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Personal information management effectiveness of knowledge workers: conceptual development and empirical validation

Yujong Hwang[1,2], William J. Kettinger[3] and Mun Y. Yi[4]

[1] School of Accountancy and MIS, Driehause College of Business, DePaul University, Chicago, IL, U.S.A.; [2] College of International Studies, Kyung Hee University, Yongin, Republic of Korea; [3] Management Information Systems Department, Fogelman College of Business and Economics, University of Memphis, Memphis, TN, USA; [4] Department of Knowledge Service Engineering, College of Information Science and Technology, Korea Advanced Institute of Science and Technology, Daejoen, Republic of Korea

Correspondence: Yujong Hwang, School of Accountancy and MIS, Driehause College of Business, DePaul University, 1 E Jackson Blvd, Chicago, IL 60604, U.S.A.
Tel: +1 (312) 362 5487;
Fax: +1 (312) 362 6208;
E-mail: yhwang1@depaul.edu

Abstract

What critical factors contribute to knowledge workers' effective information management and consequent job performance? This paper begins to address this important question by developing a conceptual definition of a new construct called personal information management effectiveness (PIME) and its constituent dimensions. Specifically, we theorize that PIME consists of two underlying dimensions: personal information management motivation (PIMM) and personal information management capability (PIMC). Synthesizing the extant literature on information management and information orientation, we further conceptualize PIMM as having four sub-dimensions of proactiveness, sharing, transparency, and formality, and PIMC as possessing five sub-dimensions of sensing, collecting, organizing, processing, and maintaining. Moreover, we develop a theoretical model that positions PIME as a mediator between two selected individual characteristics (IT self-efficacy and need-for-cognition) and job performance. New measures for PIME dimensions were developed and shown to have strong psychometric properties. The proposed model was empirically tested using data collected from 352 knowledge workers. As theorized, PIME was found to have significant effects on job performance (41%) and fully mediate the effects that the selected individual characteristics have on job performance. Responding to recent calls for advanced research on personal information management, the measures of PIMM and PIMC developed in this study have practical value as research and diagnostic tools and the findings provide useful insights to help organizations improve knowledge workers' information management practices.
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Introduction

As industries are increasingly information intensive and knowledge constitutes the basis for competition, knowledge workers' effectiveness in information management is regarded as a core asset of a firm (Grant, 1996a; Davenport, 1998). Personal information management, which refers to the activities related to the acquisition, usage, and maintenance of information by an individual, is important as all knowledge workers must manage their documents, files, emails, messages and other forms of information every day in their work environment. It is through these personal information items that they seek to manage their work day and complete their job tasks

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successfully. For individuals, better personal information management means a better utilization of their precious and limited resources (time, energy, attention). According to Jones (2007), better personal information management should translate to better employee productivity. However, just as all employees are not equally motivated or capable, so too they are not equal in their personal information management effectiveness (PIME).

Knowledge management (KM) is rooted in effective personal information management behaviors, as KM represents the synergetic process of managing personalized information related to facts, procedures, concepts, interpretations, ideas, observations, and judgment, across various entities in an organization (Alavi & Leidner, 2001). Recently, Davenport (2010) goes further by stating 'In the early days of knowledge management, most organizations focused on institutional solutions to the problems of knowledge creation, sharing, and application. Today, however, both organizations and their employees have begun to realize that knowledge management starts and ends with individual behaviors. They are initiating programs and activities to manage personal, work-related information and knowledge'.

In articulating the knowledge-based view (KBV) of a firm, Grant (1996a) argues that knowledge resides within the individual and the primary role of the organization is to direct this knowledge toward organizational objectives (Tsoukas, 1996; Grant, 1996b). An important ingredient in converting personal knowledge to organizational performance is to improve personal information management activities, thereby facilitating the effective creation and utilization of organizational knowledge. Research clarifying PIME is needed as a basis for understanding the explicit relationship between individual and organization knowledge, thereby enhancing the possibilities of knowledge codification, reuse, and work process improvement. A clearer understanding of PIME should also benefit the development and positioning of IT within an organization by more closely linking the IT functions with people throughout the firm as IT is a tool that facilitates the management of information.

Surprisingly, despite the recognized importance of PIME, no studies have empirically examined its dimensions or assessed its influence on job performance. In terms of empirical research, calls for psychometric development of PIME measures have been cited as an important need. For example, Kelly (2006, p. 86) states, 'Developing valid and reliable metrics for the study of personal information management behavior and evaluation of personal information management tools is an important area that needs attention.' In addition, little research has examined how PIME is influenced by innate individual characteristics. In this research, we explore the effects of two individual characteristics known to influence the quality of information processing: IT self-efficacy and cognitive style. The former epitomizes one's confidence in using IT, technical artifacts that are designed to aid the processing of information; the latter encapsulates one's cognitive tendencies in processing information. While there are many individual characteristics that can potentially influence one's information management motivation and capability, we consider these two variables among the most important as contemporary knowledge workers are situated in information-intensive environments where one's abilities in deploying technological artifacts and one's cognitive efforts are key drivers of effective information management.

Responding to the calls made by prior research (i.e., Whittaker *et al*, 2000; Kelly, 2006) and addressing the gap in the literature, we develop and perform an initial test of a new model designed to trace the effects of PIME, defined as the individual quality to carry out information-related activities in a manner conducive to his or her goal attainment, on a knowledge worker's job performance and its role in mediating the effects of the selected individual characteristics (i.e., IT self-efficacy and cognitive style) on job performance. Specifically, building upon the elaboration likelihood model (ELM) and integration theory of human performance developed in psychology (Heider, 1958; Anderson & Butzin, 1974; Locke *et al*, 1978; Kanfer & Ackerman, 1989), we conceptualize PIME as a high level construct consisting of two component constructs: (1) personal information management motivation (PIMM), the degree to which a person is motivated to use information effectively, and (2) personal information management capability (PIMC), the degree to which a person possesses the capability to manage information effectively. We propose a model that links individual characteristics to job performance via these PIME constructs.

Further, in this research, we develop measures of PIME, which can be utilized by managers to improve individual employees' job performance and ultimately the information management effectiveness of their organization. While the evidence mounts that we must improve the information management effectiveness of employees, it could be argued that a disproportionate amount of IS scholarly energy has been directed at identifying salient characteristics of IT rather than focusing on understanding the information management aspects of knowledge workers. Supporters of this argument contend that technology is only a tool designed to support the management of information while knowledge workers are the ultimate agents who put information to use (George *et al*, 2008; Ragowsky *et al*, 2008; Mithas *et al*, 2011). Considering the information-intensive nature of knowledge work and the role of individual performance as a fundamental driver of organizational effectiveness, this research on PIME represents an initial yet important step toward understanding the role of information management effectiveness at the individual level.

Research model and hypotheses

Overview

Figure 1 presents the conceptual framework that has guided our research. The framework considers PIME,

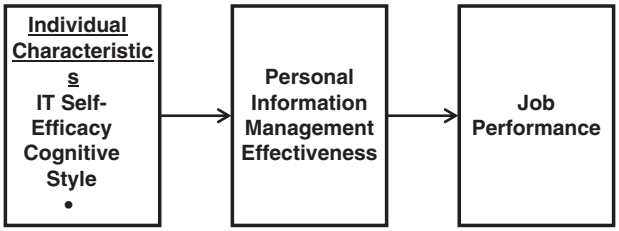

Figure 1 Conceptual framework of PIME.

formed by PIMM and PIMC, as a central determinant of a knowledge worker's performance and as a key variable in linking individual characteristics to performance. Our conceptual framework is based on the assumption that information management effectiveness is a critical precondition of knowledge workers' job performance differences, given that a knowledge worker's job is highly information-intensive and information-dependent, mediating the effects individual level factors such as IT self-efficacy and cognitive style (need-for-cognition) have on job performance.

