The Contingent Effects of Social Networks on Social Learning in ERP Assimilation

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Abstract

In the assimilation stage of enterprise resource planning (ERP) systems, a major challenge for employees and managers is to overcome knowledge barriers and learn ERP knowledge efficiently. Social learning refers to informal learning-from-others in daily works. Prior literature has shown benefits of social networks on individual learning. However, several studies suggested that the value of social networks doesn’t generalize to all conditions. We employed a comparative case study to identify key components of social learning and investigate the contingent effects of social networks on social learning in different organizational settings. Data obtained by interviewing 23 ERP users in two firms in China indicate that 1) social learning is a bidirectional process with two essential stages, 2) instrumental ties, position homophily, external ties, and centrality of ERP learning network are positively associated with social learning, and 3) expressive ties and rank homophily affect social learning contingently.

1. Introduction

ERP systems are commercial software packages that integrate transactions-oriented data and business processes across functional activities of an organization [1]. Despite the extensive adoption, successful implementation, and years of assimilation, organizations often do not utilize installed ERP applications to their full functional potential [2]. Research argues that ERP systems are complex and assimilating ERP systems into organizational tasks and processes effectively is challenging [3]. In the assimilation phase, users still face significant knowledge barriers to understand and use the system in ways beyond routine business transactions [4]. The business value of ERP systems cannot be fully realized until ERP users extensively learn and assimilate ERP knowledge in an organization [3].

Thus, user learning has become a significant research topic and an important practice in ERP assimilation phase [5]. The prevailing research suggests that learning-from-others, which we refer as social learning, is key to information seeking and knowledge acquisition for ERP users [2]. Social learning in this study is conceptualized as an informal, interactive, and improvised learning process occurring in advice or friendship networks composed of ERP users to acquire explicit and implicit ERP knowledge. Through social learning, ERP users interact with each other in daily work, transfer or share their explicit and implicit system knowledge [6], and improve their level of ERP assimilation [5]. Given the significant effects of ERP users on ERP assimilation, understanding social learning in the ERP assimilation phase is essential to the realization of returns on ERP investment [5].

There is a growing body of literature on the importance of social networks as a locus of learning (e.g., [7, 8]). An important insight from this literature is that information and knowledge are distributed in networks according to unique work circumstances of each employee in organizations [9], thus actions and outcomes can be predicted by the ties and positions employees occupy in networks. Existing literature on networks and learning has primarily focused on how social networks increase learning performance (e.g., [10, 11]). However, it has been suggested that network embeddedness does not necessarily lead to positive outcomes [12]. The effectiveness of ties and positions may not be uniform, but rather varies depending on the situation [13]. For example, Xiao and Tsui [12] pointed out that a clan-like, high-commitment organizational culture is detrimental to the facilitative effect of structural holes on employees’ career achievements. Thus, the purpose of this study is to explore the contingent effects of social networks on social learning in the ERP assimilation context. We are interested in addressing two specific research questions: 1) What are the key components of social learning? 2) How do social networks contingently affect social learning in the ERP assimilation context?

Given the limited prior research in literature, we conducted a comparative case study to explore the contingent effects of social networks on social learning. The next section of this study presents our theoretical background. This is followed by a description of our case organizations and the case study methodology. We then present our interpretation of the main findings of this study, along with the propositions related to our research questions developed from the case evidence. We conclude with discussion of implications and limitations for research and practice.

2. Theoretical Background

2.1. Social learning

Researchers have conceptualized learning as a social and relational activity. Based on social network theory, individual learning, viewed as a product of social interactions, highlights individuals’ intentional information and knowledge seeking and helping [7, 11]. Social learning as we used in this study resonates with this perspective of learning. However, the relationship between social learning and knowledge seeking are complex in social networks.

First, based on social network theory, instrumental ties serve as channels for the exchange of work-related resources including information, advice, and knowledge [14]. In contrast, expressive ties are relationships developed for friendships, trust, and emotional support [14]. Literature on knowledge seeking suggests that advice networks connected by instrumental ties promote learning, especially the structure of
describe individual boundary spanning
at copier repair technicians
social learning scholars.
The process of social learning, as a specific form of
cognition in enterprise information portals.
investment, learning-by-doing occurs in three distinct learning processes, i.e., learning-by
locality, and learning-from-others in the

Second, prior studies on knowledge seeking suggest that
individuals often acquire explicit knowledge in daily work
(e.g., [19]). Orr [20] showed that copier repair technicians
learn explicit knowledge in consultation with documentation
or, more often, with colleagues in the course of resolving
technical problems. Moreover, focusing on explicit knowledge
enables one to map the learning network easier [11]. However,
social learning provides individuals with both explicit and
implicit knowledge. Expressive ties provide users with
valuable resources (e.g., trust, extensive interactions)
necessary for learning tacit knowledge [16].

