strong>Not relevant</strong></td>
</tr>
</tbody>
</table>
**Context-specific knowledge.** This type of knowledge is important for creating mutual understanding between organizational members, which is the foundation for any knowledge-sharing activity. When it comes to how much context-specific knowledge should be shared and integrated, we argue that transfer activities for creating exploration and exploitation capacities require a medium degree of such knowledge. A high degree is not necessary since not all context-specific knowledge is required; it should not be too low as mutual understanding would not be established if there were a low level of understanding of context-specific knowledge. This knowledge is especially important for creating integration mechanisms for ambidexterity, either at the organizational or individual level, in order to ensure the ability of specialized units to collaborate when this is required, regardless of the structural separation among exploitative and explorative units.

As “firms are considered superior to markets due to greater common context-specific knowledge” (Sabherwal & Becerra-Fernandez, 2005, p. 304), continuous integrating and updating of context-specific knowledge at the organizational level is crucial. Context-specific knowledge should be shared widely across units in the organization, especially when it involves creating the integration mechanism for ambidexterity. This type of knowledge should be updated for all units when new critical knowledge is added. Therefore, it should be available to a great extent at the organizational level.

**Technology-specific knowledge.** This type of knowledge refers to techniques, methods, or procedures from one context that can be applied in another context. A best practice is an internal method or technique “performed in a superior way in some part of the organization and [that] is deemed superior to internal alternate practices and known alternatives outside the company” (Szulanski, 1996, p. 28). Based on this definition, the content of best practices is mainly technology-specific knowledge, which should be shared to a high degree to increase the efficiency and effectiveness of organizational operations. Technology-specific knowledge is
also important for exploration activities, since it relates to the underlying scientific theory and disciplines. However, when it comes to creating an integration mechanism and updating common knowledge, it is not required that the full content of technology-specific knowledge be shared. Only important theory and methodology for establishing a common understanding should be shared.

When it comes to how widely technology-specific knowledge should be shared in organizations, we argue that it should be shared to a medium extent. As best practices will be spread to relevant units that have similar functions or operations as the source, such knowledge is not shared with the whole organization, but only with the relevant units. In addition, exploration activities are conducted in some specific units. Therefore, such knowledge is available to a medium extent at the organizational level.

**Context-and-technology-specific knowledge.** Context-and-technology-specific knowledge is complex and entails significant interdependencies. It requires experience and individual ability to make judgments and decisions (Sabherwal & Becerra-Fernandez, 2005). It is especially crucial for making decisions related to organizational strategy. Integrating such knowledge into R&D units, which focus on exploration innovation, may be beneficial. However, the complexity, and often tacit nature, of context-and-technology-specific knowledge make it significantly more difficult to be shared to the full extent, and thus it can be shared at medium-low degree only. When it comes to exploitation activities, this type of knowledge is better kept at the unit level due to the difficulty of standardizing it. Regarding its use for an ambidexterity integration mechanism, this knowledge is not relevant for bridging the knowledge gap between units. Therefore, it is available to a small extent at the organizational level, to selected units, and to specific individuals only.

**The cost of preparation for transferring specialized knowledge at the organizational level**
The overall efficiency of transferring specialized knowledge is related to the cost and speed of transfer (Gupta & Govindarajan, 2000). At the project level, the cost of transfer is dependent on the purpose of transfer, the nature of knowledge, and the knowledge profiles of the individual team members (i.e., T-shaped or M-shaped skills). In this section, we do not discuss the cost of transfer at the project level. Instead, we focus on identifying the basic costs that are incurred when organizations prepare to overcome the barriers created by multiple levels of specialization when transferring specific types of knowledge across specialized units. These costs result from codifying and decontextualizing knowledge, from using the necessary mechanisms for the effective transfer specialized knowledge, and include the costs of building individual capability for sending, receiving, and integrating specialized knowledge.

