

# The influences of knowledge loss and knowledge retention mechanisms on the absorptive capacity and performance of a MIS department

Knowledge  
loss and  
knowledge  
retention

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## Abstract

**Purpose** – Knowledge loss impact on the performance of management information system (MIS) departments due to its influence on absorptive capacity. Furthermore, knowledge retention in human resource management and information system application is also included in the research model, in order to examine their effectiveness in mitigating knowledge loss. The paper aims to discuss these issues.

**Design/methodology/approach** – Survey method and hypotheses are tested with the collected data from 191 Taiwanese IS personnel.

**Findings** – The results not only indicate knowledge loss has impacts on the absorptive capacity and performance of MIS departments while information systems could mitigate knowledge loss, but also provide deeper understanding of knowledge loss and potential issues for academics; as for practitioners, this study could serve as a reference to design and adopt knowledge management (KM) mechanisms.

**Originality/value** – KM is an important issue for organizations since it is the source of competitive advantages and excellent performance, although the investment in KM is not necessary effective in retaining knowledge. This study conducts survey to examine the influences of knowledge loss in MIS departments, since the high turnover rate of employees and the rapid environmental changes in technical world may worsen the situation. According to dynamic capability theory, absorptive capacity is a critical ability to have while facing turbulent environment.

**Keywords** Performance, Knowledge management, Absorptive capacity, Knowledge loss, Knowledge retention

**Paper type** Research paper

## 1. Introduction

Organizational knowledge is believed to be a critical determinant to a firm's capabilities and competitive advantage (Lubit, 2001; Ravinchandran and Lertwongsatien, 2005; Ross *et al.*, 1996). Although the initiatives for knowledge management (KM) are taken, organizations still struggle against the difficulties in preventing knowledge loss. Previous studies have described the impact of knowledge loss on organizational performance (Angell *et al.*, 2013; Droege and Hoobler, 2003; Massingham, 2008),



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but have not clearly explained how knowledge loss could damage performance, and what the components are that cause knowledge loss.

In this paper, we focus on the department of management information system (MIS) and try to address the relationship between knowledge loss and performance, by illustrating the absorptive capacity of the MIS department. Due to the rapid change of technical knowledge, employees in the MIS department have to keep themselves well informed of any new technical knowledge and their applications. To prevent knowledge loss or mitigate its impact on the essential competencies and performance of the MIS department, organizations must implement knowledge retention mechanisms. Hence, we include retention mechanisms in the research model to examine as to whether they could prevent knowledge loss and protect its effectiveness.

Although knowledge loss is an imperative issue in the field of organizational KM, there are still some ambiguous dimensions. We discuss knowledge loss in the MIS department and propose a research model to examine its influence on the absorptive capacity and performance. The major purposes of this research are: addressing the influences of knowledge loss by illustrating its impact on absorptive capacity and performance of the MIS department; identifying the components causing knowledge loss in the MIS department, in order to take the right actions to retain specific knowledge; and proposing a research model based on theoretical foundations including retention mechanisms to examine whether they could prevent knowledge loss and to protect their effectiveness.

## **2. Theoretical background and hypotheses**

### *2.1 Knowledge loss*

Knowledge is believed to be the source of competitive advantage for organizations; thus, organizations should pay attention to identify, acquire, manage, transfer, exploit, diffuse, and retain valuable knowledge (Beckett *et al.*, 2000; De Long and Fahey, 2000; Ravinchandran and Lertwongsatien, 2005; Ross *et al.*, 1996; Schiuma, 2012). However, there is still the possibility of knowledge loss even if organizations conduct KM practices. To understand this issue more profoundly, we have summarized previous studies of knowledge loss in Table I.

Prior researchers have conducted literature reviews and case studies to explore the impacts of knowledge loss in organizations and have made suggestions on knowledge retention. For example, Angell *et al.* (2013) and Massingham (2008), both asserted that knowledge loss impacts organizations' competitive advantages and productivities, while Angell *et al.* (2013), further concluded that the transformation of knowledge and capabilities into organizational routines is a helpful way to retain valuable knowledge. Moreover, tacit knowledge may be effective when embedded in a particular firm's culture, structure, a set of processes, and routines, and the development and propagation of routines that can also help to spread tacit knowledge (Lubit, 2001). Aggestam *et al.* (2010), put focus on the process of knowledge storage, introducing situations in which knowledge loss might happen. For researches using the survey methods (e.g. Martins and Meyer, 2012; Norman, 2004), key points were usually factors resulting in knowledge loss; that is, knowledge loss was regarded as the dependent variable.

Although negative influences of knowledge loss on organizational performance were presented by several case studies, there are only a few that have discussed this issue by developing and examining research models based on theories. Droege and Hoobler (2003), proposed a framework and four propositions linking employee turnover and knowledge loss, but evidence has proved that their relevance were still insufficient.

Studies	Definition of knowledge loss	Consequence of knowledge loss	Research method	Finding
Angell <i>et al.</i> (2013)	Unintentional evaporation of knowledge that accumulates from learning and from individual and collective actions	Reduction of company performance, customer satisfaction and core competencies High-training costs for recruits of strategic positions	Literature analysis and multiple case study	Architectural knowledge should be retained and diffused in organizations; networks catalyze the improvement of organizational capabilities; existing capabilities should be transformed into organizational routines
Martins and Meyer (2012)	Decrease of problem-solving, decision-making and effective action-performing capabilities	Failure in maintaining capacity (mentioned in definition of knowledge loss) and competitiveness	Survey method	Knowledge behaviors, strategy implementation, leadership and people knowledge loss risks are the most important factors in tacit knowledge retention in organizations
Aggestam <i>et al.</i> (2010)	No new knowledge is stored in the repository in knowledge capturing process	Failure in developing information systems Low information system quality caused by storing wrong knowledge	Interpretive field study and case study	Identifying types of knowledge loss including unwanted loss such as uncovered knowledge, lack of storage approach, employees' unwillingness to share, and wanted loss such as abandonment of irrelevant, incorrect or obsolete knowledge
Massingham (2008)	The loss of human capital, structural capital, relational capital and social capital in organizations	Decrease of organizational output Decrease of organizational productivity Decrease of organizational memory Decrease of organizational learning Disruption or termination of external knowledge flows	Case study	Loss of human capital decreases organizational output and productivity; loss of social capital decreases accumulated experiences shared within the organization; loss of structural capital decreases organizational learning; loss of relational capital decreases external knowledge flows
Norman (2004)	In the context of business alliances, a firm's valuable and critical knowledge-based resources are learned or used by the other firm	A threat of competitiveness	Survey method	Trust is a key factor; for trusted partners, the more information they share with each other, the less knowledge loss they experience
Parker (2012)		Risk of losing competitive advantages Failure in business alliances A threat of vulnerable new firm's survival	Exploratory interviews and survey	The governance of relationship contributes to knowledge acquisition and the formal governance of contracts contributes to mitigate knowledge loss in business alliances
Droege and Hoobler (2003)	The failure of tacit knowledge diffusion before employees' turnover	Decrease of firm performance Difficulty in transforming production factors into value-added products and services	Literature review	Social ties-building activities, interactions and collaboration among employees, working units and departments would facilitate tacit knowledge diffusion and sharing within organizations and thus protect the knowledge from loss

**Table I.**  
Prior researches on  
knowledge loss

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In order to deal with this gap, we develop a research model based on the resource based view (RBV), and the dynamic capability theory (DCT), expecting to provide theory-based arguments and verified evidence of the knowledge loss's impact on the capabilities and performance of the MIS department.

*2.1.1 Sub-dimensions of knowledge loss.* According to Angell *et al.* (2013) and Perrott (2007), knowledge loss is "the intentional or unintentional evaporation of knowledge that accumulates from learning, individual and collective actions." Another research stream puts emphasis on intellectual capital within organizations where knowledge loss is regarded as capital loss (Droege and Hoobler, 2003; Massingham, 2008). There is no consensus on the formation of knowledge loss. In order to fit these situations in a MIS department, we adopt the Ravinchandran and Lertwongsatien's (2005) research, to discuss the three components of knowledge loss – the loss of IS personnel skills, internal partnership, and the external partnership.

*2.1.1.1 IS personnel skills.* In organizations, employees are the creators and suppliers of knowledge; each employee possesses unique knowledge and skills for managing their tasks with effectiveness and efficiency. In intellectual capital theory, human capital is termed by knowledge and capabilities which employees possess (Steward and Ruckdeschel, 1998); human capital is also the source of innovative ideas and various competencies that ultimately reflect the excellent performance and competitive advantages of firms (Bontis, 1998; Snell and Dean, 1992; Subramaniam and Youndt, 2005).

In Ravinchandran and Lertwongsatien's (2005) research, they drew on the intellectual capital theory for their argument of the casual relationship between IS resources and IS capabilities. Teece *et al.* (1997) proposed that the positions and applications of organizational assets were decisive to the development of capabilities. Since it is certain that the task-related skills and the specification of the employees are assets of an organization, their contribution to build capabilities and increase performance could be inferred. Based on the above perspectives, we reason that these negative situations could happen due to the loss of IS personnel skills that deteriorates the performance of the MIS department and decreases the absorptive capacity of IS personnel in a rapidly changing technological world.

*2.1.1.2 Internal partnership.* In organizations, employees import new expertise and ideas (Subramaniam and Youndt, 2005), and link them to social networks like "nodes" (Bontis, 1998); through these networks, social capital is created and dispersed. Social capital are the existing resources derived from social relationships among employees (Droege and Hoobler, 2003; Youndt and Snell, 2004); it helps to form organizational memory that includes a unique understanding and experience of each social network, which can be used as references to solve current problems (Massingham, 2008). In addition, good interactions and partnerships are effective for service delivery (Rockart and Short, 1989). For IS departments, the ability to convert knowledge into practice and bring value to the firms is partly dependent on the understanding and coordination with other units within the organizations (Harris and Katz, 1989; Ravinchandran and Rai, 2000; Ravinchandran and Lertwongsatien, 2005). Therefore, we argue that a poor partnership with other departments creates obstacles for accomplishing tasks, while generating and circulating knowledge in the MIS department.

*2.1.1.3 External partnership.* Ravinchandran and Lertwongsatien (2005), further pointed out that an IS units' partnership with vendors and suppliers is also a critical factor to the development of IS capabilities. Since technologies change and develop rapidly, it is not only difficult, but almost impossible, for information technology-related

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departments to obtain all the required resources and knowledge. Business partners could therefore serve as the sources and providers of various technical knowledge.