Finally, prior research argue that social networks play an
important role in affecting access to information and
knowledge, a key mechanism leading to better learning performance [21]. Podolny and Page [10] suggested that social
networks can foster learning in two ways: promoting the rapid
transfer of self-contained information, and providing
individuals with information that is qualitatively distinct from
what they already possess. However the effects of social
networks on individual learning are not merely informational
benefits. Ibarra and Andrews [22] proposed that, except the
benefit of access to information and resource, advice networks
have another benefit resulting from one’s ties with another,
amely power and influence.

However, the extant research has primarily investigated
antecedents or consequences of learning rather than the
process of learning. Ryu et al. [23] proposed that learning
occurs in three distinct learning processes, i.e., learning-by
investment, learning-by-doing, and learning-from-others in the
context of knowledge transfer in enterprise information portals.
The process of social learning, as a specific form of
learning-from-others, has not received adequate attention from
scholars.

2.2. Social network theory and network effects on
social learning
A social network is conceptualized as “a specific set of
linkages among a defined set of persons, with the additional
property that the characteristics of these linkages as a whole
may be used to interpret the social behaviour of the persons
involved” [24, p.2]. A social network views patterns of
individual interactions as a graph of connections, with
individuals within a network being called nodes and
relationships between individuals being called ties [25]. Social
network theory describes the ties and the structure of a
network as resources and predictors for social actions [26].
Prior research has identified five basic characteristics of social
networks: instrumental ties, expressive ties, external ties,
centrality, and homophily.

Based on the strength of the ties, network researchers
distinguished the ties into instrumental and expressive (also
called weak and strong ties ) [27, 28]. Granovetter [29]

classified acquaintances or friends of friends as instrumental
ties whereas friends, relatives, or neighbours were considered
as expressive ties. Instrumental ties are efficient for obtaining
novel information [28]. Burt [26]’s theory of structural holes implied that employees can achieve learning from
instrumental ties by gaining non-redundant information. Via
instrumental ties, ERP users have access to information about
different areas that could contribute to broad understanding
and high level assimilation [5].

Expressive ties describe close and frequent relationships
between two persons [14]. People connected via expressive
ties would communicate more effectively, frequently, and
extensively [17], that in turn contributes to accelerating ERP
users’ learning of complex and implicit knowledge [5].

External ties describe individual boundary spanning
relationships across departmental or functional boundaries
in organizations [30]. External ties facilitate the acquisition of
knowledge that is distinct from self-contained knowledge [6],
which motivates ERP users to see a problem or task from an
alternative perspective [6], facilitates breaking traditional
paradigms of thinking and doing [5], and stimulates creativity
and innovation [31].

Centrality represents how central an actor is within a
network, and is defined most broadly by number of direct ties
held by an actor [32]. Centrality has been shown to yield a
number of important benefits including high information
quality [15], better job performance [21], etc. That is because
a central position provides access to diverse source of
information and knowledge for individuals who occupy it,
which gives them a particular pool of opportunities, resources,
and information to draw upon when solving complex
problems [33]. Centrality of a friendship network or advice
network has been found as a key predictor of social learning of
ERP knowledge [5].

Homophily is defined as the similarity degree between
connected individuals in age, race, gender, rank, etc. [34]. It
refers to the fact that people are prone to maintain
relationships and bond together with those similar to
themselves [14]. In the assimilation phase, homophily makes
the assimilation of ERP systems easier [5], through improving
the odds of forming direct and frequent learning behaviors
among ERP users and creating more opportunities to clarify
misunderstandings about ERP knowledge [35].

2.3. A contingent view of social networks
Relying on the resources and information obtained from
social networks [26], employees can report high information
quality [15], effectively transfer knowledge [6], and achieve
better learning performance [11]. However, although
researchers agreed that ties and networks matter, the issue of
contingency has not received adequate attention in the
discussion [13]. There is a growing body of research focusing
on “the harder and more interesting issues of how ties and
networks matter, under what circumstances, to what extent,
and in what ways” [36, p.297]. This stream of literature argued
that network effects vary depending on characteristics of the
context around the networks, or of the nodes themselves. For
example, Carnabuci and Diószegi [37] pointed out that
cognitive styles of employees are a critical contingency
3. Case Study Design

Given the limited research about how social networks impact on social learning in the context of ERP assimilation, we conducted a comparative case study [38], which is appropriate for three reasons. First, case study is especially useful for developing theoretical insights when little is known about a phenomenon, or research focuses on areas that current perspectives seem inadequate. Second, multiple cases permit a replication logic [39]. Cases are treated as independent experiments that confirm or disconfirm inferences from the others. Finally, multiple cases are effective to yield more accurate, robust, and generalizable theory based on comparative data [40].