**Codifying and decontextualizing specialized knowledge.** The existing literature has presented willingness and ability as two key reasons that the transfer or integration of knowledge may be difficult (e.g., Hansen, 1999; Reagans & McEvily, 2003; Szulanski, 2000). In the chapter on theoretical background, we presented different levels of specialization, which, we argue, create significant barriers that create costs by reducing ability or willingness. The lack of ability to transfer knowledge in a specialized context may be related to the characteristics of the knowledge transferred, as the nature of the knowledge may make it difficult for the receiver to understand (Szulanski, 1996). Specialized knowledge is considered “knowledge that is possessed by a very limited number of individuals and is expensive to transfer” (Sabherwal & Becerra-Fernandez, 2005, p. 302). Here, the cost of transfer is argued to reflect, but not predict (Szulanski, 1996), the difficulty of the transfer (Teece, 1977; Von Hippel, 1994). Knowledge that is developed in diverse domains generates negative consequences for each other when interests are in conflict, and this thus generates costs for those involved (Carlile, 2004). These costs are not only related to what is new, but also to transforming both common and domain-specific knowledge, making the actors less willing to make such changes (Carlile,
This is related both to the specialist having increased learning costs in other specialized domains (Postrel, 2002), which reduces willingness, and specialization of learning competence in units that creates competency traps and opportunity costs for exploration (Levinthal & March, 1993). Lastly, the specialized organization creates barriers by the geographical separation of units and by imposing hierarchical communication lines that reduce the ability to effectively transfer knowledge (Simon, 1962). Hence, all types of specialized knowledge will have significant barriers to transfer based on specialization being manifested at multiple levels. However, context-and-technology-specific knowledge, being the most complex, is suggested to be the most costly to decode and transfer (Postrel, 2002; Szulanski, 1996; Szulanski et al., 2016). Context-specific knowledge is less costly to decode, whereas technology-specific knowledge is less difficult to transfer than the other two types owing to its characteristics of scientific and theoretical generalization.

**Building the appropriate transfer mechanism.** As noted earlier, the effectiveness of integrating a type of specialized knowledge depends on the availability of the common knowledge required for the chosen mechanism of transfer. Less common knowledge is available for context-and-technology-specific knowledge; hence, the cost of creating a mechanism for the internalization of context-and-technology specific knowledge is high. In addition, the cost of transferring technology-specific knowledge is higher than for transferring context-specific knowledge because socialization requires more resources than does the exchange of knowledge.

**Developing the capability to send, receive, and integrate knowledge for transfer.** At the organizational level, firms should develop the capacity to send, receive, and integrate knowledge before any specific transfer occurs since this capacity requires quite a lot of time and resources for it to be built. Transferring and integrating context-and-technology specific knowledge requires the ability to understand the knowledge in an in-depth manner, albeit
without practicing it. Only interactional expertise can achieve this. Transferring technology-specific knowledge to spread best practices requires at least trans-specialist understanding in order to attain commonly grounded knowledge between the source and the recipient. Transferring context-specific knowledge, when it has been decoded and is widely available at the organizational level, is less costly than with the other two types. The recipients need a sense-making ability to understand such context-specific knowledge if they have the required background and education to work in specialized organizations. The overall transfer cost decreases with experience (Tushman, 1977).

**Cost to acquire interactional expertise.** Acquiring interactional expertise is argued to be a long and hard process (Collins, 2018), requiring months or years of interaction across different specialties (Collins, 2004). This type of expertise is critical for deciding when and how to transfer specialized knowledge across units, based on an assessment of the benefits and costs of the transfer. It is important that an individual with interactional expertise not only functions across dyadic relations between units, but also at an organizational level in order to be able to assess the transfer of specialized knowledge among several units. This is thus an initial cost that is necessary for a decision-making process that involves the transfer of specialized knowledge. The cost of acquiring such expertise should increase in relation to the number of domains this individual covers. Based on the characteristics of knowledge specialization, it is cheaper to learn some items together (Postrel, 2002), and there are reduced costs for building interactional expertise across cognate specialties (Collins, 2004). However, the effects of transferring specialized knowledge across specialties that are less related may be greater, and this expertise may have a higher value. The cost of building interactional expertise is also lowered when an individual has had extensive prior interaction with the other specialized domain, for example, through job rotation.
An overview of the costs involved in enabling the basic conditions for transferring specialized knowledge at the organizational level can be found in Table 4.