Accumulated findings in psychology show that motivation and capability are two fundamental drivers of human effectiveness in learning and performance. Motivation has been conceptualized as an essential mechanism in linking individual needs to performance. Motivation guides choices and actions to result in performance differences (Locke, 1991). Numerous studies have found that motivation is a key determinant of human effectiveness in skill learning and task performance (e.g., Bandura, 1986; Kanfer & Ackerman, 1989; Locke & Latham, 1990; Kraiger *et al*, 1993). Another stream of research has focused on the effects of cognitive-intellectual capability in predicting individual effectiveness to show a substantial positive relationship between capability and performance across a wide range of jobs (e.g., McHenry *et al*, 1990; Mount & Barrick, 1995; House *et al*, 1996). While motivation provides insight into whether an individual is willing to do a given job, capability shows whether an individual has the cognitive competency required for the job.

Integrating the perspectives of the two streams, research has confirmed that both motivation and capability simultaneously play significant roles in determining human performance across various domains (Vroom, 1964; Anderson & Butzin, 1974; Terborg, 1977; Locke *et al*, 1978; Kanfer & Ackerman, 1989). For example, in a meta-analysis of training literature spanning 20 years, Colquitt *et al* (2000) showed that motivation to learn ($\beta = 0.39$, $P<0.05$) and cognitive ability ($\beta = 0.76$, $P<0.05$) were independent and simultaneous determinants of performance. Kanfer & Ackerman's (1989) unified framework includes both the main effects of motivation and capability and the interaction effects between motivation and capability determinants of human performance. However, other researchers have found the interaction effects to be equivocal (Terborg, 1977). For example, Terborg (1977) found a clear interaction effect between motivation and capability in only 2 out of 14 studies he reviewed. Thus, based on these mixed findings, the proposed model theorizes the motivation and capability variables as determinants – formative factors – of information management effectiveness, but does not formally include the interaction effect between the motivation and capability determinants. The interaction effect will be examined in a post-hoc analysis in the Test of Model and Hypotheses section.

The ELM, proposed by Petty & Cacioppo (1986), and used widely in communications psychology, further supports the view that motivation and ability are two key intervening mechanisms for effective information processing and management activities. Petty and Cacioppo postulate that information elaboration will occur if both motivation and ability are present. In this view, motivation to think about a message is not enough for persuasive communication. The person must have the ability to properly process the information. Corroborating this perspective, Hwang *et al* (2010) provides a detailed literature review of the relationship between the motivation and capability aspects of personal information use and their potential impact on performance. Hwang *et al* (2010) argue that the previous information behavior and management literature, such as user competence (Marcolin *et al*, 2000), did not completely show the relationship between information management behavior and job performance. They also suggest that a more broad information management framework, such as the information orientation model (Marchand *et al*, 2000), would be useful to understand an individual's job performance.

Agreeing with the basic premise of Marchand *et al*'s information orientation view (Marchand *et al*, 2000, 2001, 2002), we expect the significance of information management effectiveness in determining individual job performance to be also true given that organizational effectiveness is driven by the collective quality of individual job performance (Grant, 1996a, b; Marchand *et al*, 2000, 2001, 2002). Marchand *et al* (2000, 2001, 2002) found that information orientation of a firm was a significant determinant of business performance with a high path coefficient of 0.52 based on a survey of 1009 senior managers in 22 countries and 25 industries. While the Marchand *et al*'s study was based on senior managers' perceptions regarding information use at the organizational level, it is premised on the KBV that the cumulative effect of information practice and performance at the individual level has a net effect on organizational level information management effectiveness and ultimately organizational performance. Further, authors such as Marchand *et al* (2000) and Davenport (1998, 2010) argue that the effects of individual differences on job performance will be mediated by individuals' information management effectiveness.

Recognizing the fundamental and concurrent effects motivation and capability have on human effectiveness, the integration theory of human performance postulates motivation and capability as two primary drivers of

individual learning and effectiveness (Heider, 1958; Kanfer & Ackerman, 1989). The integration theory perspective of human performance can be traced back to Heider (1958), who theorized personal action outcome to be a function of power (i.e., ability) and trying (i.e., motivation) while holding the environment factors constant. Heider's integration perspective has substantially influenced major contemporary theories and models of human behavior including expectancy theory (Vroom, 1964), social cognitive theory (Bandura, 1986), goal setting theory (Locke & Latham, 1990), and ELM (Petty & Cacioppo, 1986), as well as many empirical studies (e.g., Anderson & Butzin, 1974; Terborg, 1977; Locke *et al*, 1978; Kanfer & Ackerman, 1989; Colquitt *et al*, 2000).

Applying the integration theory perspective and Marchand *et al*'s information orientation perspective to our study's context, we conceptualize PIMM and PIMC as two underlying dimensions of PIME of knowledge workers. Because PIMM and PIMC are two distinct factors, each of which captures a different facet of the PIME construct, they are modeled as formative (also called composite) indicators of their higher order construct (Edwards, 2001; Yi & Davis, 2003) as shown in Figure 2. This conceptualization of PIME enables the effects of individual characteristics on the motivation and capability aspects of PIME to be traced separately, and the model testing to be more consistent with the integration theory perspective (Anderson & Butzin, 1974; Locke *et al*, 1978; Kanfer & Ackerman, 1989).

Personal information management motivation

Motivation theorists generally agree that motivation is a multidimensional construct and the core component of motivation is one's willingness to exert attentional effort (e.g., Kanfer & Ackerman, 1989; Locke & Latham, 1990; Ashford & Black, 1996). Kanfer & Ackerman (1989) define motivation as a multidimensional construct, evident through the direction, intensity, and persistence of attentional effort. At the measurement level, depending on the study context, motivation has been operationalized in various alternative forms. Several studies in the information systems (IS) field focused on the motivational aspects of information use by examining variables mostly around the ideas of extrinsic motivation in the form of reward, reputation, and image (Becker, 1998; Kankanhalli *et al*, 2005; Ko *et al*, 2005; Wasko & Faraj, 2005) and intrinsic motivation in the form of enjoyment in helping others, enjoyment in learning, and sense of self-worth (Kankanhalli *et al*, 2005; Wasko & Faraj, 2005). A recent model of KM motivation focused on knowledge sharing (Gagne, 2009) includes several motivation types such as engaging in an activity voluntarily (autonomous) or due to external or internal pressures (controlled), and argues that including psychological factors that address individuals' needs for relatedness, competency and autonomy are also important. For example, based on Gagne's (2009) proposals, sharing knowledge may create a sense of self-worth and feelings of value and connections to others. Competency and autonomy feelings may result from work

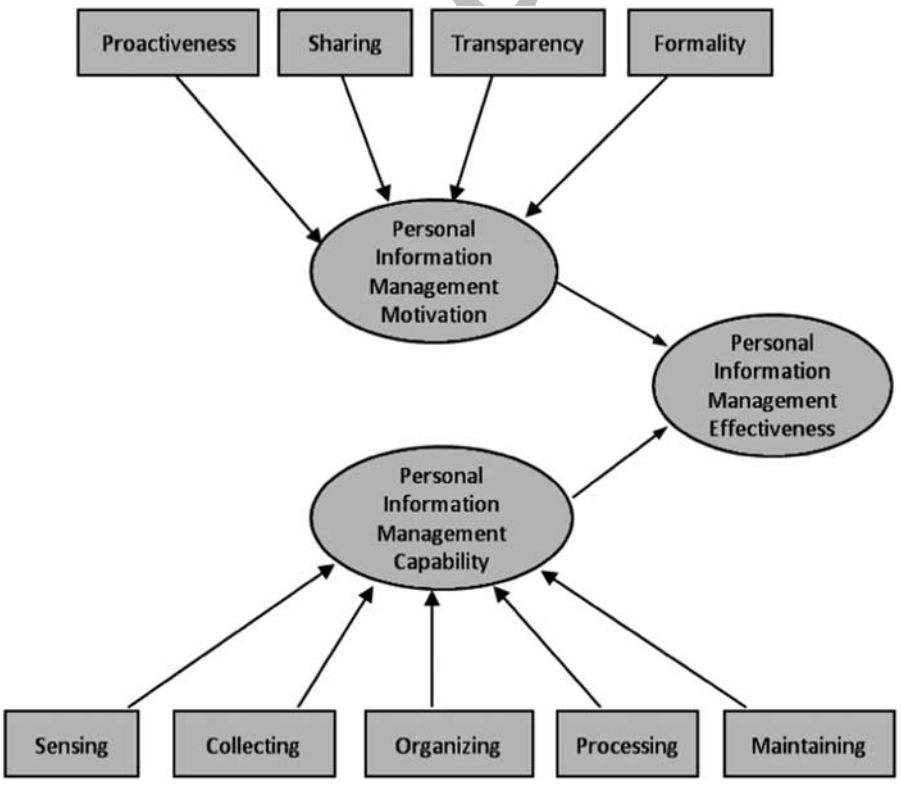

Figure 2 Sub-dimensions of PIME.

designs that promote autonomy and proactiveness, or climates that foster innovation/openness and sharing of mistakes as well as failures (transparency), and social norms/pressures to conform to expected practices (e.g. formality or the use of formal information sources *vs* informal).