3.1. Case study protocol and firms

We followed the general guidelines for conducting positivist exploratory case studies [41]. A case study protocol was first developed based on an extensive literature research and brainstorming. The research setting was different case firms that had successfully implemented SAP R3 (a popular ERP system from SAP) and were in the assimilation phase. These criteria were set for two reasons. First, compared with other types of ERP systems, especially ERP products of domestic vendors in China, SAP R3 is more complex, difficult to assimilate, and demands more extensive user learning, which provides an ideal research context. Second, limiting to one type of ERP systems can rule out the potential complications introduced by ERP systems on users’ social learning because of differences in the complexity of system knowledge.

Based on these criteria, we chose 2 firms from a population of 9 firms that we had access to. Table 1 summarizes the diverse characteristics of the case firms. A key challenge of our study was that firm A and firm B were significantly different in size. However, considering that our aim was to understand ERP users’ networks and social learning, the two case firms fit our purpose because of the similar scale of ERP users.

### Table 1. Profiles of the case companies

<table>
<thead>
<tr>
<th>Firm</th>
<th>Type of enterprise</th>
<th>Industry</th>
<th>Annual sales (billion RMB)</th>
<th>Number of employees</th>
<th>Number of ERP users</th>
<th>ERP modules in use</th>
<th>Years ERP use</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Joint Venture</td>
<td>Aviation</td>
<td>0.3</td>
<td>231</td>
<td>200-210</td>
<td>Finance &amp; Controlling(FI/CO), Quality Management (QM), Materials Management (MM)</td>
<td>10</td>
</tr>
<tr>
<td>B</td>
<td>State-owned</td>
<td>Petroleum</td>
<td>66.7</td>
<td>5000</td>
<td>190-200</td>
<td>FI/CO, MM, Project System(PS), Plant Maintenance(PM)</td>
<td>4</td>
</tr>
</tbody>
</table>

### Table 2. Profiles of informants

<table>
<thead>
<tr>
<th>Firm</th>
<th>Number of informants</th>
<th>Manager</th>
<th>Key user</th>
<th>Common user</th>
<th>IT staff</th>
<th>Source of informants</th>
<th>Interview time</th>
<th>Transcript in Chinese</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>13</td>
<td>IT manager (A₁)</td>
<td>QM module (A₁)</td>
<td>FI module (A₂)</td>
<td>MM module (A₃)</td>
<td>IT department (A₄, A₁₂)</td>
<td>About 6 hours</td>
<td>About 88,000 words</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>MM module (A₁₀)</td>
<td>CO module (A₅)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>10</td>
<td>IT manager (B₁₀)</td>
<td>FICO module (B₁)</td>
<td>MM module (B₄)</td>
<td>PS module (B₇)</td>
<td>IT department (B₈)</td>
<td>About 6 hours</td>
<td>About 80,000 words</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>PM module (B₉)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>23</td>
<td>2</td>
<td>9</td>
<td>9</td>
<td>3</td>
<td>12</td>
<td>168,000</td>
<td></td>
</tr>
</tbody>
</table>

3.2. Data sources

The primary data source was semi-structured interviews. In each firm we interviewed four types of informants who were related to ERP systems, including IT managers, key users, common users, and IT staff, which strengthened the confidence in the accuracy of findings through triangulation of data collected from multiple informants [42]. Key users provided expert knowledge during the implementation, configuration, and daily running of the system. Common users used ERP systems to accomplish their daily works. IT staff were responsible for the maintenance and support of the systems.

We conducted 23 interviews with 10 in December 2013 and 13 in January 2014, because the case firms were located in different cities. We recorded and transcribed the interviews, most within 72 hours of their occurrence. The interviews ranged from 20 to 60 minutes. A key advantage of our study is its data collection with at least one key user and one common user for each ERP module, which improved the coverage and generalization of findings. Table 2 provides detail profiles of the informants.