In the intellectual capital theory, the concept of knowledge flow across organizations is emphasized by the characteristics of relational capital, which refers to deriving knowledge from the relationships with business partners and clients outside the organizations (Bontis, 1998; De Pablos, 2002; Steward and Ruckdeschel, 1998). Employees cooperate with business partners and interact with clients; thereby receiving feedback and learning from them at the same time. These processes facilitate knowledge flow between organizations and external environments (Massingham, 2008). In this study, we consider the opposite situation and believe that the loss of an external partnership hinders employees in the MIS department from acquiring knowledge, and hence, impairs their performance.

*2.1.2 Drivers of knowledge loss.* Because the sharing and transferring of knowledge is extremely vital to KM, given the fact that organizations struggle with knowledge loss resulting from employee turnover. In addition, critical knowledge loss occurs by job transfer, mobility, and alternative work arrangements (Omotayo, 2015). Meanwhile, KM endeavors help organizations to share valuable organizational insights, to reduce superfluous work, to avoid reinventing the wheel, to reduce training time for employees, to retain intellectual capital as employees' turnover in an organization, and staff turnover, means an inevitable leakage and loss of knowledge (Epetimehin and Ekundayo, 2011). Therefore, since the 1980s, the high turnover rate, including unemployment, resignation, retirement, and rotation, has been a thorny problem for IS personnel (Chang, 2009; Igarria and Greenhaus, 1992), and the main cause of organizational knowledge loss (Levy, 2011; Martins and Meyer, 2012; Massingham, 2008). When employees depart, valuable knowledge, and skills also disappear if organizations do not apply mechanisms to retain them (Droege and Hoobler, 2003; Massingham, 2008). In light of this, retaining employees who possess valuable knowledge should be as equally important as an element in an organization's KM strategy, by motivating employees to participate in knowledgeable activities (Omotayo, 2015).

Moreover, when employees frequently leave, it not only damages the social network, but also causes poor internal and external partnerships. A high employee turnover rate impairs employees' loyalty, social network, sharing of knowledge, and common experiences (Capelli, 2000; Dess and Shaw, 2001; Massingham, 2008), while hindering the knowledge flow across organizations (De Pablos, 2002; Massingham, 2008); this is because business partners have to frequently adjust themselves to different ways of working with other contacts. Thus, it is difficult to develop a stable relationship between the focal organization and its business partner.

According to the above arguments, we believe that in a MIS department, the higher employee turnover rate is, the greater the possibility to have knowledge loss; thus, we posit:

- H1.* The rate of employee turnover has positive effect on knowledge loss in an MIS department.

## *2.2 Absorptive capacity of MIS department*

Rapid changes in the technical environment challenge the MIS departments' absorptive capacity. The concept of absorptive capacity is derived from the DCT. Teece *et al.*

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(1997) defined dynamic capability as the ability to “integrate, build, and reconfigure internal and external competencies to address rapidly changing environments” (p. 516). Pavlou and El Sawy (2006) proposed that an absorptive capacity was a nature of dynamic capabilities and had indirect effects on building a competitive advantage in turbulent environments such as a new product development (NPD). Thus, we assert that the poor absorptive capacity of the MIS department has a negative impact on their performance.

The source of absorptive capacity could be illustrated by the relationship between knowledge and dynamic capabilities. In the perspective of the RBV, competitive advantages are derived from valuable and non-substitutable resources including knowledge (Eisenhardt and Martin, 2000; Ravinchandran and Lertwongsatien, 2005; Teece *et al.*, 1997). Cepeda and Vera (2007), indicated that KM processes facilitated the deployment of dynamic capabilities, because organizations would make strategic decisions based on the types of problems their knowledge could solve. Moreover, Lubit (2001), asserted that to provide a sustained competitive advantage, an organization needs knowledge that is difficult for outsiders to copy, as well as the ability to rapidly develop new knowledge; therefore, for knowledge to provide a sustainable competitive advantage, the skills and resources that underlie a firm's core competencies must be extensively transferable within the firm, but very difficult for other firms to copy or develop. Meanwhile, tacit knowledge can be the basis for sustainable competitive advantage, because it can be spread within a firm, but it is very difficult for other firms to imitate (Lubit, 2001). Cohen and Levinthal (1990), argued that prior knowledge with basic skills, shared language, and recent developments in specific fields, also contribute to the formation of absorptive capacity. The concept of prior knowledge could be connected to knowledge loss in our research.

Therefore, as basic skill is similar to IS personnel skill, it is required for identifying potential useful knowledge; moreover, it is necessary to acquire a basic understanding before absorbing advanced knowledge, and then later apply the advanced knowledge to improve project quality, effectiveness, and efficiency. However, if a firm loses its employees with basic skills, the mechanism of absorbing advanced knowledge is damaged, not to mention the application on improving performance and solving current problems.

Moreover, communities of practice strengthen topic-specific social networks by enabling knowledge retention and allowing for the dissemination of the best practices and lessons learned (Cervigon and Romero, 2008). Engaging workers in networks helps build their collective knowledge base (or “knowledge capital”), and expands their knowledge assets, which in turn will help foster a sustainable organizational context (Kothari *et al.*, 2011).

Then, losing an internal partnership means losing the shared understanding and integration within the department. Cohen and Levinthal (1990), emphasized that shared language and knowledge within a department was an essential factor in effective communication. Thus, when tasks in a department are highly interdependent, losing internal partnership would impede communication and the accumulation of shared experiences, followed by the failure in integrating new knowledge with existing knowledge. Besides, Zahra and George (2002), asserted that social networks among different working units in an organization could reduce barriers in communication, facilitate knowledge distribution, and help employees to understand changes in organizational culture or politics. Thus, once there are leaks in the internal partnership, it would strongly influence the communication within the organization and thereby block the distribution of knowledge.

Finally, losing an external partnership means losing possible ways to detect potentially important knowledge, access new technologies, and acquire required knowledge. According to Cohen and Levinthal (1990), for technical information which employees could not easily understand, there is a need for an “interface” or “gatekeeper,” which senses, imports, and interprets externally important information for other employees. Gatekeepers were the foundation of organizational absorptive capacity, because they made information meaningful to the organization and catalyze the diffusion of knowledge. Massingham (2008), described that the relationship between an organization and its business partners is the bridge for knowledge flow. Once the relationship ceases, the source of new knowledge disappears, giving no more input to absorptive capacity.

Based on theoretical statements and previous studies, we propose that the loss of IS personnel skills, internal partnership, and external partnership, have negative impacts on absorptive capacity of the MIS department:

- H2.* Knowledge loss has a positive effect on the decrease of the MIS department’s absorptive capacity.
- H2a.* Loss of IS personnel skills has a positive effect on the decrease of the MIS department’s absorptive capacity.
- H2b.* Internal partnership has a positive effect on the decrease of the MIS department’s absorptive capacity.
- H2c.* External partnership has a positive effect on the decrease of the MIS department’s absorptive capacity.

### *2.3 Performance of the MIS department*

We examine the direct impacts of knowledge loss on the performance of the MIS department as well. Evidence and descriptions of the situations could be provided by the RBV after employees’ turnover. According to the RBV, organizational resources could be transferred into unique competencies and long-term competitive advantages (Wernerfelt, 1984). Later research also demonstrated the relationship between resources and a firm’s performance, and emphasized the inimitability and irreplaceability of organizational resources, including knowledge that are components of competitive advantages (Eisenhardt and Martin, 2000; Ravinchandran and Lertwongsatien, 2005; Ross *et al.*, 1996).

Employees leave with their unique and professional IS personnel skills; as this expertise is often tacit and difficult to regain (Droege and Hoobler, 2003). Thus, when performing certain tasks, there would be a shortage of specific knowledge since the support and organizational productivity have decreased. To deal with this gap, existing employees have to distract themselves from tasks at hand and spend extra time training new recruits, which impacts on their working efficiency and productivity (Alexander *et al.*, 1994; Droege and Hoobler, 2003). Moreover, established social networks are disrupted (Dess and Shaw, 2001; Pennings *et al.*, 1998), and the “backbone of effective performance” (Droege and Hoobler, 2003) of employees’ loyalty also wavers.

Based on the statements mentioned above, it can be expected that knowledge loss would impact the efficiency and effectiveness of the MIS department; thus, we posit:

- H3.* Knowledge loss has a positive effect on the decrease of the MIS department’s performance.

#### 2.4 *Absorptive capacity and performance of the MIS department*

We draw on DCT to explain the relationship between the absorptive capacity and performance. Several studies regarded dynamic capabilities as the antecedents of functional competencies which enable organizations to perform operational processes in effective ways (Cepeda and Vera, 2007; Pavlou and El Sawy, 2006). In this paper, we apply Pavlou and El Sawy's (2006), induction of dynamic capability to illustrate the absorptive capacity and examine its function on the MIS departments' performance. The four enabling processes Pavlou and El Sawy (2006) proposed were sensing, learning, coordinating, and integrating. They proved that dynamic capabilities enabled effective execution of operational processes in a NPD. We focussed only on the learning process, which had included critical abilities such as "acquire, assimilate, transform, and exploit existing resources (p. 202), since it is realized by absorptive capacity."

Under the condition of the rapid changes in technologies, absorptive capacity makes IS personnel more proficient and able to deal with their tasks (Cohen and Levinthal, 1990). On the contrary, when the MIS department of an organization could not sense the change of new information technology and knowledge, acquire them, or incorporate them into existing systems, it would imply that the organization could not react to a disturbing environment and thus lose its competitiveness. In sum, absorptive capacity enables employees in the MIS department to respond to rapid changes and enhances their performance. We thus posit:

- H4.* Decrease of the MIS departments' absorptive capacity has a positive effect on the decrease of the MIS department's performance.