In their work, Marchand *et al* (2000, 2001, 2002) define information management behaviors/values of a company as functioning 'to instill and promote behaviors and values in its people for effective use of information' (p. 72) and include proactiveness, sharing, transparency, formality, control, and integrity as its sub-dimensions. In adapting Marchand *et al*'s information behaviors/values to the individual level, we reconceptualize it as PIMM, a person's willingness to exert effort to make effective use of information, and measure an individual knowledge worker's PIMM by tapping into its sub-dimensions consisting of proactiveness, sharing, transparency, and formality. Marchand *et al*'s control sub-dimension focuses on the effectiveness of the organizational level control system and its organizational practice in the company, which in our initial field interviews proved problematic to adapt to the individual-level model. Further, the field interviews revealed that at the individual level the formality sub-dimension, which is included in this study, reflected some aspects of control in that the individual demonstrated a willingness to use the organizationally provided information over personal or informal channels. The integrity dimension, which is about one's willingness to falsely manipulate information for personal gains, was not included because of the sensitive and ethical nature of the questions required. Our study site did not allow these types of questions to be distributed. Thus, excluding formality and integrity, we have redefined the remaining sub-dimensions to be relevant to the individual-level information management practices.

Information proactiveness is defined as a person's willingness to *actively seek out information* for his or her job. Proactive information use involves exerting effort to learn ways to improve the use of information with respect to his or her job, actively seeking out information to enhance the tasks at hand, and collecting data to better respond to changes in the business environment (Marchand *et al*, 2000, 2001, 2002). Research evidence suggests that some people are more predisposed toward information scanning and learning new knowledge (Taylor, 1968; Ma & Agarwal, 2007), which would then motivate the effective information management practices.

Information sharing is defined as a person's willingness to *distribute information in a collaborative fashion*. There are many ways to share information effectively. Information may be shared formally through meetings, reports, emails, and memos, or informally through conversations. Information sharing is dependent on a person's perceived degree of dependence or interdependence among members of the organization or outsiders such as suppliers and customers and would be essential for the effective information management.

Information transparency is defined as a person's willingness to *disclose negative information* about his/her job experience to other people, so that they can learn. Transparent information use helps workers acquire appropriate skills and role behaviors, which will significantly help follow organizational procedures (Reichers, 1987; Morrison, 1993) and the overall information management effectiveness. It builds friendship networks and social support (Nelson & Quick, 1991; Sheng *et al*, 2008), effective relationship management, higher performance (Witt & Burke, 2002) and group decision task (Cooper & Haines, 2008).

Information formality is defined as a person's willingness to *use formal patterns of information communication*. Formal patterns of information communication exist as official and tangible resources within an organization in the forms of policies, manuals, company reports, company websites, and document archives. Formal patterns of information communication were generally considered more stable and predictable over time (Rogers & Agarwala-Rogers, 1976). People who are willing to use more formal patterns of information communication are likely to achieve better efficiency in operations and process management (Yigitbasioglu & Velcu, 2012), produce more consistent information flows, and deliver more predictable patterns of work (Rogers & Agarwala-Rogers, 1976). Also, formal patterns of information communication tend to provide more complete, high-quality information (Nonaka & Takeuchi, 1995; Keith *et al*, 2009), which would be beneficial to information management. Owing to continuous advancements in information and communication technologies, knowledge workers can use the formal patterns of information and communication technologies such as Enterprise Resource Planning (ERP), performance scorecards, and business intelligence software that would be helpful to uncover causes of poor performance (Yigitbasioglu & Velcu, 2012).

Personal information management capability

Substantial research has been devoted to identifying different types of abilities and their roles over the course of task performance and skill acquisition (e.g., Anderson, 1982; Kanfer & Ackerman, 1989; Kyllonen & Christal, 1990). Individuals' capability of information and IT use has been investigated with the concept of user competence (Munro *et al*, 1997; Marcolin *et al*, 2000; Neumann & Fink, 2007). User competence is defined as the user's potential to apply IT, and subsequently information, to its fullest possible extent so as to maximize performance of specific job tasks (Marcolin *et al*, 2000). Marcolin *et al* (2000) conclude that competence is a multidimensional construct that should be measured with the appropriate methodologies and understood as a determinant of performance.

Marchand *et al* (2000, 2001, 2002) define information management practice as an effort 'to manage information effectively over the life cycle of information use, including

sensing, collecting, organizing, processing, and maintaining information' (p. 72). Their conceptualization of information management practice is based on the traditional view of information life cycle (Ashby, 1956; Taylor, 1968; Kuhlthau, 1991). Given that individuals also go through the information life cycle for information management activities and that the underlying theoretical basis is applicable to the information management activities at the individual level, we adapt their view of information management practices and define PIMC as a person's ability to manage information effectively over the information life cycle, which consists of sensing, collecting, organizing, processing, and maintaining activities.

Sensing information is defined as a person's ability to *actively scan the environment* to detect and identify information for the job. Sensing means to become aware of, perceive, or detect events or conditions in a person's environment. A knowledge worker needs to continuously identify events, trends, and changes in business conditions, and make sense out of them. A person uses cognitive judgments about his or her external environment to make a valuation judgment whether potentially collectable information will satisfy a new or unanswered problem or decision.

C*ollecting information* is defined as a person's ability to *gather information relevant to* the job. A knowledge worker decides whether the decisional benefits received from collecting new information are worth the associated cost of its collection. Information overload is an important mechanism to understand this capability. Some people can collect information well to prevent information overload while others cannot. Collecting information includes filtering information to prevent information overload and identifying key knowledge sources (Davis & Yi, 2004).

Organizing information is defined as a person's ability to *arrange information* well for the job. As individual knowledge workers commonly deal with the problem of information overload, the organizing phase of the information management life cycle that focuses on indexing, classifying, and connecting information is a discerning factor for individual effectiveness (Marchand *et al*, 2001). Individual knowledge workers need to know what categories to use in organizing information, often using technical means to organize information. Organizing information requires appropriate skills, expertise, and work habits that a knowledge worker must possess.

Processing information is defined as a person's ability to *translate information into specific knowledge* for the job. Analysis is a critical part of information processing. The purpose of analysis is to translate information into specific knowledge required for the operation of the business. Individual knowledge workers must be able to access appropriate information sources before making a decision. Then, they must actively engage in analyzing information sources to derive useful knowledge as inputs to decisions.

Maintaining information is defined as a person's ability to *accurately discern the future value* of processed information. Maintaining information involves reusing existing information, updating existing information so that it can remain current, and refreshing data to ensure the best information (Marchand *et al*, 2001). A knowledge worker needs to decide whether information should continue to be stored and updated in anticipation of future use.

Research hypotheses

Figure 3 presents each element of the proposed model examined in this study as well as hypotheses relating them. To reduce word length we did not label every dimension in our research model and all subsequent discussion with the prefix 'Perceived'; however, all measures in our study are based on survey and are thus perceived measures. Consistent with the conceptualization of PIME as a higher order aggregate construct consisting of two distinct underlying factors (PIMM, PIMC), and PIMM and PIMC as second-order constructs consisting of multiple first-order factors, the model links the first-order factors of PIMM (proactiveness, sharing, transparency, formality) and the first-order factors of PIMC (sensing, collecting, organizing, processing, maintaining) to PIME via their aggregate effects on PIMM and PIMC, respectively. Age, job experience, and gender are added to the model as control variables for the dependent variable, job performance, so that the effect of PIME on job performance can be more clearly assessed.