3.3. Data analysis

explaining the relationship between social networks and innovative performance. Li et al. [13] argued that the specific institutional and cultural contexts moderate the positive effects of ties on firm performance. It’s important to note that, the effects of networks are not uniform across all conditions. Given the contingent view of network effects, it is logical to suspect whether benefits of social networks on social learning can be generalized to different conditions. And we are interested in knowing how different the effects of social networks on social learning are in different organizational settings.
4. Main Findings

4.1. Social learning and the learning process

4.1.1. Social learning in ERP assimilation. After the rollout of an ERP system, ERP users need to assimilate it into their daily work [44], which determines whether an organization can achieve the level of anticipated benefits from the ERP system [4]. Our case evidence showed that there are a number of learning approaches undertaken by ERP users in the assimilation stage (see Table 3), that can be further grouped into three learning processes.

We found that in ERP assimilation, learning-by-doing is widely viewed as the most significant way to acquire knowledge, and learning-from-others is pervasively regarded as the most efficient way to solve problems and the essential supplement to learning-by-doing, while learning-by-investment is considered to have limited benefits to the acquisition of ERP knowledge. A key user of FI module of firm A stated, “The most important way to get ERP knowledge, especially to apply the system innovatively, is to constantly practice in daily works. Then ERP users will get deeper understanding of the functions and internal logic of the system through their experience, which can empower the ERP users to grasp the use tips solidly and give their suggestions. When encountering problems on the job, ERP users would consult to other users or IT support personnel directly, which is supposed to be a fast way. Because tasks have time limits, there is no sufficient time for ERP users to find solutions on their own. Also, the operation manual is normally superficial about how to operate but not why. Besides, we don’t update the operation manual timely, the problems confronted by ERP users in practice are always brand-new. Thus it can’t guide ERP users to figure out the problems.” (A6)

The interviews yielded transcripts about 154 pages. Two researchers reviewed the data, began with an in-depth analysis of each case through the lens of our research questions, and coded them following an open coding strategy with the text analysis software NVivo 8.0. The passages in the transcripts were first coded as free nodes based on the central ideas, such as “training”, “learning”, “friends”, “work”. Most of the free nodes were later merged into tree nodes if the concepts were similar or related to other nodes in a tree. In the end, five root tree nodes emerged, and each of the root nodes has two- or three-level tree structure with multiple child nodes that represent refined ideas. The coding was carried out mostly to highlight the major ideas and concepts that embedded in the interview transcripts. We then turned to cross-case analysis, in which the insights that emerged from firm A were compared with those from firm B, in order to identify consistent patterns and discrepancies [43].

<table>
<thead>
<tr>
<th>Company A</th>
<th>Company B</th>
<th>Learning approach</th>
<th>Learning process and definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>M K C I M K C I</td>
<td>Practice</td>
<td>Learning-by-doing (Accumulated Knowledge: receive feedback and learn from experience with working on tasks.)</td>
<td></td>
</tr>
<tr>
<td>✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓</td>
<td>ERP users</td>
<td>Learning-from-others (Communication with others: give advices or send knowledge to others and get them from others.)</td>
<td></td>
</tr>
<tr>
<td>✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓</td>
<td>IT professionals</td>
<td>Learning-by-investment (Knowledge investment: consume a certain amount of resources and time to search for new skills and techniques.)</td>
<td></td>
</tr>
<tr>
<td>✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓</td>
<td>ERP knowledge database</td>
<td></td>
<td></td>
</tr>
<tr>
<td>✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓</td>
<td>External sources</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: M represents IT managers. K represents key users. C represents common users. I represents IT staff.

Literature suggested that one common way to acquire ERP knowledge is to communicate and abstract from organizationally designated sources, such as ERP knowledge database, trainers, and IT professionals [45]. However, in the ERP assimilation phase, knowledge is commonly obtained in the informal problem-solving processes. A common user of MM module of firm B stated, “At the beginning, we learned the system from the training program before the rollout, and knew the operational steps. But it would be impossible to undertake routine works if ERP users don’t practice them. Even though ERP users memorize all contents taught during the training, when confronting problems on the job, they often can’t go on further with their work. ERP users can submit their questions to the help desk and wait for answers from IT staff. Although the help desk is easy and convenient to use, ERP users have to wait a long time to get responses. And sometimes IT staff can’t give us appropriate solutions due to lack of sufficient professional or business knowledge, and need to work with us to find the most suitable solution. Thus we often discuss problems among ERP users first. If we can’t settle, then we submit them.” (B6)

Our interviews provided relatively rich evidences that social learning is one of the most significant approaches to acquire ERP knowledge in the assimilation phase and can be instrumental in assisting ERP users to cope with knowledge barriers in practice. Therefore, we propose:

P1: Social learning is a significant mechanism in users’ learning in the assimilation phase of ERP technology in organizations.