Table 4
Basic cost of preparation for transferring specialized knowledge across specialized units.

<table>
<thead>
<tr>
<th>Type of specialized knowledge</th>
<th>Context-specific knowledge</th>
<th>Technology-specific knowledge</th>
<th>Context-and-technology-specific knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost factors</td>
<td><strong>Why it occurs</strong></td>
<td><strong>The basic cost of preparation for transferring specialized knowledge at the organizational level</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Coverage</strong></td>
<td>High coverage (need to continuous update and transfer across organization)</td>
<td>Medium coverage (for relevant units and members, not for everyone)</td>
<td>Low coverage (limited, only transfer when needed, for strategy purposes)</td>
</tr>
<tr>
<td><strong>Codifying and decontextualizing specialized knowledge</strong></td>
<td>Medium cost (to decode sticky contextual knowledge)</td>
<td>Medium-low cost (to decode technical knowledge)</td>
<td>High cost (complex and tacit knowledge is difficult to decode)</td>
</tr>
<tr>
<td>Building transfer mechanisms</td>
<td>Low cost (Exchange)</td>
<td>Medium cost (Socialization)</td>
<td>High cost (Internalization)</td>
</tr>
<tr>
<td>Developing the capacity to send, receive, and integrate knowledge</td>
<td>Low cost (requires sense-making ability, assuming that organizations recruit the right people for the job)</td>
<td>Medium cost (requires at least trans-specialist understanding)</td>
<td>High cost (requires interactional expertise)</td>
</tr>
</tbody>
</table>

A Decision-Making Process Model for a Specific Knowledge Transfer Project

A critical role of management in a specialized organization is to decide whether a knowledge transfer project should be implemented, and, if so, what the important factors are that the key decision-maker should consider when deciding how this should occur. The following proposes a decision-making process for the interactional expert to use when deciding whether the specialized knowledge of a specialized unit should be transferred (see Figure 2).
Figure 2. Conceptual model for the decision-making process.

This decision-making process comprises four steps that end with a decision whether or not to transfer specialized knowledge. The process entails identifying the strategic purpose or benefit, choosing the right combination of source and recipient of the transfer, identifying the type of specialized knowledge to be transferred, and analyzing the costs and benefits of transferring the identified specialized knowledge from the chosen source to the recipient to achieve the desired strategic purpose. The main points of this process are summarized in Table 5.
Table 5

The step-by-step decision-making process for transferring specialized knowledge.

<table>
<thead>
<tr>
<th>Step 1</th>
<th>Identify the underlying strategic purpose</th>
<th>Step 2</th>
<th>Choose the right combination of source and recipient</th>
<th>Step 3</th>
<th>Identify type of specialized knowledge to transfer</th>
<th>Step 4</th>
<th>Calculating the net present value of the specific knowledge transfer initiative</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Understand the strategic choice of the specialized organization</td>
<td></td>
<td>Identifying the specialized units and involving the appropriate specialists</td>
<td></td>
<td>Focusing on the critical specific knowledge and checking conditions for transfer</td>
<td></td>
<td>Building different scenarios for cost and desired strategic outcome</td>
</tr>
<tr>
<td></td>
<td>Building exploration capacity (e.g., recombining differentiated knowledge)</td>
<td>Source: Selected units</td>
<td>Technology-specific + Context-and-technology specific</td>
<td>Method: Start-up team; tiger team; etc.</td>
<td>Cost of implementing transfer method</td>
<td>Desired strategic outcome</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Building exploitation capacity (e.g., spreading best practice)</td>
<td>Source: High performance units</td>
<td>Technology-specific knowledge</td>
<td>Method: Multi-unit task teams; Rotation; etc.</td>
<td>Cost of implementing transfer method</td>
<td>Potential savings and extra revenue</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Building integration mechanism for ambidexterity (e.g., establishing and updating common knowledge)</td>
<td>Source: All</td>
<td>Context-specific knowledge</td>
<td>Method: Central consulting resource, skill pool management, etc.</td>
<td>Cost of implementing transfer method</td>
<td>Level of individual absorptive capacity</td>
<td></td>
</tr>
</tbody>
</table>