Knowledge workers use information as the main input in their job, and their major products are distillations of that information (Kelloway & Barling, 2000). A knowledge worker's job largely relies on effectively managing information. Considering the central role of information in their jobs, knowledge workers who are motivated to use information effectively for proactiveness, transparency, formality, and sharing of information, and who are competent in managing information effectively over its life cycle consisting of information sensing, collecting, organizing, processing, and maintaining activities should be able to perform well in their job functions. Based on the effects of PIMM and PIMC on performance, and the conceptualization of PIME as a higher order construct consisting of PIMM and PIMC, we hypothesize that:

H1: *PIME, consisting of PIMM and PIMC, will have a positive effect on job performance.*

Although the concept of computer self-efficacy has been widely studied as a component of the acceptance of technology, its effect on knowledge workers' information motivation or information capability has not been investigated by prior research. Several other studies also have suggested that efficacy beliefs facilitate an individual's motivation to integrate and use complex information effectively. Bandura & Jourdan (1991) and Wood & Bandura (1989) found that individuals with high self-efficacy performed significantly better in management simulations requiring complex information integration and learning of nonlinear probabilities and contingencies. Cervone *et al* (1991) noted that individuals with high

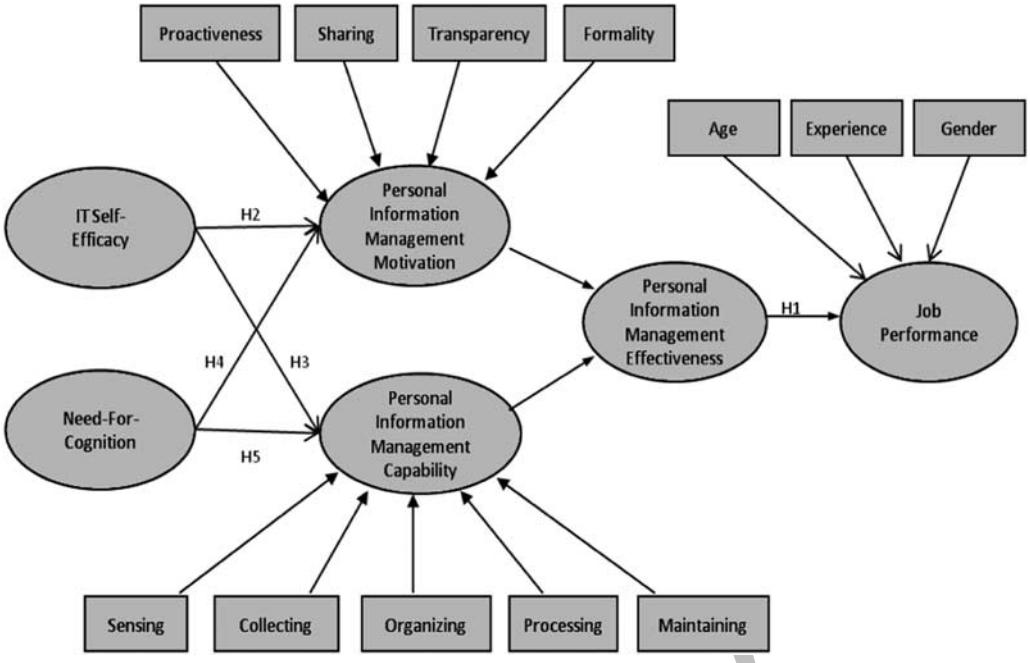

Figure 3 Proposed research model of PIME.

self-efficacy were motivated to learn more from feedback, responded more adaptively to the decision environment, and more successfully translated their learning into improved performance. This study relates IT self-efficacy, an individual judgment of one's capability to use IT, to PIMM because a knowledge worker who is confident in using IT is likely to be more motivated to use and manage information effectively given the automated support readily available for various information management activities and his or her confidence in utilizing the support. Thus, we hypothesize that:

H2: *IT self-efficacy will have a positive effect on PIMM.*

Bandura & Schunk (1981) explain how self-efficacy influences an individual's capability. Capability in dealing with one's environment is not a fixed act or simply knowing what to do. Rather, it involves a generative ability in which component skills must be selected and organized into integrated courses of action to manage changing task demands. This generative ability, such as PIMC, thus requires flexible orchestration of multiple sub-skills, which are thought to be heavily influenced by the belief about one's IT ability as IT skills are commonly supportive of these sub-skills of information management. IT self-efficacy is concerned with judgments about how well one can use the IT required to deal with prospective situations containing many ambiguous, unpredictable, and often stressful dimensions of the information management lifecycle (Schunk, 1981; Bandura, 1986; Brown & Ganesan, 2001; Yi & Hwang, 2003). Thus, we hypothesize that:

H3: *IT self-efficacy will have a positive effect on PIMC.*

Petty & Cacioppo's (1986) need-for-cognition, a cognitive style that focuses on an individual's tendency to engage in and enjoy effortful cognitive endeavors, suggests that individuals vary in regard to the predisposition to exercise cognitive effort. Need-for-cognition is one of the cognitive styles focusing on the perceived needs of cognitive processes by individuals. A meta-analysis conducted by Cacioppo *et al* (1996) shows that need-for-cognition is negatively correlated with communication apprehension and positively with cognitive innovativeness (a desire for new experiences that stimulate thinking), each of which can contribute to PIMM. Cohen *et al* (1956) describe need-for-cognition as a need to structure relevant situations in meaningful, integrated ways, and as a need to understand and make reasonable the experiential world. They showed that if a subject is more engaged with high need-for-cognition, this should generate higher motivation for the task, which then should lead to greater effort and high performance (Cohen *et al*, 1956). Thus, we hypothesize that:

H4: *Need-for-cognition will have a positive effect on PIMM.*

Cohen (1957) posits that individuals with high need-for-cognition can effectively organize, elaborate upon, and evaluate information. A person's preferred mode of processing information (need-for-cognition) can influence the development of his or her cognitive abilities in a number of ways. For example, a person with high need-for-cognition pays attention to detail, focuses on hard data, and adopts a step-by-step approach to processing information (Allinson & Hayes, 1996). A person with low need-for-cognition, on the other hand, is less concerned with detail,

more receptive to soft data, more likely to emphasize synthesis and simultaneous integration of many inputs at the same time, and more inclined to arrive at immediate judgments based on feelings. Mennecke *et al* (2000) found that need-for-cognition was related to accuracy of information-intensive and problem-solving capabilities and task performance. Differences in need-for-cognition affect what individuals attend to, how they interpret data, and how these interpretations influence and modify their cognitive abilities. Thus, we hypothesize that:

H5: *Need-for-cognition will have a positive effect on PIMC.*

The collective testing of the above hypotheses (H1–H5) cannot answer whether the direct effects of IT self-efficacy and need-for-cognition on job performance will be fully mediated by PIMM and PIMC. Although there have been many studies regarding the direct relationship between self-efficacy and performance (e.g., Wood & Bandura, 1989) or between need-for-cognition and performance (Woltz, 1988; Haynes & Allinson, 1998), the extent of the mediating effects of PIME between these constructs and performance is unknown.

Our model's conceptualization is consistent with studies on individual differences, which were found to influence information management activities (Brown & Inouye, 1978; Salomon, 1984; Petty & Cacioppo, 1986; Wood & Bandura, 1989; Taylor, 2004; Junglas *et al*, 2008; Foss *et al*, 2010). In addition, including IT self-efficacy and cognitive style in the model allows us to understand how much the underlying dimensions of PIME can be influenced through these two widely studied individual characteristic variables, linking prior research on self-efficacy and cognitive style to PIME. IT self-efficacy is one of the key aspects of user competence related to managerial actions (Marcolin *et al*, 2000). IT self-efficacy is closely related to the level of persistence, amount of effort, level of goal commitment, and self-set goal levels within the context of performing tasks using a computer (Marakas *et al*, 1998), which is commonly utilized to manage information. Need-for-cognition has been theorized as a central underlying mechanism responsible for effective information processing (Salomon, 1984; Petty & Cacioppo, 1986). Although there are alternative operationalizations of cognitive style, in this study we focus on need-for-cognition, an individual's dispositional characteristic in exerting cognitive effort in processing information, which is directly rooted in ELM with reliable measurement properties (Petty & Cacioppo, 1986). Thus, the theory serves as an important foundation for the proposed model.