4.1.2. Stages in social learning. Literature on individual learning has explored the antecedents that predict or explain better learning outcomes [45]. However, there is little insight into the learning process itself. To better understand it, we asked informants about important things related to learning from other ERP users, and the informants expressed a number of key points about social learning, shown in Table 4. Based on this evidence, we argue that social learning is more likely...
to be a problem-solving process that consists of multiple stages occurring in a certain order, shown in Table 4 and Figure 1.

Based on the evidence, we propose a stage model of social learning: social learning consists of two stages identified as communication and learning, and six substages identified as question, delivery, comprehension, solution, acquisition, and internalization.

Table 4. Stages of social learning

<table>
<thead>
<tr>
<th>Substage</th>
<th>Key point</th>
<th>Stage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question</td>
<td>Know learning what</td>
<td>Communication</td>
</tr>
<tr>
<td>Delivery</td>
<td>Ask matched persons</td>
<td></td>
</tr>
<tr>
<td>Comprehension</td>
<td>Understand each other</td>
<td></td>
</tr>
<tr>
<td>Solution</td>
<td>Find solutions</td>
<td></td>
</tr>
<tr>
<td>Acquisition</td>
<td>Get knowledge or information</td>
<td></td>
</tr>
<tr>
<td>Internalization</td>
<td>Memorize and practice</td>
<td></td>
</tr>
</tbody>
</table>

**Communication.** This stage comprises three substages with the purpose of searching for potential solutions, or superior knowledge, including question, delivery, and understand.

**Question** The question substage comprises ERP users’ events or needs that lead to the decision to search. The premise of a search is that both the ERP users’ needs and the knowledge to meet those needs exist within the organization. The search may lead to the discovery of solutions or superior knowledge. Generally, during this substage, one learner carefully considers about those needs and organizes a set of pertinent questions. This substage is specific to the learner, and followed by the question centric transmission to one advisor.

**Delivery** The delivery substage begins when the learner finds one advisor who fits his/her needs, and formulates his/her prepared questions to the advisor. In this substage, questions flow from the learner to the advisor through established social ties between the two, or new question-specific social ties between them are established if one does not exist. Delivery-related activities cease after the advisor understands the learner’s needs. Otherwise, the search would return to the question substage, and the learner needs to rethink his/her needs and questions, restart the delivery substage until the advisor clearly understands the issue.

**Comprehension** The comprehension substage begins when the advisor starts understanding the questions of the learner. During this substage, the advisor attempts to understand what the learner is experiencing from within the learner's frame of reference. The comprehension substage provides a great opportunity to explore a range of knowledge related to potential solutions.

Overall, the communication stage describes the knowledge-searching, question-formulation, and issue-
channels transmitting needs and knowledge to address the needs of the learner, and highlights the considerable effect of interactions between the learner and the advisor. Therefore, we propose:

**P2: Social learning has two essential stages that include communication and learning in a bidirectional process of interactions between learners and advisors.**

### 4.2. The contingent factors of social networks

The stage model of social learning reveals that social ties are the primary conduits for both communication and learning. Extant literature suggested that instrumental ties, expressive ties, external ties, centrality, homophily of established social networks may facilitate social learning. However, we identified inconsistent facilitation patterns in the two case firms. Cross-case analysis indicated that social networks played different roles in facilitating social learning. Table 5 shows the discrepancies of networks effects respectively.

**Table 5. Evidence map of the effects of social networks**

<table>
<thead>
<tr>
<th>Company A</th>
<th>Company B</th>
<th>Network factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>K</td>
<td>C</td>
</tr>
<tr>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

**Instrumental ties.** Our case evidence confirmed that instrumental ties play an important role in social learning. We identified similar pattern in both firms. On one hand, according to some interviewees, instrumental ties, as potential channels for conveying needs of ERP users, could trigger social learning in the behavioral pathway that prompts ERP users to engage in learning behaviors by affecting the likelihood or frequency of social learning. Our case evidence indicated that instrumental ties motivate question-asking behavior of ERP users and enhance opportunities of communications. On the other hand, consistent with Uzzi’s [46] argument that instrumental ties foster rapid feedbacks and joint problem-solving arrangements, which help employees to acquire non-redundant information and new combinations of knowledge, our interviews showed that instrumental ties serve as a primary conduit for solution and knowledge transmission and promote social learning in the informational pathway that facilitates ERP users to gain updated information or knowledge via networks. Table 6 shows the detail case evidence.

**External ties.** Nelson [48] pointed out that external ties are either instrumental ties or expressive ties, but are more likely to be helpful to work-related information and knowledge exchange [30]. Our interviews revealed the same pattern in the two firms that external ties tend to generate cross-functional knowledge transfer. Table 8 shows the detail case evidence. Thus, compared with the behavioral pathway, external ties are more apt to ease social learning in the informational pathway.