**Step 1: Identifying the strategic intent.** As previously presented, the benefits of transferring specialized knowledge within an organization can be categorized into three groups of strategic outcomes. Each purpose requires different expertise and mechanisms of transfer, thus resulting in different cost levels. Managers, when considering a knowledge transfer proposal, need to analyze the ultimate purpose of this specific activity.

**Step 2: Choosing the right combination of source and recipient for the transfer.**

Based on the purpose of knowledge transfer, managers decide who should be involved in the
transfer initiative. It is recommended that a general manager who does not have interactional expertise should assign this task to an interactional expert who has knowledge and understanding related to the initiative. In this step, the interactional expert selects the specialized units and the specialists with relevant expertise.

**Step 3: Identifying the type of specialized knowledge to transfer.** Step 3 entails the identification of the type of specialized knowledge that the interactional expert considers should be transferred—whether it is context-specific, technology-specific, or context-and-technology-specific knowledge (Sabherwal & Becerra-Fernandez, 2005). Each category of knowledge specialty has a different value for knowledge integration.

**Step 4: Calculating the net present value of the specific knowledge transfer initiative.** Step 4 concerns analysis of the potential costs and benefits of the specific initiative to transfer the specialized knowledge in an organization. Hence, cost analysis in this step is not related to the basic cost for creating the basic conditions for knowledge transfer discussed in the previous section. This cost is related to the specific method of transfer and the people directly involved in the transfer initiative. Similarly, benefits of the transfer are related to, but not the same as, the underlying purpose. For example, when the purpose is to build exploration innovation capacity, the benefits of the transfer refer to the potential strategic outcome for the organization. When the purpose is to build exploitation capacity, benefits refer to potential savings and extra revenue for incremental innovation. When the purpose is building an integration mechanism for ambidexterity, benefits refer to the increase in individual absorptive capacity. The final decision regarding whether specialized knowledge should be transferred is dependent on the operationalization of costs and benefits in the specialized organization.

The outcome of this process is the final decision of whether or not to transfer. If the net present value is higher than zero, that is, the benefits of this specific transfer are greater than
the costs, the initiative to transfer specialized knowledge should proceed. If the costs are greater, it should not.

**Discussion**

An organizational context in which specialization manifests itself at multiple levels according to organizational core capabilities that rest on specialized knowledge interacting with a specialized infrastructure raises several important theoretical questions—whether to maintain specialization for increased efficiency, or to integrate knowledge across specialized units in order to build innovation capacity, to update organizational common knowledge, or to spread best practices. Balancing these two opposing forces indicates the need to transfer knowledge across domains only when the benefit to the organization is greater than the cost; and, thus, knowing what specialized knowledge to transfer based on the desired outcomes and the methods required to transfer the specific type of knowledge. This paper responds to a call for research by Barley et al. (2018) that acknowledges the value of uncommon ground in organizations. Hence, this paper has sought to increase understanding of how to assess whether specialized knowledge should be transferred across units in specialized organizations.