The integration theory perspective postulates that motivation and ability are major determinants of human performance (Heider, 1958; Vroom, 1964; Anderson & Butzin, 1974; Locke *et al*, 1978; Kanfer & Ackerman, 1989; Locke & Latham, 1990). Given the essential role of information management activities in knowledge workers' job functions, we theorize that one's confidence in using IT or strong need-for-cognition will not influence a knowledge worker's job performance without altering PIMM and PIMC. Rather, we theorize IT self-efficacy and need-for-cognition to serve as distal determinants of information-intensive job performance by exerting their effects indirectly via PIMM and PIMC, the two underlying components of PIME. While some part of this idea has been proposed by ELM (Petty & Cacioppo, 1986), which theorized need-for-cognition as an antecedent of motivation to process information, we go beyond the original conceptualization of ELM by developing a nomological network involving IT self-efficacy, PIMM, PIMC, and job performance.

Further, this information-driven perspective essentially challenges both the technology-driven perspective of the direct link between IT self-efficacy and performance and the cognition-driven perspective of the direct link between need-for-cognition and performance in that the effects of technology or cognition are posited to have no direct effects on job performance in the presence of PIMM and PIMC. To test these alternative perspectives, we hypothesize that:

H6: *PIMM and PIMC will fully mediate the effect of IT self-efficacy on performance.*

H7: *PIMM and PIMC will fully mediate the effect of need-for-cognition on performance.*

Research method

Measure development

Following standard measure development procedures (e.g., Churchill, 1979; Davis, 1989; Straub, 1989; Yi & Davis, 2003), the PIMM and PIMC scales were developed through iterative steps including specifying the domain of the constructs, generating a sample of items, pilot-testing and purifying the items, collecting additional data, and assessing the reliability and validity of the measure. Based on our conceptual definitions and prior study findings related to the PIMM and PIMC sub-dimensions, we generated six items for each dimension of PIMM (proactiveness, sharing, transparency, and formality) and PIMC (sensing, collecting, organizing, processing, and maintaining), resulting in 24 items for PIMM and 30 items for PIMC. The initial set of items was purified and refined through two pilot tests using 120 (50 for the first pilot test and 70 for the second pilot test) MBA students as participants (see Appendix A for the detailed descriptions of pretest and pilot testing procedures).

Throughout the scale development processes, considerable efforts were made to ensure the content validity of the study variables and to make distinctions among the four dimensions of PIMM and five dimensions of PIMC. Using the final set of items (see Appendix B) determined from the pilot tests, the main study was conducted in a field setting. A six-item scale adapted from prior research (Witt, 1998; Robertson *et al*, 2000) was used to measure self-perceived job performance, which were found to have significant correlations with supervisory-rated job performance in a

meta-analysis of 102 research articles that were published between 1955 and 2007 (Heidemeier & Moser, 2009). Also, Robertson *et al*'s (2000) measure was found to have high reliability (0.86) with focus on current job performance in general tasks and proved reliable in the various organizational settings (Khan *et al*, 2010). Three items adapted from Compeau & Higgins' (1995) computer self-efficacy scale were used to measure IT self-efficacy and three items adapted from Petty & Cacioppo's (1986) need-for-cognition scale were used to measure need-for-cognition. An 11-point Likert-type scale (0 = 'completely disagree'; 10 = 'completely agree') was used for all items.

Main study

To test the proposed model and research hypotheses in a field study setting, we surveyed 352 knowledge workers in one of the largest healthcare insurance companies located in the eastern United States. Before the main study data collection, an online survey website was developed by the authors, and the survey format and website features were revised based on the feedback from four managers working in the same company where the main study was conducted. In particular, managers wanted to confirm the anonymous nature of the survey, and the survey website was tested and revised to ensure this feature. Employees voluntarily participated in the online survey, which took about 20–25 min of their free time at the office. An email was sent to 910 employees in 11 divisions by the division managers with a description of the survey and survey website address. Within three weeks, 352 employees completed the survey, resulting in a relatively high response rate of 39%. No differences of the study variables were found between the first-week participants (10%) and the third-week participants (10%), indicating that non-response bias was unlikely an issue.

To assess the common method bias problems in the survey design, following Podsakoff *et al* (2003), we first ran Harman's one-factor test. In this test, all the principal constructs are entered into a principal components factor analysis. Evidence for common method bias exists when a single factor emerges from the analysis, or one general factor accounts for the majority of the covariance in the variables. Since each of the principal constructs explained roughly equal variance (all constructs in the model from 5.3 to 11.1%), the test results did not indicate common method bias as an issue. Second, a partial correlation method (Podsakoff *et al*, 2003) was employed in which the first factor from the principal components factor analysis was entered into the Partial Least Square (PLS) model as a control variable on the dependent variable (job performance). This control factor did not produce a significant change in variance explained in the dependent variable, further indicating the lack of common method bias (Podsakoff & Organ, 1986; Lindell & Whitney, 2001).

As shown in Table 1, the average age of survey participants was 38 years old, and more female employees (83%) participated in the study because the company had a dominant number of female workers (i.e., more than 80%). Most of the participants had less than 10 years of job experience. Survey participants had various knowledge-based job positions including senior manager, financial analyst, IT manager, credit reviewer, and marketing researcher, and the job positions were scattered in 11 divisions. The survey participants were selected based on several methodological considerations. First, they are in the various job titles, roles, and positions that mostly require intensive knowledge work. Second, the target company is one of the biggest insurance companies in the U.S. – cultural and industry differences of the samples are controlled. Third, the samples are employees in the IT headquarters of the insurance company, which daily requires a large number of unstructured information-related decisions for customers as well as colleagues. To increase generalizability of the study, we surveyed employees in multiple divisions of varied tasks, sizes, and histories. The statistical comparisons using *post-hoc* tests with ANOVA found no significant differences in the study variables across ages, experiences, genders, and divisions.

Table 1 Sample demographics ($n = 352$)

Age	AVG: 37.54 years	(SD) 11.19 years
Current Job Experience	AVG: 3.38 years	(SD) 2.52 years
Gender	Male	17%
	Female	83%

Note: AVG, average; SD, standard deviation

Results

Measure validation and model testing were conducted using PLS-Graph (Chin, 1998), a structural equation modeling tool that utilizes a component-based approach to estimation. PLS was preferred to covariance-based modeling tools such as LISREL and EQS because the primary interest of the current study was to assess the predictive validity of PIME, and its antecedents, with a focus on individual paths rather than the model fit (Falk & Miller, 1992; Chin, 1998; Compeau *et al*, 1999; Gefen *et al*, 2000). Furthermore, PLS allows the flexibility of representing both formative and reflective latent constructs, which was preferred for the proposed model testing in this study. It has been known that the endogenous nature of the formatively measured constructs in our model would result in significantly more problems with covariance-based modeling tools.

Psychometric properties of measures

Before testing the hypothesized structure model, we first evaluated the psychometric properties of the study variables through confirmatory factor analysis using a measurement model in which the first-order latent variables were specified as correlated variables with no causal paths. The measurement model was assessed by using PLS to examine internal consistency reliability and convergent

and discriminant validity (Barclay *et al*, 1995; Chin *et al*, 2003; Yi & Davis, 2003; Lee & Larsen, 2009; Lee *et al*, 2009). Internal consistencies of 0.7 or higher are considered adequate. Two criteria are generally applied to assess convergent and discriminant validity: (1) the square root of the average variance extracted (AVE) by a construct should be at least 0.707 and should exceed that construct's correlation with other constructs and (2) item loadings should be at least 0.707 and an item should load more highly on the one it is intended to measure than on any other construct.

Table 2 shows internal consistency reliabilities, convergent and discriminant validities, and correlations among latent constructs. The internal consistency reliabilities were at least 0.82, exceeding the minimal reliability criteria. Also, satisfying convergent and discriminant validity criteria, (1) the square root of the AVE was greater than 0.707 (at least 0.78) and greater than the correlation between that construct and other constructs without exception, and (2) the factor structure matrix (Table 3) shows that all items exhibited high loadings (at least 0.75) on their respective constructs without exceptions and no items loaded higher on constructs that they were not intended to measure. Collectively, the psychometric properties of the study variables were considered excellent and sufficiently strong to support valid testing of the proposed structural model.