**Centrality.** Centrality is defined by number of direct ties held by one actor in the network [32]. The central positions of a friendship network or advice network provide individuals who occupy them with more information and knowledge [33]. However, we didn’t collected in-depth data to map friendship and advice networks of the two case firms. We asked who the most frequently asked ERP users were in each module to trace the structure of the ERP-specific learning network. Our case evidence revealed the same pattern in the two case firms that positions with high centrality of the ERP learning network predict better learning outcomes. From the learner’s perspective, learners with high centrality own more channels for information and knowledge, easily achieve learning benefits through the informational pathway. From the advisor’s perspective, a knowledgeable advisor tends to be more central in the ERP-specific learning network, and become a source to transmit information and knowledge. Table 9 shows the detailed case evidence.

**Table 6. Case evidence for instrumental ties**

<table>
<thead>
<tr>
<th>Influence mechanism</th>
<th>Case evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Behavioral pathway</td>
<td>“Our offices are on the same floor, we work together, sit next to others. We have worked together for years and know each other very well. It makes me feel comfortable to ask questions without scruples.” (Common user of MM module, B4)</td>
</tr>
<tr>
<td></td>
<td>“Generally speaking, we have routine works and fixed partners. When meeting problems, more than ERP system’s problems, we have a tacit understanding to discuss problems in our team first.” (Common user of MM module, A2)</td>
</tr>
<tr>
<td></td>
<td>“We are colleagues with the same goal to finish tasks during working hours. Provided I have questions, I think everybody would help me so long as he/she could. Thus even an ERP user is introverted, there is no need for him/her to feel embarrassed to express his/her thoughts.” (Key user of FI module, A6)</td>
</tr>
<tr>
<td>Informational pathway</td>
<td>“Through continual cooperation, we have known quite well about the capabilities and personal traits of frequently contacted peers in jobs. They underwent different issues, accumulated distinct knowledge and skills. Take A (one user of QM module) and B (one user of CO module) for example, to the same problem, they often provide different solutions from qualitatively distinct perspectives. Thus I can grasp more diverse and comprehensive knowledge during frequent interactions with them.” (Key user of CO module, A8)</td>
</tr>
<tr>
<td></td>
<td>“Generally speaking, while I confront difficulties when using the system, the person I ask for help is more likely to be one of peers who closely meshed with my work. They may have met the same situations before, then they can give me quick feedbacks and right knowledge.” (Key user of PS module, B7)</td>
</tr>
</tbody>
</table>
Homophily. Kilduff and Tsai [49] argued that creating and maintaining social ties cost resources. Therefore, users must selectively choose the ties to create, the ties to maintain, and the ties to dissolve [21]. Homophily refers to the fact that people tend to maintain relationships and bond together with those similar to themselves [14]. Homophily improved the odds of forming direct and frequent learning behaviors among system users [35]. Our case evidence indicated that different kinds of homophily play distinct roles on social learning in the two sampled firms.

Table 7. Case evidence for expressive ties

<table>
<thead>
<tr>
<th>Influence mechanism</th>
<th>Case evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Behavioral pathway</td>
<td>“My final goal is to resolve problems. However, I won’t ask one person who is unsociable in the usual interactions, even she is knowledgeable. It’s a painful experience to communicate with such persons.” (Common user of PS module, B9)</td>
</tr>
<tr>
<td></td>
<td>“Frankly speaking, except IT support personnel, our routine works are not to help others deal with difficulties. Helping others need ERP users to cost time and energy, especially when the problems are complex and need a long time to explain in detail. In such situations, selecting one person with good relationships is much better. After all, everybody is quite busy.” (Key user of PM module, B6)</td>
</tr>
<tr>
<td>Informational pathway</td>
<td>“Users with good friendships will answer questions readily, and explain in detail. While users without good friendships may not provide helps, or are more likely to just tell the basic or routine operations without any extensions.” (Key user of FICO module, B2)</td>
</tr>
<tr>
<td></td>
<td>“I prefer to ask C (one user of FICO module). Of course he is experienced and knowledgeable. However more importantly, we are close friends. To the same problem, he always provides me deep insights into the system and tells me more knowledge than others. Sometimes, if he gains some tips on the system or jobs, he would positively tell me. Moreover, the problem may be too difficult to resolve during working hours. C will find solutions after work. Once, he helped me until the midnight, but let his wife drive their fevered son to the hospital alone. Peers with common relationships are definitely impossible to do like this.” (Common user of FICO module, B3)</td>
</tr>
</tbody>
</table>