#### 2.5 *"Human resource management (HRM) practices"-based knowledge retention*

Knowledge retention refers to keeping knowledge within an organization. Based on the storage location, there are two major mechanisms that can be used to retain knowledge. One is HRM practices-based, which emphasizes the transferring of knowledge from one member to another. Previous research has suggested that the retention mechanisms in HRM practices encourage knowledge sharing and distribution (Aiman-Smith *et al.*, 2006; Angell *et al.*, 2013; Droege and Hoobler, 2003; Hofer-Alfeis, 2008). The use of HRM practices can be seen as being concerned, because if the employees are not committed and loyal to their organization, then there is a risk of losing knowledge possessed by the employees through staff turnover (Hislop, 2013). For this reason, the recruitment and selection process by employers can be utilized, as well, to support KM activities. This can be used to recruit people whose values are compatible with the existing organizational culture, and whose personalities are conducive to knowledge sharing (Omotayo, 2015).

However, few studies have provided the empirical evidence of their effectiveness. In this study, we take previous research as references and include three implements in our research model to examine their effectiveness – phased retirement plans, mandatory handover process, and job rotation programs. In phased retirement plans, retirees are hired as consultants or directors, so that their tacit expertise could still be accessed (Aiman-Smith *et al.*, 2006; Angell *et al.*, 2013); the plans might help to embed knowledge in an internal and external partnership as well. Organizations could still reach the social networks where the retirees were involved. However, since certain social networks could be risky due to how it was established or involved, job rotation programs could reduce the hazard (Hofer-Alfeis, 2008). In the program, employees are dispatched to subsidiaries



to learn different practices, share knowledge, and build social networks (Angell *et al.*, 2013); the mandatory handover process would also be an effective mechanism to retain personnel skills. Although it often takes a month to process and extract the recorded expertise of a departing employee under the supervision of the managers, it can reinforce the transfer of knowledge, and reduce the burden of training recruits, and the pressure of self-learning from new staff (Angell *et al.*, 2013).

In brief, in accordance with past research, we state that practices in HRM could reduce the possibilities of knowledge loss and include this construct in our research model, in order to actually examine their effectiveness. Thus, we posit:

- H5. “HRM practices”-based knowledge retention has a negative effect on knowledge loss in the MIS department.

### 2.6 “Information systems (IS)”-based knowledge retention (knowledge management systems (KMS))

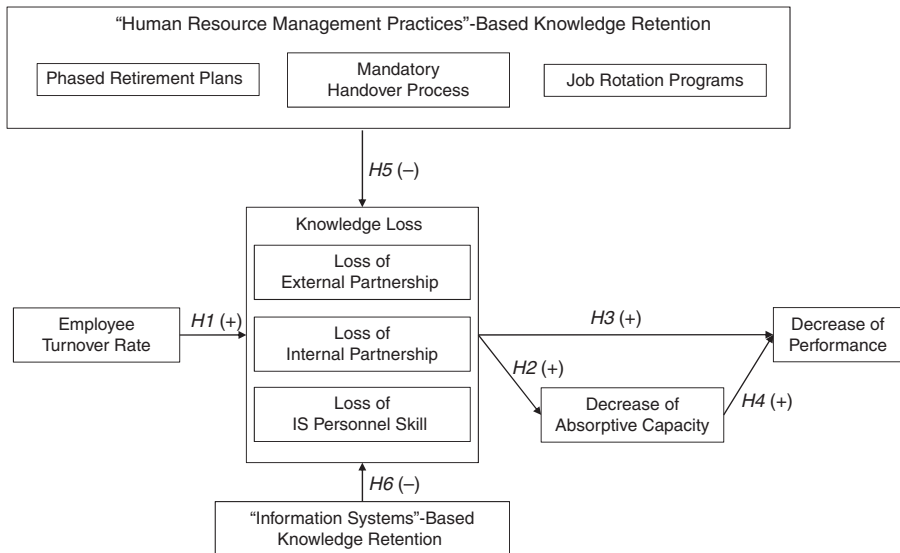
In terms of KM, we focus on the technology-enabled practices. Alavi and Leidner (2001), emphasized the importance of KMS by illustrating the various applications of information technology. Three common functions of KMS were addressed – codifying and sharing, mapping internal knowledge, and creating knowledge networks. Codifying and sharing were achieved by recording the expertise of making decisions in KMS for employees to search; the process facilitates the diffusion and retention of the best practices. Tacit knowledge embedded in organizational routines, or accumulated by experience, was difficult to record in written form; mapping internal knowledge could help to retain it. Systems with this function such as knowledge maps and enterprise directories have collected the locations and categories of expertise within the organization, so that other employees could turn to them when encountering-related problems. Creating knowledge networks was for communication among employees to transcend geographical barriers. Experts in specific professional areas got together through online forums; they discussed certain issue and shared relevant knowledge. Through this process, new knowledge was conceivably created and the discussion records were also available so that other employees could access (Alavi and Leidner, 2001).

The applications of KMS mentioned above retain the required and critical knowledge for employees to finish their tasks and improve their performance, and more importantly, KMS makes that knowledge accessible even after the owners of said knowledge leave the organization. Therefore, we believe that the practices of KM could assist in retaining knowledge, and thus we included them in our research model to examine their effectiveness. We thus posit:

- H6. “IS”-based knowledge retention has a negative effect on knowledge loss in the MIS department.

### 2.7 Research model

According to the literature review, we sum up our statements with a research model as shown in Figure 1. There are three major parts: knowledge loss, its consequences, and knowledge retention. Knowledge loss is composed of three sub-dimensions – loss of external partnership, loss of internal partnership, and loss of IS personnel skill. Furthermore, the decrease of performance and absorptive capacity as a mediator are the consequences. As for knowledge retention; practices in HRM and the application of IS are both included.



**Figure 1.**  
Research model

### 3. Research methodology

#### 3.1 Sampling and data collection

We use the survey method to collect data for this research. According to the conceptual research model and the context we specified, IS personnel are selected to be our samples. In pretests, the draft questionnaire was reviewed by two MIS academic experts and revised by seven IS personnel, who gave suggestions that included ambiguity in expression and format inconsistency. Then, the questionnaire was revised accordingly to make the formal survey. The survey was conducted both in paper form and a web-based questionnaire; the online questionnaire was conducted on a platform named "mySurvey." We collected data through convenience sampling. Paper questionnaires were mainly distributed to MBA students from the Information Management Department of National Sun Yat-sen University, and the collected data from the online questionnaire were distributed with its URL through a personal social network. While distributing the questionnaire, we described the purpose and incentives of the survey, that each valid response would generate a donation of NT\$20 for the Taiwan Fund for Children and Families' organization. The period of data collection was approximately one month, and a total of 212 samples were returned, however, 21 samples were removed because of either incomplete value and/or invalid response.

#### 3.2 Sample representatives

Table II shows the demographic information of the respondents. Our respondents consisted of 69.6 percent male and 30.4 percent female; the age of most respondents (89 percent) ranged from 21 to 40 years old. For working tenure, 64.4 percent respondents have worked more than three years, 47.6 percent of companies have 500 employees or more, and 52.4 percent of companies have less than 500 employees. These statistics indicate that there are respondents from both small and medium enterprises, as well as large or international enterprises; moreover, the ratio of the two clusters is nearly half to half. Therefore, through our survey, the situations and mechanisms in small, medium, and large enterprises could be revealed.

Measure	Category	Frequency	Percentage (%)
Gender	Male	133	69.6
	Female	58	30.4
Age	20 or less	1	0.5
	21-40	170	89.1
	41 and above	20	10.4
Tenure	Below 1 year	10	5.2
	1-3 years	58	30.4
	4-9 years	65	34.0
	10 years and above	58	30.4
Education	High School or under	3	1.6
	Bachelor	101	52.9
	Master	83	43.5
	PhD	4	2.0
Industrial classification	Information technology	91	47.6
	Finance and insurance	5	2.6
	Manufacturing	51	26.7
	Service	11	5.8
	Medical	4	2.1
	Transport	1	0.5
	Retail	2	1.0
	Telecommunication	7	3.7
	Government	11	5.8
	Education	3	1.6
	Others	5	2.6
Size of the company	10 employees or less	9	4.8
	11-500 employees	91	47.6
	501 employees or above	91	47.6
Job title	Programmer	97	50.8
	System analyst	11	5.8
	Project leader	11	5.8
	Executive of MIS department	12	6.3
	Network administrator	11	5.8
	Database administrator	6	3.1
	System testing engineer	3	1.6
	System maintenance engineer	7	3.5
	Others	33	17.3

**Table II.**  
Demographic  
information about  
the respondents

**Note:**  $n = 191$

### 3.3 Constructs and measurements

Items of constructs are either adapted from previous studies or developed based on definitions of constructs to fit our research context. All questions were evaluated with a seven-point Likert scale. In the following, definitions of each construct and sources of items are described.

**3.3.1 Turnover rate.** Employee turnover refers to the movement of employment relationship across organizations (Currivan, 1999). In most research, employee turnover is classified into voluntary turnover and involuntary turnover (Dess and Shaw, 2001; Shaw *et al.*, 1998). The two turnover types are not differentiated because our focus is to compare the situation before and after employees' leave the MIS department; that is to say, resignation, retirement, transference, and dismissal, are all cases of employee turnover in our research context.

We adopt the turnover rate formula mentioned in Terborg and Lee's (1984) research: the number of voluntary turnover was divided by the number of employees for the year, and then multiplied by 100. Since we did not distinguish turnover types, we used the modified formula: the number of turnovers are divided by the number of employees, and then multiplied by 100. Two items are used to collect the required data for computing the turnover rate – the number of employees in the MIS department and the departing employees over the last three years.

In order to reach a consistency of format, after computing with the formula, we coded the turnover rate into the seven-point scale data. The moderate level of employee turnover rate is 15 percent (Toten, 2005), so we assigned it to the middle point four of the Likert scale, and averaged out 5 percent for each interval. Table III shows the conversion of the turnover rate to a seven-point Likert scale.

**3.3.2 Knowledge loss.** Knowledge loss includes three components – loss of IS personnel skills, internal partnership, and external partnership. Loss of IS personnel skill refers to the loss of their unique expertise after the employees have left. Loss of internal partnership and external partnership, to a certain extent, decreases knowledge sharing, mutual understanding, trust, effective cooperation, communication quality, and increases conflicts among the MIS department, other departments, and external business partners, respectively. A total of 16 items are adopted from Ravinchandran and Lertwongsatien's (2005) research.

**3.3.3 Decrease of absorptive capacity.** Absorptive capacity refers to the ability to sense, acquire, assimilate new information and new knowledge, and then apply them to existing tasks. The total of four items are adopted from Pavlou and El Sawy's (2006) research. The items measure to the extent of reduced absorptive capacity of the MIS department after employees have left during the last three years.