Test of model and hypotheses

The PLS structural model and hypotheses were assessed by examining path coefficients and their significance levels. Following Chin (1998), bootstrapping (with 500 resamples) was performed on the model to obtain estimates of standard errors for testing the statistical significance of path coefficients using a *t*-test. The PIMM and PIMC constructs conceptualized as second-order constructs in the proposed model were represented by the factor scores derived from the confirmatory factor analysis (Agarwal & Karahanna, 2000; Yi & Davis, 2003). Similarly, the PIME construct, conceptualized as a higher order construct of PIMM and PIMC, was represented by the factor scores derived from the run of the submodel consisting of IT self-efficacy, need-for-cognition, PIMM, and PIMC. Consistent with our theorization of the model, the first-order dimensions of PIMM and PIMC were modeled as formative indicators of their second-order construct.

As shown in Figure 4, all of the first five hypotheses (Hypothesis 1–Hypothesis 5), each of which corresponds to a path in the model, were supported within the 0.001 significance level, supporting the model with high confidence. The model explained substantial variance in job performance ($R^2 = 0.41$) and modest variances in PIMM ($R^2 = 0.24$) and PIMC ($R^2 = 0.11$). The first-order dimensions of PIMM and PIMC were all well related to their second-order construct as indicated by the significant weights in the model. PIMM and PIMC were both significantly and equally well related to their higher order PIME construct. In a *post-hoc* analysis, we have found that the interaction term, PIMM×PIMC, had no significant effect on job performance ($\beta = -0.07$, ns), confirming that motivation and capability are two separate antecedents of performance without interaction and that the original model without the interaction term is a better representation of the phenomenon under study.

To assess whether PIMM and PIMC fully mediated the effects of IT self-efficacy and need-for-cognition on performance, as hypothesized by Hypotheses 6 and 7, we followed the three-step testing procedures specified by Baron & Kenny (1986): (1) significant relationships exist between the independent variables and the dependent variable, (2) significant relationships exist between the independent variables and the hypothesized mediators, and (3) in the presence of the significant relationships between the mediators and the dependent variable, the previously significant relationships between the independent variables and the dependent variable are no longer significant or the strength of the relationships decrease significantly. PLS analysis results supported all three of Baron & Kenny's (1986) criteria for mediational effects. First, IT self-efficacy and need-for-cognition had a

Table 2 Reliabilities, convergent and discriminant validities, and correlations table

	Mean	*SD*	*ICR*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*
(1) Proactiveness	**7.23**	**2.41**	**0.82**	**0.78**											
(2) Sharing	**8.32**	**2.24**	**0.93**	0.61*	**0.90**										
(3) Transparency	**7.24**	**3.04**	**0.93**	0.54*	0.65*	**0.85**									
(4) Formality	**6.39**	**2.11**	**0.93**	0.47*	0.40	0.35	**0.85**								
(5) Sensing	**7.58**	**1.95**	**0.92**	0.42*	0.40	0.43*	0.34	**0.83**							
(6) Collecting	**7.65**	**2.04**	**0.92**	0.46*	0.48*	0.44*	0.39	0.68*	**0.89**						
(7) Organizing	**6.88**	**2.06**	**0.91**	0.42*	0.42*	0.35	0.26	0.46*	0.50*	**0.87**					
(8) Processing	**7.25**	**1.99**	**0.87**	0.48*	0.40	0.36	0.41*	0.63*	0.74*	0.55*	**0.83**				
(9) Maintaining	**6.78**	**2.05**	**0.85**	0.46*	0.40	0.44*	0.34	0.60*	0.68*	0.61*	0.75*	**0.86**			
(10) Performance	**8.21**	**1.98**	**0.95**	0.51*	0.53*	0.45*	0.31	0.50*	0.49*	0.40	0.52*	0.49*	**0.87**		
(11) IT self-efficacy	**7.25**	**1.88**	**0.88**	0.36	0.28	0.34	0.39	0.22	0.25	0.18	0.21	0.29	0.22	**0.85**	
(12) Need-cognition	**7.46**	**2.05**	**0.90**	0.16	0.13	0.17	0.17	0.19	0.15	0.12	0.19	0.11	0.19	0.01	**0.86**

Note: Diagonal element is the square roots of AVE and should be larger than the off-diagonal and > 0.707 for the convergent and discriminant validities. Internal Consistency Reliability (ICR) should be larger than 0.70. *$P < 0.05$.

Table 3 Factor structure matrix of loadings and cross-loadings

	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*
Proactiveness 1	**0.80**	0.47	0.38	0.38	0.40	0.39	0.37	0.48	0.41	0.45	0.25	0.15
Proactiveness 2	**0.79**	0.54	0.49	0.38	0.28	0.40	0.27	0.34	0.30	0.38	0.27	0.16
Proactiveness 3	**0.75**	0.42	0.38	0.34	0.31	0.28	0.35	0.30	0.35	0.36	0.32	0.05
Sharing 1	0.54	**0.89**	0.58	0.42	0.36	0.45	0.34	0.38	0.39	0.45	0.27	0.13
Sharing 2	0.59	**0.93**	0.61	0.36	0.38	0.44	0.42	0.40	0.38	0.54	0.26	0.11
Sharing 3	0.52	**0.88**	0.55	0.31	0.34	0.39	0.36	0.28	0.29	0.43	0.21	0.12
Transparency 1	0.43	0.53	**0.85**	0.32	0.39	0.46	0.32	0.34	0.38	0.40	0.27	0.13
Transparency 2	0.44	0.55	**0.85**	0.26	0.39	0.40	0.24	0.31	0.35	0.42	0.26	0.11
Transparency 3	0.43	0.47	**0.81**	0.32	0.35	0.32	0.23	0.30	0.34	0.36	0.33	0.17
Transparency 4	0.48	0.59	**0.89**	0.30	0.39	0.37	0.37	0.31	0.43	0.41	0.30	0.20
Transparency 5	0.48	0.63	**0.83**	0.29	0.29	0.34	0.32	0.25	0.35	0.30	0.25	0.12
Formality 1	0.38	0.35	0.28	**0.86**	0.25	0.29	0.20	0.34	0.27	0.23	0.28	0.19
Formality 2	0.40	0.34	0.28	**0.88**	0.32	0.33	0.25	0.39	0.32	0.23	0.32	0.16
Formality 3	0.39	0.31	0.32	**0.87**	0.27	0.29	0.23	0.31	0.26	0.24	0.37	0.15
Formality 4	0.39	0.30	0.28	**0.81**	0.25	0.32	0.24	0.31	0.27	0.26	0.31	0.11
Formality 5	0.43	0.39	0.31	**0.81**	0.32	0.40	0.19	0.38	0.31	0.32	0.35	0.11
Sensing 1	0.36	0.32	0.35	0.32	**0.85**	0.54	0.36	0.52	0.43	0.42	0.19	0.21
Sensing 2	0.37	0.34	0.37	0.28	**0.90**	0.57	0.37	0.53	0.49	0.46	0.18	0.21
Sensing 3	0.41	0.35	0.38	0.33	**0.86**	0.59	0.43	0.53	0.53	0.36	0.21	0.17
Sensing 4	0.28	0.36	0.36	0.22	**0.76**	0.55	0.35	0.50	0.48	0.46	0.15	0.11
Sensing 5	0.34	0.30	0.33	0.27	**0.78**	0.58	0.44	0.56	0.58	0.33	0.17	0.08
Collecting 1	0.42	0.42	0.40	0.40	0.62	**0.91**	0.43	0.67	0.65	0.44	0.23	0.11
Collecting 2	0.42	0.44	0.40	0.40	0.64	**0.93**	0.48	0.68	0.62	0.43	0.24	0.17
Collecting 3	0.39	0.42	0.38	0.23	0.55	**0.83**	0.42	0.61	0.54	0.45	0.20	0.12
Organizing 1	0.34	0.40	0.33	0.16	0.44	0.44	**0.86**	0.47	0.48	0.38	0.06	0.11
Organizing 2	0.39	0.35	0.32	0.25	0.39	0.44	**0.86**	0.48	0.58	0.28	0.20	0.12
Organizing 3	0.38	0.35	0.28	0.28	0.39	0.43	**0.90**	0.50	0.55	0.39	0.22	0.08
Processing 1	0.27	0.29	0.27	0.26	0.45	0.57	0.37	**0.78**	0.61	0.45	0.10	0.09
Processing 2	0.45	0.38	0.33	0.39	0.58	0.67	0.53	**0.89**	0.66	0.45	0.23	0.18
Processing 3	0.47	0.31	0.29	0.36	0.53	0.58	0.47	**0.80**	0.58	0.41	0.19	0.20
Maintaining 1	0.48	0.39	0.44	0.37	0.59	0.60	0.53	0.64	**0.89**	0.41	0.32	0.19
Maintaining 2	0.30	0.29	0.30	0.20	0.42	0.57	0.52	0.65	**0.83**	0.43	0.16	0.02
Performance 1	0.45	0.49	0.38	0.29	0.44	0.46	0.36	0.49	0.45	**0.86**	0.28	0.16
Performance 2	0.52	0.52	0.42	0.29	0.46	0.42	0.36	0.46	0.44	**0.91**	0.22	0.19
Performance 3	0.45	0.47	0.39	0.24	0.48	0.45	0.37	0.49	0.42	**0.89**	0.19	0.16
Performance 4	0.47	0.44	0.38	0.28	0.40	0.42	0.34	0.42	0.42	**0.89**	0.20	0.19
Performance 5	0.38	0.40	0.38	0.23	0.36	0.40	0.32	0.41	0.40	**0.84**	0.15	0.14
Performance 6	0.39	0.44	0.42	0.25	0.44	0.42	0.35	0.45	0.42	**0.84**	0.12	0.17
IT Self-Efficacy 1	0.23	0.22	0.29	0.25	0.07	0.15	0.12	0.10	0.19	0.12	**0.77**	0.03
IT Self-Efficacy 2	0.35	0.25	0.28	0.38	0.22	0.21	0.17	0.19	0.26	0.23	**0.88**	0.02
IT Self-Efficacy 3	0.31	0.23	0.29	0.34	0.24	0.27	0.16	0.22	0.27	0.21	**0.89**	0.02
Need-Cognition 1	0.13	0.11	0.09	0.13	0.13	0.09	0.12	0.15	0.06	0.14	0.01	**0.82**
Need-Cognition 1	0.17	0.13	0.16	0.19	0.19	0.15	0.12	0.19	0.13	0.18	0.02	**0.92**
Need-Cognition 1	0.10	0.10	0.19	0.12	0.17	0.15	0.06	0.15	0.09	0.18	0.01	**0.85**