Table 8. Case evidence for external ties

<table>
<thead>
<tr>
<th>Influence mechanism</th>
<th>Case evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Informational pathway</td>
<td>“If one ERP user wants to understand the system deeper, it’s certainly not enough to read operational manual or help documents. In my company, those acknowledged seasoned ERP user all communicate with other departments frequently. Then they can get a wider understanding of system functions of other ERP modules. These ERP users are clear about what their mistakes will trigger to others’ works.” (Common user of MM module, A2)</td>
</tr>
<tr>
<td></td>
<td>“Through interactions with other ERP users of different modules, I can acquire knowledge that is different from what I have know. Some ERP users only know the knowledge within their working range. They will be hard to come out of themselves without outside contacts. Take our purchasing department for example, we are quite convenient to contact with other ERP users of different departments. Departments of quality, production, payment are more likely to be one stage next to material purchase. Thus we have more opportunities to interact with them, then know much wider about the system.” (Key user of MM module, A10)</td>
</tr>
<tr>
<td></td>
<td>“Our finance department links closely with other departments, thus in routine works, there are many tasks needing cross-departmental cooperation. ERP users can utilize these chances to extend their knowledge and grasp certain operations of other ERP modules. Take D (one user of FICO module) for example, he contacts with other ERP modules very frequently, especially the PM module. Some ERP users of the PM module know less than what he knows about the PM module.” (Key user of FICO module, B2)</td>
</tr>
</tbody>
</table>

Table 9. Case evidence for centrality

<table>
<thead>
<tr>
<th>Individual role</th>
<th>Case evidence (Informational pathway)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advisor</td>
<td>“In our module, both I and the other colleague answer questions more. ERP users are aware that we use the system well and know knowledge of other ERP modules, thus they prefer us to help them.” (Key user of FICO module, B2)</td>
</tr>
<tr>
<td></td>
<td>“It’s certainly B2 (we asked frequently). He is the most knowledgeable in our module. More than ERP users of FICO module like asking him for help.” (Common user of FICO module of firm B, B3)</td>
</tr>
<tr>
<td>Learner</td>
<td>“They (ERP users of QM module) ask me quite more, especially newcomers. Because I know all transaction codes of QM module. But in return, through their questions, I also can know problems stemming from their tasks, accumulate more experiences.” (Key user of QM module, A1)</td>
</tr>
<tr>
<td></td>
<td>“On average, it must be A1 we asked most. After all, she worked here for 10 years, and confronted more problems we haven’t met.” (Common user of QM module of firm B, B3)</td>
</tr>
<tr>
<td></td>
<td>“Take the business of company vehicle repair for example, it links to our finance department. We need to check the invoices of repair charge in the system. Almost every ERP user in charge of this business once asked me for help. Sometimes they even directly let me finish their works instead of them. My leader often blamed me because I didn’t finish my own tasks in time. Although I cost much time to help others, I also learned much from them. At the beginning, I know nothing of vehicle repair. Now I can quickly judge whether the oil consumption is reasonable according to the driven kilometres, whether the repair charge is reasonable according to the breakdowns, and so on. All of these are learned from ERP users who are responsible for company vehicle repair business.” (Common user of FICO module, B3)</td>
</tr>
</tbody>
</table>

Position homophily Similarity of position signals potential similar experiences and knowledge of ERP users, which is beneficial to understand each other, save communication time, and resolve problems [35]. During our interviews, it became clear that position homophily boost social learning behaviors of users for multiple reasons. The major one is that position homophily is useful to connect to one another quickly. Another is that position homophily is conducive to resolve problems and acquire knowledge efficiently. Table 10 shows the detailed case evidence.
Rank homophily. Our case evidence showed that the effect of rank homophily on social learning varies in different firms. In firm B, users’ perception about the difficulty in building learning ties with leaders, as well as leaders’ perceived lack of technical knowledge, appear to give credence to the benefits of rank homophily (See Table 11). However, in firm A, only one common user of F1 module expressed that he took into account rank homophily due to conveniences.

Age homophily. Tsui, et al. [50] found that differences in age of individuals impede communications among individuals.