**3.3.4 Decrease of performance.** Loss of performance refers to the extent of task-related effectiveness and efficiency decrease in the MIS department. A total of eight items are adopted from Henderson and Lee (1992). The four items measuring efficiency reflect the degree of reduction in productivity, the increase of cost, and the time for finishing tasks during the last three years. The four items measuring effectiveness reflect the degree of decrease in work quality, and in the abilities to achieve goals or fulfill requests.

**3.3.5 "HRM practices"-based knowledge retention.** "HRM practices"-based knowledge retention refers to the utilization of the knowledge retention mechanisms in HRM to keep the knowledge within the organization. HRM practices include the job rotation programs, the phased retirement plans, and the mandatory handover process. The 12 items (four items for each practice) are developed based on the definition of knowledge retention mechanisms and of each practice; these items reflect the existence, completeness, and effectiveness of HRM knowledge retention mechanisms, and the employees' understanding toward them.

**Table III.**  
The conversion of  
turnover rate to  
seven-point  
Likert scale

Likert seven-point scale	1	2	3	4	5	6	7
Turnover rate	0-4%	5-9%	10-14%	15-19%	20-24%	25-29%	> 30% above

3.3.6 “IS”-based knowledge retention (KMS). “IS”-based knowledge retention refers to the application of IS to keep knowledge within the organization. A total of six items are adopted from Wong and Aspinwall’s (2005) research; they measure the characteristics of KMS used in the organization, including the appropriate storage structure and classification, application of technical tools and network, performance, ease of use, and suitability to the users’ needs.

Table IV summarizes each construct’s operational definition, number of items, and reference. A Chinese version of the questionnaire is attached in Table AI.

#### 4. Data analysis

In this research, we used Smart PLS 2.0 and SPSS to assess the reliability and validity of our measures, and to analyze the structural relationship of the model.

##### 4.1 Reliability and validity

According to Chin *et al.* (1997), a measurement model should be evaluated based on the criteria of reliability, convergent validity, and discriminant validity. To assure the reliability of the measurement model, composite reliability (CR) value, Cronbach’s  $\alpha$ , and factor loadings, should be assessed. As shown in Table AI, the CR value and Cronbach’s  $\alpha$  of each construct are all greater than 0.7, when factor loadings are all greater than 0.5. The results indicate that our measurement satisfies the acceptable level of measurement reliability.

When a construct is measured by more than one indicator, convergent validity should be assessed to assure the related extent among indicators. Convergent validity of a scale is assessed by item-total correlations, factor loadings, and the average variance extracted (AVE) (Fornell and Larcker, 1981). The results are also shown in Table AI. Item-total correlations of items are all above 0.3 ranging from 0.559 to 0.897,

Construct	Operational definition	No. References
Turnover rate	The number of employee turnover in recent three years is divided by the number of employees, and is multiplied by 100	1 Terborg and Lee (1984)
Knowledge loss	The extent to which IS personnel skills lose, and internal and external partnership decrease	16 Ravinchandran and Lertwongsatien (2005)
Decrease of absorptive capacity	The extent to which the ability to sense, acquire, assimilate new information and knowledge, and apply them to existing tasks reduces	4 Pavlou and El Sawy’s (2006)
Decrease of performance	The extent to which task-related effectiveness and efficiency decrease	8 Henderson and Lee (1992)
“Human Resource Management Practices”-based knowledge retention	The utilization of knowledge retention mechanisms in human resource management including job rotation programs, phased retirement plans and mandatory handover process to keep knowledge within the organization	12 Aiman-Smith <i>et al.</i> (2006) and Angell <i>et al.</i> (2013)
“Information Systems”-based knowledge retention	The application of information systems to keep knowledge within the organization	6 Wong and Aspinwall (2005)

**Table IV.**  
Operational  
definition

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and the AVE are all above 0.5 ranging from 0.729 to 0.9. All factor loadings are above 0.7 ranging from 0.792 to 0.969. The results indicate that our measurements satisfy the acceptable level of convergent validity.

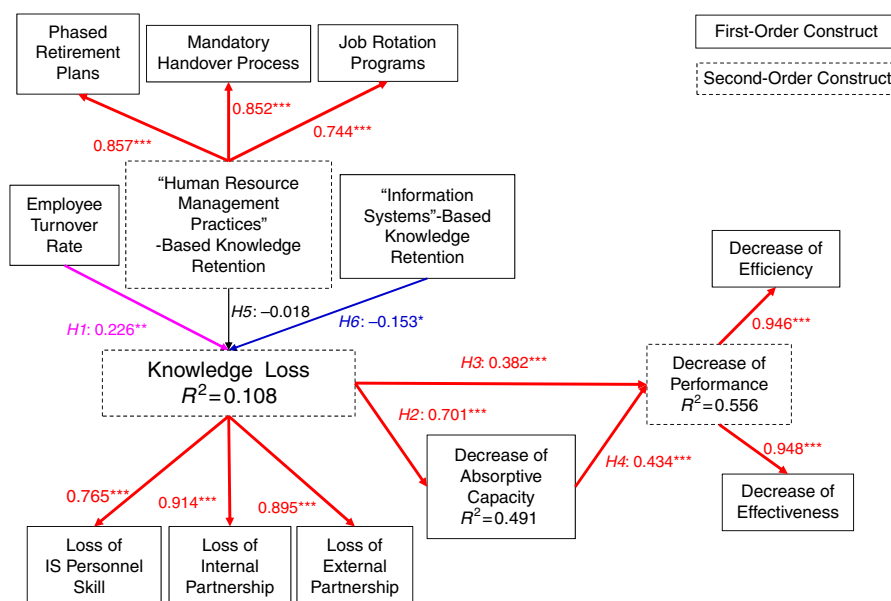
Discriminant validity is used to assure the distinctions among constructs, and it can be assessed by the square root of the AVE of each construct and cross-factor loadings. The square root of the AVE in each construct should be greater than the inter-construct correlation coefficient (Fornell and Larcker, 1981). For cross-factor loadings, each item's loading on its focal latent variable should be greater than that on other variables. As Table AII shows, the square roots of the AVE of each construct are greater than the inter-construct correlations; Table AIII shows that each item has the highest loading when it is on its focal latent variable. Although the cross-loadings of items for measuring efficiency and effectiveness are above 0.7, their differences are more than 0.1, which is an acceptable level for cross-loadings according to Hair *et al.* (2011).

#### *4.2 Reflective second order constructs*

In this research, knowledge loss, the decrease of performance, and "HRM practices"-based knowledge retention are regarded as reflective second order constructs. The reason is that their sub-dimensions have a common theme, and it will be of no effect to the essential meaning of the constructs if any one of the dimensions is deleted (Jarvis *et al.*, 2003), which means that the sub-dimensions reflect the characteristics of the main construct. Take knowledge loss as an example, its sub-dimensions are the loss of IS personnel skill, decrease of the internal and external partnership, hence, they are all used to measure a shared theme: knowledge loss. The rationale is also applied to the other two constructs – decrease of the performance and "HRM practices"-based knowledge retention. Moreover, as shown in Table AII, the correlations of the sub-constructs of knowledge loss are arranged from 0.533 to 0.7; the correlation of the two sub-constructs of the decrease of performance is 0.794; the correlations of the sub-constructs of "HRM practices"-based knowledge retention are arranged from 0.436 to 0.634. The correlations of each construct's sub-dimensions is at the moderate level (0.4-0.7), which implies that knowledge loss, the decrease of performance, and "HRM practices"-based knowledge retention are reflective second order constructs. We then use Smart PLS 2.0 and conduct a repeated indicator approach, in which the indicators measuring the sub-dimensions are repeatedly used, to measure the second order constructs. The result is shown in Figure 2. The loadings of all the sub-constructs are above 0.7, and they are all significantly related to their focal second order constructs.

#### *4.3 Common method variance (CMV)*

The methods used to collect data or measurement method may cause CMV, which would bias the interpretations of the research results (Malhotra *et al.*, 2006; Podsakoff *et al.*, 2003). The bias often occurs when the research data are collected by a single questionnaire survey, in which items of independent and dependent variables are answered by the same respondents at the same time (Lindell and Whitney, 2001). Since we conducted our survey method as described above, CMV might be a concern in this paper. To avoid any incorrect interpretations of our findings, we conducted the CMV test suggested by Malhotra *et al.* (2006), and Venkatesh *et al.* (2012). In the test, theoretically unrelated marker variables (age and tenure) are involved and we use Smart PLS software to assess the correlation among all variables. Then, we adopt



Notes: \* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$

Figure 2. Structural model and path coefficient

Malhotra *et al.*'s (2006) equations and *post hoc* estimation, in which the variable with the second smallest positive correlation value is regarded as the indicator of the CMV.

The testing results are shown in the following tables. Table AIV shows the original correlations among the variables, and the correlation between the phased retirement plans (PR) and tenure (0.002) is the second smallest positive one among all values; we thus use it to conduct calculations suggested by Malhotra *et al.* (2006). Table AV shows the adjusted *t*-value; there is no significant difference between the original and adjusted values; therefore, the bias of the CMV is not a concern in our research.

#### 4.4 The structural model: hypothesis test

Hypothesis testing is completed by partial least squares regression analysis. The structural model examines the significance of the relationships among variables as shown in Figure 2 and Table V. The path coefficient of  $H1$  ( $\beta = 0.226$ ,  $t = 3.205$ ) provides the positive and significant evidence proving that the turnover rate has a positive effect on knowledge loss. The path coefficient of  $H2$  ( $\beta = 0.701$ ,  $t = 13.879$ ), and  $H3$  ( $\beta = 0.382$ ,  $t = 5.547$ ), are also positive and significantly present that knowledge loss has a positive relation to both the decrease in absorptive capacity and performance.  $H4$  ( $\beta = 0.434$ ,  $t = 6.672$ ), is supported with a positive and significant path coefficient as well, which indicates that the decrease of the absorptive capacity has a positive effect on the decrease of the performance.

$H5$  and  $H6$ , posit that “HRM practices”-based and “IS”-based knowledge retentions are negatively related to knowledge loss. As the structural model shows, the path coefficient of  $H6$  ( $\beta = -0.153$ ,  $t = 2.455$ ) provides negative and significant evidence indicating that “IS”-based knowledge retention has a negative effect on knowledge loss.