Our contribution is two-fold. First, we have developed a conceptualization of specialization by integrating the literature on knowledge management in order to increase understanding of the concept of specialization. The current literature involves a prominent focus on how specialization affects knowledge transfer; however, it has not explored the complexity of specialization that manifests at multiple levels of analysis. In this paper, specialization is conceptualized at different levels of analysis in order to demonstrate the complexity of organizations in the presence of specialized knowledge, specialists, and specialized units. We show how these levels are related and describe the challenges that these levels create for the transfer of knowledge. Second, we have integrated and synthesized the literature on innovation, knowledge transfer, and knowledge management that deals with the types of specialized
knowledge, the need and extent of knowledge integration, and the cost of integration based on the preparation necessary, which is in turn based on the presence of knowledge transfer barriers. In doing so, we have developed a conceptual model for assessing the costs and benefits of transferring specialized knowledge across specialized units in specialized organizations, and have suggested a decision-making process based on this model in order to determine what knowledge needs to be shared, but also what should not be shared, across specialized units.

The interactional expert is suggested to be a key decision-maker in this process when it comes to identifying the relevant specialists and the type of knowledge to transfer. However, as emphasized by Ribeiro and Lima (2016), we acknowledge that an individual with interactional expertise will never have the same understanding and judgmental ability as do individuals with specialized expertise in a given specialized domain.

The timing of transfer methods has been found to affect the transfer. In cases where the source and recipient do not have an arduous relationship, Szulanski et al. (2016, p. 307) found that the “front-loading” transfer mode, in terms of which “more affordance for tacit knowledge exchange is allocated to the initiation of the transfer than to its implementation,” reduces the difficulty of transferring knowledge that have high causal ambiguity. Szulanski et al. (2016) assert that front-loading may involve the use of a collective bridge at the beginning of transfer though not in the end, which implies that the conceptual model needs to incorporate the timing of methods in order to assess the costs. Another issue relates to the social costs incurred after the knowledge is transferred; this relates to preserving the use of the new practice if it faces resistance from certain individuals (Szulanski, 2000).

**Further research**

This paper constitutes a fruitful basis for further research on the topic of specialization in organizations and the transfer of specialized knowledge in this context. The conceptualization of specialization serves as a foundation for further research topics involving
the specialized organization, specialized knowledge, knowledge management, and knowledge transfer. Our decision-making model offers a logical process with theoretical foundations for analyzing the costs and benefits of transferring specialized knowledge, and can be improved and elaborated further in future. Future research can use other approaches to analyze costs and benefits, such as using mathematical equations to express the costs and benefits of knowledge transfer and using empirical studies to calculate these. Regarding the methods of transfer, empirical results have connected the three types of specialized knowledge with mechanisms of transfer (exchange, socialization, and internalization) (e.g., Sabherwal & Becerra-Fernandez, 2005); however, there are, to our knowledge, no empirical studies that examine the connection of the three types of specialized knowledge to the structure of the transfer (i.e., boundary spanner versus collective bridge (Zhao & Anand, 2013)), or to other strategies of transfer, such as codification and personalization (Tangaraja, Rasdi, Samah, & Ismail, 2016). Such empirical studies in future research will help to significantly improve and validate the decision-making model. Finally, there is need for more research on the concept of the interactional expert, especially as regards how to identify appropriate interactional experts, and how to facilitate the efficient development of such expertise in organizations.

**Conclusion**

There is a need to manage the tension between, while preserving, differentiation and integration in specialized organizations (Barley et al., 2018). In order to achieve this, we need to increase understanding of how specialization manifests in specialized organizations, and to analyze the benefits and costs of transferring specialized knowledge across specialized domains. This paper has proposed a conceptual model and decision-making process for deciding how specialized knowledge should be shared across specialized domains in specialized organizations. The paper contributes to the literature on knowledge management by discussing the basic factors and conditions for transferring specialized knowledge, and
contributes to practice by offering guidelines for managing specialized knowledge in the context of specialization. It is especially important for specialized organizations to devise strategies to optimize the level of specialization in order to ensure they can still capture the benefits of integrating knowledge at the organizational level. This is also important for organizations possessing specialized knowledge to understand when they should share or should not share such specialized knowledge across units.