Table 10. Case evidence for position homophily

<table>
<thead>
<tr>
<th>Influence mechanism</th>
<th>Case evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Behavioral pathway (catch on to one another)</td>
<td>“My position has an advantage that there is another ERP user whose job duties are almost the same as mine. He joined the company earlier. Some of his knowledge are passed to me by word of mouth. Because the same position, he familiarizes himself with my work. Otherwise, he may not know what I say, and vice versa.” (Common user of MM module, A2)</td>
</tr>
<tr>
<td>Informational pathway (acquire knowledge)</td>
<td>“The natures of different jobs determine whether he/she (one advisor) can understand my questions correctly. If I want to discuss my tasks with someone, I must find one who stands with me in the same line. That is to say, we have the same backgrounds. Thus, discussing under the same backgrounds is more likely to analyse problems thoroughly. And it’s easy to reach a consensus as well.” (Key user of FICO module, B2)</td>
</tr>
</tbody>
</table>

Table 11. Case evidence for rank homophily

<table>
<thead>
<tr>
<th>Firm</th>
<th>Case evidence (Behavioral pathway)</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>“Rarely ask directly to high levels. They (leaders) may think that there are ERP users who can resolve my problems, I can seek help from them. Frankly speaking, I feel uncomfortable to ask leaders directly. Besides, leaders tend to be skilled in management, they may not be knowledgeable in the system and specific tasks.” (Common user of PS module, B8)</td>
</tr>
<tr>
<td>A</td>
<td>“Leaders seldom need to operate in the system. They just need to tell someone what they need. They are experts at business knowledge, but they may use the system worse than me.” (Key user of FICO module, B2)</td>
</tr>
</tbody>
</table>

Table 12. Contingent factors of social networks

<table>
<thead>
<tr>
<th>Network factor</th>
<th>Company A</th>
<th>Company B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instrumental ties</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Expressive ties</td>
<td>✗</td>
<td>✓</td>
</tr>
<tr>
<td>External ties</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Centrality</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Position homophily</td>
<td>✓</td>
<td>✗</td>
</tr>
<tr>
<td>Age homophily</td>
<td>✗</td>
<td>✗</td>
</tr>
<tr>
<td>Rank homophily</td>
<td>✗</td>
<td>✓</td>
</tr>
</tbody>
</table>

Note: ✓: the presence of this factor was validated. ✗: the presence of this factor wasn’t validated.

This study addresses the theoretical gaps both in social network and social learning literature by investigating the effects of social networks on social learning in the ERP assimilation context. A comparative case study was undertaken to develop a theoretical framework of social learning and related research propositions. Our research findings provide some insights into understanding social learning and the contingent effects of social networks.

5.1. Theoretical implications

This study extends prior social learning and knowledge transfer theories in the literature by shedding light on a nuanced social learning process in the ERP assimilation context. We propose that social learning has six substages: question, delivery, understand, solution, acquisition, and internalization. The process of social learning is bidirectional and loop-closed starting with a learner and ending with the learner.

Another contribution is that this study enriches our understanding of the role of social networks from two perspectives. First, prior research underscored the information and resource benefits of social networks on learning, but this study refines the influence mechanisms of social networks into the behavioral and informational
pathways. The results suggest that rank homophily influence social learning in the behavioral pathway, centrality and external ties are in the informational pathway, while position homophily, instrumental and expressive ties are through both the two pathways, as depicted in Figure 2.

Second, although prior research has highlighted the learning benefits of social networks, our research suggests that the network effects on social learning may also depend on certain organizational factors. The results suggest that instrumental ties, external ties, centrality of learning network, and position homophily have positive impacts on social learning, while the effects of expressive ties and rank homophily on social learning in the two case firms are different.

![Figure 2. The influence of social networks on social learning in ERP assimilation](image)

### 5.2. Management implications

This study provides some guidance for managers to better facilitate learning of ERP knowledge that is essential to realize the benefits of ERP systems and achieve expected returns on ERP investment. First, managers should be aware that employees engage in system learning mostly relying on learning from others in practice. Second, social learning is a bidirectional process. Managers need pay attention to the different stages of learning process, identify which substages is at stake, facilitate the establishment of appropriate network ties, and help make social learning more effective and efficient. Third, our study suggests that it might be effective to provide employees with considerable time and opportunities for informal interaction, discussion, and knowledge sharing in training, and organize informal group activities after work, and formal team building activities at work. More interactions provide rich opportunities to build various network ties, which facilitate social learning in the network, and result in higher level of ERP assimilation.

### 5.3. Limitation and future research directions

Despite the theoretical and practical contributions, our study has limitations and opens opportunity for future research. First, the generalizability of our findings may be restricted by the limited number of firms and informants. Future research could focus on developing empirical tests to validate the proposed framework and propositions with larger samples. Second, social learning is divided into two essential stages and six substages, but we did not identify how network factors impact these substages respectively. Further research could consider the impact of contingent factors on each of the substages. Finally, we identified the contingent effects of social networks, but didn’t explain why and how it happens. Further research could explore the organizational factors that may have contributed to these differences in effects.

### 6. Acknowledgements

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### 7. References