Note: Loadings on their respective constructs are highlighted (all greater than 0.707).

significant effect on job performance ($\beta = 0.23$, $P<0.001$ for IT self-efficacy; $\beta = 0.19$, $P<0.001$ for need-for-cognition). Second, as shown in Figure 3, IT self-efficacy and need-for-cognition had significant effects on PIMM ($\beta = 0.44$, $P<0.001$ for IT self-efficacy; $\beta = 0.20$, $P<0.001$ for need-for-cognition) and on PIMC ($\beta = 0.28$, $P<0.001$ for IT self-efficacy; $\beta = 0.18$, $P<0.001$ for need-for-cognition). Third, when IT self-efficacy, need-for-cognition, PIMM, and PIMC were all entered as independent variables, the previous significant effects of IT self-efficacy and need-for-cognition dropped to non-significance ($\beta = -0.02$, $t = -0.5$, ns for IT self-efficacy; $\beta = 0.06$, $t = 1.63$, ns for need-for-cognition), indicating full mediation.

We also tested the impacts of the demographic control variables of age, gender, and job experience, on the dependent variable, job performance, and found that each of these variables had a non-significant effect ($\beta = 0.04$ for age; $\beta = 0.03$ for job experience; $\beta = -0.06$ for gender), showing that any systematic variation of job performance is not a function of demographic characteristics.

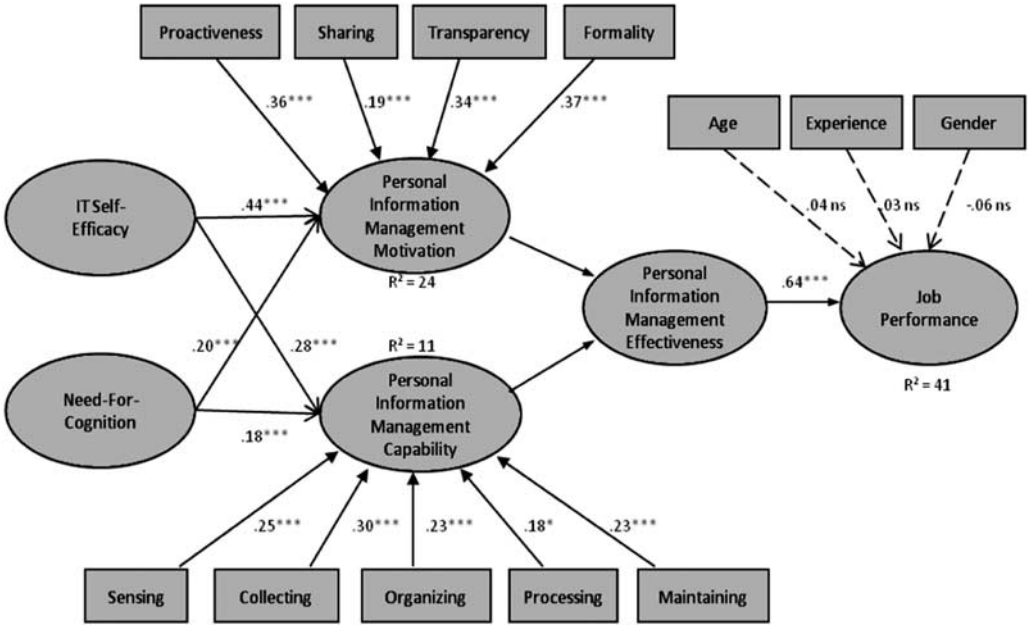

Figure 4 PLS test results of the PIME.
Note: *P<0.01; ***P<0.001.

Discussion

This study is the first to examine the effect of an individual's PIME on their job performance. In this study, we developed and tested a model that theorized PIME as a determinant of a knowledge worker's job performance. Our findings suggest that PIME has a significant positive effect on self-perceived job performance, and PIMM and PIMC fully mediate the effects of IT self-efficacy and need-for-cognition on job performance. PIME explains 41% of job performance related to knowledge work. All five path-related hypotheses (H1–H5) were supported, as well as H6 and H7, indicating full mediation. PIMM and PIMC were equally well related to the higher construct, PIME, demonstrating the contribution of motivation and capability to an individual's information management effectiveness.

The study results suggest that knowledge workers' job performance is a function of higher construct of PIME formed by both their information management motivation and capability. The findings that PIME (formed by PIMM and PIMC) directly influences performance are consistent with the basic premise of the integration theory of human performance (Heider, 1958; Anderson & Butzin, 1974; Locke *et al*, 1978; Kanfer & Ackerman, 1989), which views motivation and capability as two distinct and concurrent determinants of human performance. Rather than assessing motivation and ability as general constructs, we define and measure them as a set of specific constructs with regard to information management. We explicitly measure and model the way PIMM and PIMC (together as PIME) affect job performance, which allows for measuring mediating effects. Our study contributes to general notions of KM and performance from an information management perspective by exploring how employees' information management motivation and capability leads to them doing their job well. Future research could tease out if the motivational acts, or dimensions, reflect autonomous or controlled types of motivation. Moreover, adapting the work by Marchand *et al* (2000, 2001, 2002) to the individual level, this study articulates the sub-dimensions of PIMM and PIMC. Although much prior IS research focused on information sharing (e.g., Bock *et al*, 2005; Ko *et al*, 2005; Wasko & Faraj, 2005), the present study shows that other aspects of information management are also important in determining a knowledge worker's job performance.