**Table V.**  
Summary of  
hypotheses testing

Hypothesis	Path coefficient	Result
<i>H1</i> : The rate of employee turnover has positive effect on knowledge loss in MIS departments	0.226**	Supported
<i>H2</i> : Knowledge loss has positive effect on the decrease of MIS departments' absorptive capacity	0.701***	Supported
<i>H3</i> : Knowledge loss has positive effect on the decrease of MIS departments' performance	0.382***	Supported
<i>H4</i> : Decrease of MIS departments' absorptive capacity has positive effect on the decrease of MIS departments' performance	0.434***	Supported
<i>H5</i> : "Human resource management practices"-based knowledge retention has negative effect on knowledge loss in MIS departments	-0.018	Not supported
<i>H6</i> : "Information systems"-based knowledge retention has negative effect on knowledge loss in MIS departments	-0.153*	Supported

**Notes:** \* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$

However, *H5* ( $\beta = -0.018$ ,  $t = 0.353$ ) is not supported; the negative relationship between knowledge loss and "HRM practices"-based knowledge retention has thus unproven (Figure 2).

## 5. Discussion

### 5.1 Driver and reducing mechanisms of knowledge loss

The results of *H1* tested in this study prove that the turnover rate is significantly related to knowledge loss in the MIS department. It indicates that employee turnover is definitely a cause of knowledge loss due to the difficult retention of IS personnel skill, its internal and external partnerships, especially the latter two. The result is consistent with the argument of previous studies on knowledge loss (Capelli, 2000; De Pablos, 2002; Dess and Shaw, 2001; Droege and Hoobler, 2003; Massingham, 2008; Levy, 2011; Martins and Meyer, 2012).

On the other hand, two reducing mechanisms for knowledge loss are worth discussing from the hypotheses testing results. The path coefficient of the relationship between "IS"-based knowledge retention and knowledge loss is negative and significant (*H6*); it provides support for our assertion that the IS application is an effective way to prevent knowledge loss. The result is consistent with propositions in previous studies (Alavi and Leidner, 2001). A good KMS is a necessity to retain knowledge, since it can induce and force employees to create, share, store, and use knowledge in the system; thus, knowledge loss should be reduced at the same time. However, the path coefficient between "HRM practices"-based knowledge retentions and knowledge loss is not significant (*H5*). This result is inconsistent with propositions in previous studies (Aiman-Smith *et al.*, 2006; Angell *et al.*, 2013; Hofer-Alfeis, 2008). The possible inference is that the HRM practices designed for knowledge retention in many organizations are not well-developed enough or not effectively implemented, so that employees might have limited knowledge or awareness about these practices.

### 5.2 Knowledge loss, absorptive capacity, and performance

Consistent with prior research, we find that knowledge loss has negative influences on performance (*H3*). This result is consistent with propositions in previous studies (Alexander *et al.*, 1994; Dess and Shaw, 2001; Droege and Hoobler, 2003;



Pennings *et al.*, 1998). Since knowledge is a critical and intangible asset for an organization, its loss will not only damage organizational value, but also make an impact on performance.

To explore the relationship and condition in an MIS department, we assert that the absorptive capacity serves as a mediating variable (Sobel test statistic = 5.279) (Sobel, 1982), implicating that with the loss of IS personnel skills, the internal and external partnership reduces the MIS department's ability to acquire, analyze, and utilize new technical knowledge (*H2*) (Cohen and Levinthal, 1990; Massingham, 2008; Zahra and George, 2002); moreover, this loss will consequently impact job performance of the MIS department (*H4*), since the absorptive capacity enables employees to deal with the rapid and uncertain changes in the technical environment (Cepeda and Vera, 2007; Pavlou and El Sawy, 2006). If IS personnel are willing to provide their valuable knowledge, their internal and external partnership could also prevent knowledge loss; in this way, the absorbing advanced knowledge will increase, as well as the performance.

The result indicates that knowledge loss mostly reduces the performance through its impact on the MIS department's absorptive capacity. The finding supports our argument that the absorptive capacity is critical for IS personnel due to the rapid and frequent changes in a technical environment, therefore, it plays a "conduct" role which can help information technology to improve performance through this channel.

In order to maintain system stability and normal functioning, the mutual sharing and impartation of working skills (*H2a*) would be the main source of task-related knowledge besides basic knowledge. Hence, the loss of internal partnership (*H2b*) implicates the reduction of cooperation, communication, accumulation of shared knowledge, and integrating ability, which finally impacts on the performance of the MIS department. As for the loss of external partnership (*H2c*), IS personnel absorb new technical knowledge from an external environment, apply it to tasks and improve performance, IS personnel mainly focus on the stability of the systems, as their main concern might not be importing and integrating new technology.

## 6. Implications

### 6.1 Academic implications

With the collected data from 191 IS personnel, we validated the proposed hypotheses. All the hypotheses are supported except for *H5*. This study confirms the three components of knowledge loss, and further analyzes their different weight in various types of industries. To explore knowledge loss in a more objective and empirical perspective, this study proposed a research model based on prior studies and conducted a questionnaire survey. The results have provided some academic implications.

First, we provided empirical evidence for the impacts of knowledge loss to clarify the relationship between knowledge loss and the decrease of the MIS department's performance, by exploring the mediating effect of an absorptive capacity. We substantiate the critical role of IS personnel's absorptive capacity.

Second, the effectiveness of "IS"-based knowledge retention is proven. Previous studies suggested that practices in HRM and KMS are useful for recording, locating, and continuously assessing, important expertise for organizations (Angell *et al.*, 2013; Massingham, 2008). Thus, we include the two constructs: "HRM practices"-based and

“IS”-based knowledge retention in our research model. However, the results show that the “HRM practices”-based knowledge retention is not significantly related to knowledge loss; this is inconsistent with the assertions of previous studies (Aiman-Smith *et al.*, 2006; Angell *et al.*, 2013; Hofer-Alfeis, 2008), and is worth further discussion in future studies.

### 6.2 Practical implications

Although organizations implement KM mechanisms and invest in KMS, it still remains difficult to prevent knowledge loss. This study provides reference for practitioners to understand and consider the aspects of knowledge loss before they make any effort, or spend time and money, on implementing KM practices. The following paragraphs describe the four practical implications of this study.

First, according to the results from the hypotheses testing, we confirm that a high employee turnover rate is a significant cause of knowledge loss, so the priority for organizations should be to provide exceptional reasons for employees to stay with the company.

Second, this study provides empirical evidence for the effectiveness of IS on mitigating knowledge loss in the MIS department. It suggests that if KMS is in accordance with the characteristics of knowledge and the type of industry, it could retain critical knowledge and indirectly prevent the decrease of absorptive capacity and performance of the MIS department.

Third, although the effectiveness of the testing result of “HRM practices”-based knowledge retention mechanisms is inconsistent with previous research, it is still worth exploring, since knowledge loss could be mitigated and, in turn, improve its performance.

Finally, this study illustrates the components of knowledge loss and proves their impacts on absorptive capacity and on the performance of the MIS department. Thus, MIS managers and/or executives could analyze which information is most likely to be lost, and then take initiatives to prevent either the decrease of performance, or to improve performance.

## 7. Limitations

The limitations of this study could implicate possible issues and design for future study. First, the respondents filled out their questionnaires according to the situation at the time and point they received it. Long-term or longitudinal study is then suggested, in order to investigate the changes in the organizations within a specific period, or to compare the results between two time periods.

Second, the  $R^2$  value of knowledge loss (0.108) is quite low, implicating the lack of explanatory power of the turnover rate, “HRM practices”-based, and “IS”-based knowledge retentions. We suggest that researchers develop measurements for the effectiveness of HRM practices and assume there are still other undiscovered, or unexplored, knowledge retention mechanisms, or causes of knowledge loss.

Furthermore, environmental variables (such as: dynamic complexity) are not included in our research, researchers may consider more variables that have the potentiality to intervene in the relationship among knowledge loss, and the decrease of absorptive capacity and performance. The limitations mentioned above provide potential issues for future studies to explore knowledge loss, and to make recommendations to practitioners, as well as to contribute to KM research.

## 8. Conclusion

The main purposes of this study can be summarized as follows. First, this study explores the relationship between knowledge loss, the decrease of absorptive capacity, and the decrease of performance in the MIS department. Second, to illustrate the components of knowledge loss – the loss of IS personnel skills, the loss of internal partnership, and the loss of external partnership. Third, to examine the effectiveness of “HRM practices”-based knowledge retention and of “IS”-based knowledge retention. By proving the mediating effects of IS personnel’s absorptive capacity on the relationship between knowledge loss and the decrease of performance, we substantiate the critical role of IS personnel’s absorptive capacity. After realizing the negative influence of knowledge loss, organizations should take any and all actions to retain knowledge. In this study, the effectiveness of “HRM practices”-based and “IS”-based knowledge retention practices are examined; “IS”-based practices are validated to ensure effects on knowledge loss mitigation in the MIS department.

## References

- Aggestam, L., Söderström, E. and Persson, A. (2010), “Seven types of knowledge loss in the knowledge capture process”, *The 18th European Conference on Information Systems Proceedings, Pretoria, June 7-9*.
- Aiman-Smith, L., Bergey, P., Cantwell, A. and Doran, M. (2006), “The coming knowledge and capability shortage”, *Research Technology Management*, Vol. 49 No. 4, pp. 15-23.
- Alavi, M. and Leidner, D.E. (2001), “Review: knowledge management and knowledge management systems: conceptual foundations and research issues”, *MIS Quarterly*, Vol. 25 No. 1, pp. 107-136.
- Alexander, J.A., Bloom, J.R. and Nuchols, B.A. (1994), “Nursing turnover and hospital efficiency: an organization-level analysis”, *Industrial Relations*, Vol. 33 No. 4, pp. 505-520.
- Angell, L.C., Belkhdja, O. and Daghfou, A. (2013), “Understanding and managing knowledge loss”, *Journal of Knowledge Management*, Vol. 17 No. 5, pp. 639-660.
- Beckett, A.J., Wainwright, E.R.C. and Bance, D. (2000), “Knowledge management: strategy or software?”, *Management Decision*, Vol. 38 No. 9, pp. 601-606.
- Bontis, N. (1998), “Intellectual capital: an exploratory study that develops measures and models”, *Management Decision*, Vol. 36 No. 2, pp. 63-76.
- Capelli, P. (2000), “A market-driven approach to retaining talent”, *Harvard Business Review*, Vol. 78 No. 1, pp. 103-113.
- Cepeda, G. and Vera, D. (2007), “Dynamic capabilities and operational capabilities: a knowledge management perspective”, *Journal of Business Research*, Vol. 60 No. 5, pp. 426-437.
- Cervigon, V.G. and Romero, N. (2008), “A knowledge management experience in the energy sector”, *Proceedings of the Engineering Management Conference*, pp. 1-4.
- Chang, C.L.H. (2009), “The study of the turnover of MIS professionals – the gap between Taiwanese and US societies”, *International Journal of Information Management*, Vol. 30 No. 4, pp. 301-314.
- Chin, W.W., Gopal, A. and Salisbury, W.D. (1997), “Advancing the theory of adaptive structuration: the development of a scale to measure faithfulness of appropriation”, *Information System Research*, Vol. 8 No. 4, pp. 342-367.
- Cohen, W.M. and Levinthal, D.A. (1990), “Absorptive capacity: a new perspective on learning and innovation”, *Administrative Science Quarterly*, Vol. 35 No. 1, pp. 128-152.

- Currihan, D.B. (1999), "The causal order of job satisfaction and organizational commitment in models of employee turnover", *Human Resource Management Review*, Vol. 9 No. 4, pp. 495-524.
- De Long, D.W. and Fahey, L. (2000), "Diagnosing cultural barriers to knowledge management", *Academy of Management Executive*, Vol. 14 No. 4, pp. 113-127, doi: 10.5465/AME.2000.3979820.
- De Pablos, P.O. (2002), "Evidence of intellectual capital measurement from Asia, Europe and the Middle East", *Journal of Intellectual Capital*, Vol. 3 No. 3, pp. 287-302.
- Dess, G.G. and Shaw, J.D. (2001), "Voluntary turnover, social capital, and organization performance", *Academy of Management Review*, Vol. 26 No. 3, pp. 496-524.
- Droege, S.B. and Hoobler, J.M. (2003), "Employee turnover and tacit knowledge diffusion: a network perspective", *Journal of Managerial Issues*, Vol. 15 No. 1, pp. 50-61.
- Eisenhardt, K.M. and Martin, J.A. (2000), "Dynamic capabilities: what are they?", *Strategic Management Journal*, Vol. 21 Nos 10/11, pp. 1105-1121.
- Epetimehin, F.M. and Ekundayo, O. (2011), "Organizational knowledge management: survival strategy for Nigeria insurance industry", *Interdisciplinary Review of Economics and Management*, Vol. 1 No. 2, pp. 9-15.
- Fornell, C. and Larcker, D.F. (1981), "Evaluating structural equation models with unobservable variables and measurement error", *Journal of Marketing Research*, Vol. 18 No. 1, pp. 39-50.
- Hair, J.F., Ringle, C.M. and Sarstedt, M. (2011), "PLS-SEM: indeed a silver bullet", *Journal of Marketing Theory and Practice*, Vol. 19 No. 2, pp. 139-151.
- Harris, S.E. and Katz, J.L. (1989), "Predicting organizational performance using information technology managerial cost ratios", *System Sciences*, Vol. 4, pp. 197-204, doi: 10.1109/HICSS.1989.48122.
- Henderson, J. and Lee, S. (1992), "Managing I/S design teams: a control theories perspective", *Management Science*, Vol. 38 No. 6, pp. 757-777.
- Hislop, D. (2013), *Knowledge Management in Organizations: A Critical Introduction*, 3rd ed., Oxford University Press, Oxford.
- Hofer-Alfeis, J. (2008), "Knowledge management solutions for the leaving expert issue", *Journal of Knowledge Management*, Vol. 12 No. 4, pp. 44-54.
- Igbaria, M. and Greenhaus, J.H. (1992), "Determinants of MIS employees' turnover intentions: a structural equation model", *Communications of the ACM*, Vol. 35 No. 2, pp. 35-49.
- Jarvis, C.B., MacKenzie, S.B. and Podsakoff, P.M. (2003), "A critical review of construct indicators and measurement model misspecification in marketing and consumer research", *Journal of Consumer Research*, Vol. 30 No. 2, pp. 199-218.
- Kothari, A., Hovanec, N., Hastie, R. and Sibbald, S. (2011), "Lessons from the business sector for successful knowledge management in health care: a systematic review", *BMC Health Services Research*, Vol. 11, pp. 173-183.
- Levy, M. (2011), "Knowledge retention: minimizing organizational business loss", *Journal of Knowledge Management*, Vol. 14 No. 4, pp. 582-600.
- Lindell, M.K. and Whitney, D.J. (2001), "Accounting for common method variance in cross-sectional research designs", *Journal of Applied Psychology*, Vol. 86 No. 1, pp. 114-121.
- Lubit, R. (2001), "Tacit knowledge and knowledge management: the keys to sustainable competitive advantage", *Organizational Dynamics*, Vol. 29 No. 4, pp. 164-178.

- Malhotra, N.K., Kim, S.S. and Patil, A. (2006), "Common method variance in IS research: a comparison of alternative approaches and a reanalysis of past research", *Management Science*, Vol. 52 No. 12, pp. 1865-1883.
- Martins, E.C. and Meyer, H.W.J. (2012), "Organizational and behavioral factors that influence knowledge retention", *Journal of Knowledge Management*, Vol. 16 No. 1, pp. 77-96.
- Massingham, P. (2008), "Measuring the impact of knowledge loss: more than ripples on a pond?", *Management Learning*, Vol. 39 No. 5, pp. 541-560.
- Norman, P.M. (2004), "Knowledge acquisition, knowledge loss, and satisfaction in high technology alliances", *Journal of Business Research*, Vol. 57 No. 6, pp. 610-619.
- Omotayo, F.O. (2015), "Knowledge management as an important tool in organizational management: a review of literature", *Library Philosophy and Practice*, paper 1238.
- Parker, H. (2012), "Knowledge acquisition and leakage in inter-firm relationships involving new technology-based firms", *Management Decision*, Vol. 50 No. 9, pp. 1618-1633.
- Pavlou, P.A. and El Sawy, O.A. (2006), "From IT leveraging competence to competitive advantage in turbulent environments: the case of new product development", *Information Systems Research*, Vol. 17 No. 3, pp. 198-227.
- Pennings, J.M., Lee, K. and Witteloostuijn, A.V. (1998), "Human capital, social capital, and firm dissolution", *Academy of Management Journal*, Vol. 41 No. 4, pp. 425-440, doi: 10.2307/257082.
- Perrott, B.E. (2007), "A strategic risk approach to knowledge management", *Business Horizons*, Vol. 50 No. 6, pp. 523-533.
- Podsakoff, P.M., MacKenzie, S.B., Lee, J.Y. and Podsakoff, N.P. (2003), "Common method biases in behavioral research: a critical review of the literature and recommended remedies", *Journal of Applied Psychology*, Vol. 88 No. 5, pp. 879-903.
- Ravichandran, T. and Rai, A. (2000), "Quality management in systems development: an organizational system perspective", *MIS Quarterly*, Vol. 24 No. 3, pp. 381-416.
- Ravinchandran, T.T. and Lertwongsatien, C. (2005), "Effect of information systems resources and capabilities on firm performance: a resource-based perspective", *Journal of Management Information Systems*, Vol. 21 No. 4, pp. 237-276.
- Rockart, J.R. and Short, J. (1989), "IT in the 1990s: managing organizational interdependence", *Sloan Management Review*, Vol. 30 No. 2, pp. 7-17.
- Ross, J.W., Beath, C. and Goodhue, D.L. (1996), "Develop long-term competitiveness through it assets", *Sloan Management Review*, Vol. 38 No. 1, pp. 31-42.
- Schiama, G. (2012), "Managing knowledge for business performance improvement", *Journal of Knowledge Management*, Vol. 16 No. 4, pp. 515-522.
- Shaw, J.D., Delery, J.E., Jenkins, G.D. Jr and Gupta, N. (1998), "An organizational-level analysis of voluntary and involuntary turnover", *Academy of Management Journal*, Vol. 41 No. 5, pp. 511-525.
- Snell, S.A. and Dean, J.W. (1992), "Integrated manufacturing and human resources management: a human capital perspective", *Academy of Management Journal*, Vol. 35 No. 3, pp. 467-504.
- Sobel, M.E. (1982), "Asymptotic confidence intervals for indirect effects in structural equation models", *Sociological Methodology*, Vol. 13, pp. 290-312.
- Steward, T. and Ruckdeschel, C. (1998), "Intellectual capital: the new wealth of organizations", *Performance Improvement*, Vol. 37 No. 7, pp. 56-59.

- Subramaniam, M. and Youndt, M.A. (2005), "The influence of intellectual capital on the types of innovative capabilities", *Academy of Management Journal*, Vol. 48 No. 3, pp. 450-463.
- Teece, D., Pisano, G. and Shuen, A. (1997), "Dynamic capabilities and strategic management", *Strategic Management Journal*, Vol. 18 No. 7, pp. 509-533.
- Terborg, J.R. and Lee, T.W. (1984), "Extension of turnover research: a predictive study of organizational turnover rates for a two-year period", *Academy of Management Journal*, Vol. 27 No. 4, pp. 793-810.
- Toten, M. (2005), "Is there an optimal level of employee turnover?", WorkplaceInfo, available at: [www.workplaceinfo.com.au/human-resources-management/hr-strategy/is-there-an-optimal-level-of-employee-turnover](http://www.workplaceinfo.com.au/human-resources-management/hr-strategy/is-there-an-optimal-level-of-employee-turnover) (accessed May 2, 2016).
- Venkatesh, V., Thong, J.Y.L. and Xu, X. (2012), "Consumer acceptance and use of information technology: extending the unified theory of acceptance and use of technology", *MIS Quarterly*, Vol. 36 No. 1, pp. 157-178.
- Wernerfelt, B. (1984), "A resource-based view of the firm", *Strategic Management Journal*, Vol. 5 No. 2, pp. 171-180.
- Wong, K.Y. and Aspinwall, E. (2005), "An empirical study of the important factors for knowledge-management adoption in the SME sector", *Journal of Knowledge Management*, Vol. 9 No. 3, pp. 64-82.
- Youndt, M.A. and Snell, S.A. (2004), "Human resource configurations, intellectual capital, and organisational performance", *Journal of Managerial Issues*, Vol. 16 No. 3, pp. 337-360.
- Zahra, S.A. and George, G. (2002), "Absorptive capacity: a review, reconceptualization, and extension", *The Academy of Management Review*, Vol. 27 No. 2, pp. 185-203.

### Further reading

- Henderson, J.C. (1998), "Involvement as a predictor of performance in I/S planning and design", Working Paper No. 175, Center for Information Systems Research, Massachusetts Institute of Technology, Cambridge, MA.

**Appendix**

**Knowledge loss and knowledge retention**

Constructs	Items: compared to the situation before employees' turnover during these three years	Factors	
		Loadings	ITC
<sup>a</sup> Loss of IS personnel skill CR = 0.915 $\alpha = 0.875$ AVE = 0.729	PS1: critical technical knowledge loses severely in our department	0.836	0.559
	PS2: the skills and knowledge to manage IT projects loses severely in our department	0.920	0.667
	PS3: business knowledge loses severely in our department	0.861	0.648
	PS4: knowledge of routines and methods used in our department loses severely	0.794	0.609
<sup>a</sup> Loss of internal partnership CR = 0.970 $\alpha = 0.959$ AVE = 0.756	IP1: the degree of knowledge sharing between our department and related departments in the organization decreases	0.806	0.725
	IP2: the degree to which our department and related departments in the organization understand the working environment and tasks of each other decreases	0.882	0.768
	IP3: the degree of trust between our department and related departments in the organization decreases	0.894	0.752
	IP4: the degree of effective cooperation between our department and related departments in the organization decreases	0.900	0.771
	IP5: conflicts between our department and related departments in the organization increase	0.837	0.707
	IP6: the quality of communication between our department and related departments in the organization decreases	0.893	0.800
<sup>a</sup> Loss of external partnership CR = 0.967 $\alpha = 0.958$ AVE = 0.828	EP1: the degree of knowledge sharing between our department and business partners/vendors outside the organization decreases	0.894	0.792
	EP2: the degree to which our department and business partners/vendors outside the organization understand the working environment and tasks of each other decreases	0.911	0.793
	EP3: the degree of trust between our department and business partners/vendors outside the organization decreases	0.923	0.792
	EP4: the degree of effective cooperation between our department and business partners/vendors outside the organization decreases	0.927	0.759
	EP5: conflicts between our department and business partners/vendors outside the organization increase	0.871	0.737
	EP6: the quality of communication between our department and business partners/vendors outside the organization decreases	0.932	0.783
Decrease of absorptive capacity CR = 0.958 $\alpha = 0.941$ AVE = 0.850	AC1: our department's the capacity for successfully learning new things decreases	0.894	0.815
	AC2: our department's the capacity for analyzing new information and knowledge decreases	0.907	0.897
	AC3: our department's the capacity for assimilating new information and knowledge decreases	0.941	0.892
	AC4: our department's the capacity for utilizing knowledge into system development decreases	0.945	0.832

(continued)

**Table AI.**  
Results of factor analysis

Constructs	Items: compared to the situation before employees' turnover during these three years	Factors	
		Loadings	ITC
<sup>b</sup> Decrease of efficiency CR = 0.959 $\alpha = 0.943$ AVE = 0.854	EY1: the amount of work our department produces decreases	0.919	0.839
	EY2: the efficiency of our department operations decreases	0.929	0.847
	EY3: given the same amount of work, we need more budgets to accomplish it	0.913	0.831
	EY4: given the same amount of work, we need more time to accomplish it	0.935	0.828
<sup>b</sup> Decrease of effectiveness CR = 0.950 $\alpha = 0.930$ AVE = 0.827	ES1: the quality of systems our department develops declines	0.932	0.836
	ES2: the quality of system maintenance our department conducts declines	0.906	0.810
	ES3: our department's ability to meet the goals of the department decreases	0.870	0.774
	ES4: our department's ability to meet and support for users' requests decreases	0.929	0.835
"Information Systems"-based knowledge retention CR = 0.943 $\alpha = 0.929$ AVE = 0.735	KMS1: the knowledge management systems we use in our company are appropriate and good-performing	0.833	0.780
	KMS2: we apply technological tools (collaborative tools, knowledge bases, searching tools, document management systems, intelligent systems, etc.) to facilitate knowledge storage	0.859	0.802
	KMS3: we utilize network (intranet or internet) to accelerate knowledge sharing and storage	0.792	0.686
	KMS4: the knowledge structures or categories for a repository in our company is appropriate	0.903	0.806
	KMS5: the knowledge management systems in our company are easy to use	0.883	0.851
	KMS6: the knowledge management systems in our company are suitable to users' needs	0.870	0.836
<sup>c</sup> Phased retirement plans CR = 0.973 $\alpha = 0.962$ AVE = 0.9	Phased retirement plans: organizations hire retired employees as part-time employees, consultants or other adjunct positions in order to continuously access their unique knowledge or social network		
	PR1: there are rigorous and robust phased retirement plans in our company	0.962	0.677
	PR2: the phased retirement plans in our company are actually executed	0.968	0.673
	PR3: the phased retirement plans in our company are effective	0.969	0.680
<sup>c</sup> Mandatory handover process CR = 0.968 $\alpha = 0.956$ AVE = 0.884	PR4: employees in our company understand the phased retirement plans clearly	0.893	0.622
	Mandatory handover process: organizations regulate employees to handover their tasks to new recruits several months before they leave, and executives should supervise the entire process		
	MH1: there are rigorous and robust mandatory handover processes in our company	0.951	0.757
	MH2: the mandatory handover processes in our company are actually executed	0.943	0.720
	MH3: the mandatory handover processes in our company are effective	0.948	0.795
MH4: employees in our company understand the mandatory handover processes clearly	0.918	0.731	

Table AI.

(continued)



Constructs	Items: compared to the situation before employees' turnover during these three years	Factors		Knowledge loss and knowledge retention
		Loadings	ITC	
Job rotation programs CR = 0.97 $\alpha = 0.959$ AVE = 0.889	Job rotation programs: in order to retain employees' knowledge in advance, organizations transfer employees to branches to cooperate with different colleagues for sharing knowledge, building new social network and generating new knowledge			<b>1781</b>
	JR1: there are rigorous and robust job rotation programs in our company	0.954	0.764	
	JR2: the job rotation programs in our company are actually executed	0.943	0.686	
	JR3: the job rotation programs in our company are effective	0.947	0.767	
	JR4: employees in our company understand the job rotation programs clearly	0.928	0.791	

**Notes:** <sup>a</sup>Knowledge loss is measured by three sub-dimensions – PS, loss of IS personnel skill; IP, loss of internal partnership; EP, loss of external partnership; <sup>b</sup>decrease of performance is measured by two sub-dimensions – EY, decrease of efficiency; ES, decrease of effectiveness; <sup>c</sup>“human resource management practices”-based knowledge retention is measured by three sub-dimensions – PR, phased retirement plans; MH, mandatory handover process; JR, job rotation programs

**Table AI.**

**Table AII.**  
Descriptive statistics  
and correlations

Variables	Mean	SD	<sup>a</sup> M3	<sup>b</sup> M4	PS	IP	EP	KL	AC	ES	EY	PF	KMS	PR	MH	JR	HR	TOR
PS	3.958	1.558	-0.063	-0.549	0.854*													
IP	3.664	1.401	-0.158	-0.631	0.622	0.869*												
EP	3.555	1.411	-0.079	-0.699	0.533	0.700	0.910*											
KL	3.714	1.443	-0.175	-0.264	0.765	0.914	0.895	0.769*										
AC	3.496	1.446	-0.117	-0.574	0.532	0.666	0.604	0.701	0.922*									
ES	3.692	1.479	-0.187	-0.665	0.510	0.600	0.543	0.639	0.690	0.910*								
EY	3.992	1.532	-0.407	-0.595	0.477	0.592	0.588	0.647	0.628	0.794	0.924*							
PF	3.832	1.467	-0.330	-0.479	0.521	0.629	0.597	0.679	0.695	0.946	0.948	0.868*						
KMS	4.271	1.477	-0.169	-0.426	-0.168	-0.227	-0.097	-0.186	-0.177	-0.167	-0.180	-0.183	0.857*					
PR	3.415	1.536	0.330	-0.546	-0.128	-0.148	0.030	-0.038	0.059	-0.065	-0.008	-0.038	0.271	0.948*				
MH	3.950	1.632	-0.188	-0.691	-0.118	-0.170	-0.024	-0.116	-0.080	-0.165	-0.142	-0.162	0.414	0.436	0.940*			
JR	3.747	1.556	-0.024	-0.669	-0.159	-0.191	-0.032	-0.138	-0.066	-0.096	-0.060	-0.082	0.325	0.444	0.634	0.943*		
HR	3.793	1.59	-0.087	-0.256	-0.165	-0.207	-0.013	-0.139	-0.042	-0.134	-0.088	-0.117	0.413	0.744	0.852	0.857	0.771*	
TOR	4.356	1.835	0.294	-1.329	0.282	0.273	0.125	0.248	0.191	0.191	0.171	0.191	-0.112	-0.333	-0.105	-0.201	-0.254	1*

**Notes:** <sup>a</sup>M3; Skewness; <sup>b</sup>M4; Kurtosis; <sup>c</sup>Correlation Matrix: the diagonal line of correlation matrix represents the square root of AVE. \*Correlation > 0.7; PS, loss of IS personnel skill; IP, loss of internal partnership; EP, loss of external partnership; KL, knowledge loss; AC, decrease of absorptive capacity; ES, decrease of effectiveness; EY, decrease of efficiency; PF, performance; KMS, "information systems"-based knowledge retention; PR, phased retirement plans; MH, mandatory turnover process; JR, job rotation programs; HR, "human resource management practices"-based knowledge retention; TOR, turnover rate

	PS	IP	EP	AC	ES	EY	KMS	PR	MH	JR	TOR
PS1	0.84	0.47	0.39	0.45	0.47	0.41	-0.10	-0.11	-0.10	-0.12	0.29
PS2	0.92	0.57	0.47	0.50	0.51	0.47	-0.17	-0.14	-0.15	-0.21	0.25
PS3	0.86	0.53	0.51	0.44	0.40	0.40	-0.12	-0.08	-0.07	-0.07	0.24
PS5	0.79	0.55	0.45	0.55	0.36	0.35	-0.18	-0.11	-0.09	-0.14	0.19
IP1	0.61	0.81	0.56	0.57	0.51	0.45	-0.19	-0.14	-0.09	-0.11	0.26
IP2	0.63	0.88	0.56	0.55	0.49	0.51	-0.21	-0.22	-0.15	-0.19	0.30
IP3	0.50	0.89	0.61	0.58	0.50	0.50	-0.20	-0.12	-0.15	-0.16	0.21
IP4	0.53	0.90	0.62	0.60	0.60	0.61	-0.27	-0.12	-0.20	-0.21	0.27
IP5	0.44	0.84	0.61	0.57	0.51	0.48	-0.13	-0.07	-0.12	-0.15	0.15
IP6	0.53	0.89	0.69	0.60	0.52	0.54	-0.17	-0.10	-0.16	-0.17	0.23
EP1	0.53	0.65	0.89	0.60	0.55	0.52	-0.09	0.06	0.01	-0.04	0.14
EP2	0.52	0.65	0.91	0.54	0.48	0.55	-0.14	0.00	0.06	0.03	0.11
EP3	0.48	0.66	0.92	0.58	0.48	0.53	-0.07	0.01	-0.02	0.00	0.12
EP4	0.45	0.61	0.93	0.53	0.50	0.57	-0.11	0.01	-0.05	-0.03	0.15
EP5	0.47	0.60	0.87	0.53	0.49	0.51	-0.04	0.12	-0.04	-0.08	0.05
EP6	0.46	0.65	0.93	0.53	0.47	0.54	-0.08	-0.03	-0.09	-0.07	0.11
AC1	0.46	0.61	0.56	0.89	0.62	0.56	-0.12	0.09	-0.06	0.01	0.09
AC2	0.50	0.58	0.55	0.91	0.67	0.62	-0.20	0.07	-0.09	-0.09	0.23
AC3	0.52	0.65	0.56	0.95	0.64	0.57	-0.15	0.01	-0.08	-0.11	0.17
AC4	0.48	0.62	0.56	0.94	0.62	0.57	-0.17	0.03	-0.07	-0.06	0.21
ES1	0.46	0.57	0.52	0.65	0.93	0.73	-0.15	-0.07	-0.16	-0.11	0.18
ES2	0.42	0.53	0.52	0.61	0.91	0.72	-0.18	-0.03	-0.13	-0.03	0.15
ES3	0.48	0.51	0.45	0.63	0.87	0.70	-0.14	-0.03	-0.18	-0.10	0.15
ES4	0.50	0.56	0.49	0.62	0.93	0.73	-0.13	-0.11	-0.13	-0.11	0.21
EY1	0.39	0.49	0.53	0.61	0.74	0.92	-0.17	0.05	-0.14	-0.07	0.14
EY2	0.43	0.51	0.56	0.62	0.74	0.93	-0.15	0.05	-0.13	-0.04	0.13
EY3	0.46	0.61	0.55	0.55	0.74	0.91	-0.19	-0.09	-0.14	-0.07	0.18
EY4	0.48	0.58	0.53	0.53	0.71	0.94	-0.16	-0.04	-0.11	-0.04	0.18
KMS1	-0.15	-0.17	-0.02	-0.16	-0.14	-0.16	0.83	0.39	0.38	0.37	-0.21
KMS2	-0.12	-0.18	-0.06	-0.18	-0.12	-0.13	0.86	0.22	0.31	0.28	-0.12
KMS3	-0.07	-0.20	-0.09	-0.18	-0.20	-0.16	0.79	0.09	0.29	0.20	-0.03

(continued)

Knowledge loss and knowledge retention

Table AIII.  
Cross-factor loadings

Table AIII.

	PS	IP	EP	AC	ES	EY	KMS	PR	MH	JR	TOR
KMS4	-0.21	-0.26	-0.16	-0.19	-0.21	-0.19	0.90	0.22	0.41	0.32	-0.06
KMS5	-0.14	-0.15	-0.06	-0.08	-0.04	-0.10	0.88	0.25	0.34	0.22	-0.08
KMS6	-0.15	-0.14	-0.04	-0.09	-0.10	-0.15	0.87	0.27	0.36	0.27	-0.12
PR1	-0.11	-0.15	0.02	0.04	-0.07	0.01	0.27	0.96	0.41	0.44	-0.35
PR2	-0.15	-0.18	0.01	0.03	-0.06	0.00	0.24	0.97	0.42	0.42	-0.32
PR3	-0.14	-0.15	0.03	0.03	-0.07	0.00	0.25	0.97	0.41	0.44	-0.34
PR4	-0.09	-0.08	0.05	0.10	-0.05	-0.02	0.26	0.89	0.41	0.38	-0.24
MH1	-0.13	-0.17	-0.05	-0.10	-0.17	-0.14	0.41	0.40	0.95	0.61	-0.12
MH2	-0.12	-0.16	-0.03	-0.10	-0.15	-0.13	0.38	0.36	0.94	0.58	-0.05
MH3	-0.13	-0.19	-0.02	-0.09	-0.18	-0.15	0.38	0.48	0.95	0.61	-0.14
MH4	-0.07	-0.12	0.00	-0.02	-0.11	-0.11	0.39	0.40	0.92	0.59	-0.09
JR1	-0.17	-0.21	-0.06	-0.09	-0.12	-0.10	0.34	0.40	0.62	0.95	-0.22
JR2	-0.15	-0.18	-0.02	-0.10	-0.07	-0.04	0.30	0.37	0.50	0.94	-0.18
JR3	-0.18	-0.19	-0.03	-0.08	-0.11	-0.07	0.32	0.41	0.63	0.95	-0.20
JR4	-0.10	-0.14	-0.01	0.02	-0.07	-0.02	0.27	0.48	0.63	0.93	-0.15
TOR	0.28	0.27	0.12	0.19	0.19	0.17	-0.11	-0.33	-0.11	-0.20	1.00

**Notes:** PS, loss of IS personnel skill; IP, loss of internal partnership; EP, loss of external partnership; AC, decrease of absorptive capacity; ES, decrease of effectiveness; EY, decrease of efficiency; KMS, "information systems"-based knowledge retention; PR, phased retirement plans; MH, mandatory handover process; JR, job rotation programs; TOR, turnover rate

	PS	IP	EP	KL	AC	ES	EY	PF	KMS	PR	MH	JR	HR	TOR	Age	Tenure
PS	1															
IP	0.622	1														
EP	0.533	0.7	1													
KL	0.765	0.914	0.895	1												
AC	0.532	0.666	0.604	0.701	1											
ES	0.510	0.6	0.543	0.639	0.69	1										
EY	0.477	0.592	0.588	0.647	0.628	0.794	1									
PF	0.521	0.629	0.597	0.679	0.695	0.946	0.948	1								
KMS	-0.168	-0.227	-0.097	-0.186	-0.177	-0.167	-0.18	-0.183	1							
PR	-0.128	-0.148	0.03	-0.038	0.059	-0.065	-0.008	-0.038	0.271	1						
MH	-0.118	-0.17	-0.024	-0.116	-0.08	-0.165	-0.142	-0.162	0.414	0.436	1					
JR	-0.159	-0.191	-0.032	-0.138	-0.066	-0.096	-0.06	-0.082	0.325	0.444	0.634	1				
HR	-0.165	-0.207	-0.013	-0.139	-0.042	-0.134	-0.088	-0.117	0.413	0.744	0.852	0.857	1			
TOR	0.282	0.273	0.125	0.248	0.191	0.191	0.171	0.191	-0.112	-0.333	-0.105	-0.201	-0.254	1		
Age	-0.068	-0.095	0.001	-0.059	-0.098	-0.068	-0.059	-0.067	-0.069	0.031	0.052	-0.019	0.023	-0.057	1	
Tenure	-0.004	-0.053	0.019	-0.016	-0.052	-0.097	-0.1	-0.104	-0.068	0.002	0.018	-0.035	-0.007	-0.016	0.814	1

Table AIV.  
Correlation matrix

**Table AV.**  
Adjusted *t*-value

	PS	IP	EP	KL	AC	ES	EY	PF	KMS	PR	MH	JR	HR	TOR	Age	Tenure
PS	1															
IP	10.870	1														
EP	8.616	13.417	1													
KL	16.263	30.854	27.478	1												
AC	8.594	12.220	10.370	13.455	1											
ES	8.106	10.262	8.845	11.369	13.048	1										
EY	7.420	10.050	9.946	11.613	11.043	17.883	1									
PF	8.348	11.072	10.182	12.659	13.231	39.970	40.796	1								
KMS	-2.370	-3.232	-1.367	-2.630	-2.500	-2.356	-2.543	-2.587	1							
PR	-1.801	-2.084	0.385	-0.550	0.784	-0.923	-0.137	-0.550	3.838	1						
MH	-1.661	-2.399	-0.357	-1.633	-1.130	-2.327	-1.999	-2.284	6.215	6.622	1					
JR	-2.241	-2.703	-0.467	-1.943	-0.936	-1.353	-0.853	-1.158	4.690	6.773	11.219	1				
HR	-2.327	-2.937	-0.206	-1.957	-0.605	-1.886	-1.242	-1.647	6.196	15.244	22.285	22.774	1			
TOR	4.008	3.869	1.703	3.487	2.644	2.644	2.356	2.644	-1.577	-4.886	-1.479	-2.849	-3.639	1		
Age	-0.964	-1.339	-0.014	-0.840	-1.381	-0.964	-0.840	-0.950	-0.978	0.399	0.688	-0.289	0.289	-0.812	1	
Tenure	-0.082	-0.757	0.234	-0.247	-0.743	-1.367	-1.409	-1.465	-0.964	0.000	0.220	-0.509	-0.124	-0.247	19.188	1

**Notes:** PS, loss of IS personnel skill; IP, loss of internal partnership; EP, loss of external partnership; KL, knowledge loss; AC, decrease of absorptive capacity; ES, decrease of effectiveness; EY, decrease of efficiency; PF, performance; KMS, "information systems"-based knowledge retention; PR, phased retirement plans; MH, mandatory handover process; JR, job rotation programs; HR, "human resource management practices"-based knowledge retention; TOR, turnover rate

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