This study makes several noteworthy contributions. First, as knowledge originates within individuals (Grant, 1996a), the extent to which a person is motivated and able to use information effectively has been considered crucial to the success of a firm (Kogut & Zander, 1992; Nonaka, 1994; Von Krogh *et al*, 1994; Spender, 1996). However, past literature has not empirically validated a measure of PIME. Our study develops such a measure and empirically validates the measure. Further, given that individual performance is an essential building block of organizational effectiveness, the positive effect of PIME on individual job performance provides initial empirical evidence toward establishing the linkage between individual workers' information management effectiveness and organizational effectiveness. The framework and the model provided by the present research help reduce the gap between individuals' information management activities and organizational KM processes.

Second, to better understand the effect of PIME on job performance, we explored its influence as a direct as well as a mediating construct. Therefore, we selected two well-established individual characteristics known to be cognitive-motivational factors. These factors, need-for-cognition and IT efficacy, did not show direct effects on job performance over and above the effects mediated by PIMM and PIMC. These findings suggest that boosting IT efficacy will have a positive impact on job performance as it changes an individual's willingness and ability to effectively manage and use information. Thus, the positive results associated with computer self-efficacy observed in a short-term training setting (Yi & Davis, 2003) seem transferable to an actual job setting, with PIMM and PIMC playing an important mediating role. Further, long-term training interventions directed toward enhancing need-for-cognition should help improve individuals' job performance as it is directed through PIMM and PIMC. As was found in previous research, such interventions can result in improved information accuracy and use (Mennecke *et al*, 2000). Our study findings highlight the need to broaden the horizon and more actively examine the role of other individual characteristics in the KM processes.

Third, PIME can be extended for a more comprehensive understanding of 'individual IS' (Baskerville, 2011). Baskerville (2011) argues that the individuation of IS may go unnoticed in the IS research discipline, simply because we have traditionally defined the field in terms of social, organizational, and managerial relations. He further contends that it is important to recognize that IS are more than just social, organizational, and managerial technologies but include individual IS and associated personal information within them. We agree with him in that ignoring individual IS within our discipline is a significant oversight that may simply reflect our own assumptions that personal, individual IS are uninteresting or our inadequate attention on developing theories or measurement tools to delve deeply into this area of research. Although our model was validated in a workplace setting, the work on PIME can be a useful and important stepping stone for the individual IS research. People who are 'actively collecting data and processing it into information for their various purposes, and feeding it outward' (Baskerville, 2011, p. 253) can be identified via PIMM and PIMC. Future research should be further extended to link the Individual-level IS research with the information management perspective of PIME and to start a broader understanding of individual IS in our field.

Limitations and implications for future research

We note some limitations to generalization of this study. It is unknown how well the model and its findings will generalize beyond the specific conditions of this study. Although the final field survey used employees in multiple divisions that are substantially different in structure, role, and history, which might be conducive to the generalizability of the findings, future work is needed to understand how well the new model generalizes to knowledge workers with different cultural or industrial backgrounds. To help ensure study participation and maintain the anonymity of responses, this survey used a perceptual self-report measure of performance. From a methodological point of view, additional sources of performance data (such as actual measures of job output or supervisor ratings that are not job specific) could provide further evidence of the relationship between PIME and job performance. However, it should also be noted that self-ratings of job performance done in the context of research, such as this study, tend to have lower differences between self- and supervisory ratings than when ratings are performed for administrative or developmental purposes (Heidemeier & Moser, 2009). Given that the target sample in this study includes knowledge workers across multiple business units and divisions working with different product types and at different job levels, such quantitative measures of performance were not employed in this study. We also found that common method variance bias was not a problem in this study.

Future research on information management by knowledge workers will need to carefully consider potential effects of all the sub-dimensional constructs of PIMM and PIMC, as well as their relationships among the PIME constructs themselves. However, the theoretically derived and empirically validated measures of PIME developed in this study should help provide the basic building blocks for these future research efforts.

Future research should extend the model tested in this study to include additional measures of performance (e.g., Li *et al*, 2009). Model variables could be linked to sources of data not reliant on self-reporting methods. The application of other alternative methodologies, such as the within- and between-subjects and multilevel techniques that allow the level agreement of participants about how the PIME of individual knowledge workers directly affects group, divisional and organizational performance, also needs to be examined.

The current research did not include the complete nomological net of information management but focused on the important individual characteristics for information management and the relationships to job performance. Future research could assess the complete nomological net among the current model and other organizational interventions affecting incentive systems, decision rights, values, norms and cultural changes, as well as the role of KM systems for organizational learning based on these relationships (e.g., Teo & Men, 2008; Khan *et al*, 2010). Also, the relationships among other individual characteristic constructs (e.g., cognitive style other than need-for-cognition, such as analytic or intuitive style) and PIMM and PIMC constructs deserve further exploring. We also tested the influence of information-intensive individual characteristics, such as IT self-efficacy and need-for-cognition, on knowledge workers' job performance. Future studies may explore the extent to which other motivational factors recognized to influence KM behaviors

(e.g. management support, network ties, job design, autonomy) influence an individual's motivation to manage information well.

Furthermore, the model in this study does not test the causality; future research should test it in a longitudinal study setting (Mithas & Krishnan, 2009). Also future research can include PIME as a mediating or moderating factor in the model. For example, cognitive absorption (Agarwal & Karahanna, 2000) and cultural values (Srite & Karahanna, 2006) can be tested with PIME to achieve a more complete understanding of the nomological net for IT adoption and information management.

Implications for practice

This research identifies important aspects of effective personal information management and provides validated measures of those aspects. Davenport (1998, 2010) argues that personal information effectiveness is the most crucial factor in business information management because personal manipulation of information is the main input of products in knowledge-based companies. Although a traditional KM strategy has been implemented as a top-down, enterprise-wide solution that requires high levels of consensus and full adoption across all knowledge workers of various units, a strategy focusing on PIME offers the potential of a more flexible, bottom-up approach that could respond much more quickly to change, and accommodate a spectrum of technology preferences, organization schemes, and personal habits. A KBV inspired bottom-up KM strategy that encourages PIME should reap more immediate rewards if the personal success of its individual workers is prioritized.

The scales of PIMM and PIMC developed by this study can be used to directly assess how well a knowledge worker contributes to a company's KM processes and which information management activities need further improvement through training. The scales can also be used to compare the collective effectiveness of information management between organizational units, or to monitor the effectiveness of information flows across the organization. Further, practitioners may utilize our measurement approach in conjunction with the implementation of KM systems or knowledge worker recruiting process. While we did not apply PIMM and PIMC measures to the recruiting process, several participants of the survey wrote that this measurement would be a useful tool for that purpose. The scales of PIMM and PIMC may be used to understand which aspects of information management activities need to be better supported by a KM system, or they may be applied to evaluating the implementation success of a KM system in changing employees' information management practices.

In fact, the authors used the measures of PIMM and PIMC as a diagnostic and consulting tool to help the study site company improve its information management at the organizational, divisional, and individual levels. Company employees' and divisions' average scores of PIMM and PIMC were analyzed. The practical guidance based on this analysis focused on enhancing employees' motivation and capability to use information effectively by implementing a training program or incentive system to support these activities. Without the detailed measurement scale items of PIMM and PIMC and the overall framework of these phenomena explained by our research model, this practical consulting would not have been possible.

Conclusion

In conclusion, effective use of information by knowledge workers is a fundamental driver of a firm's competitiveness. As an organization is constantly faced with changes in the business environment, its ability to acquire appropriate information and reduce uncertainty in its decision making is an essential basis for its competitive advantage. The present research establishes an empirical link among individual characteristics, PIME, and knowledge workers' job performance, representing an initial yet meaningful step toward bridging the gap between individual information management practices and organizational KM effectiveness. In today's business world, where effective use of information is a core asset of a company, our findings and measures should help organizations achieve improved results with more effective management of information.

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About the Authors

Yujong Hwang is Associate Professor in the School of Accountancy and MIS, Driehaus College of Business at DePaul University in Chicago. He is also International Scholar at Kyung Hee University in South Korea. He was Visiting Professor in the Kellogg School of Management at Northwestern University and received his Ph.D. in Business from the University of South Carolina. His research focuses on e-commerce, knowledge management, and human-computer interaction. He has published articles in the journals including *Journal of Management Information Systems, European Journal of Information Systems, IEEE Transactions, Communications of ACM, Information & Management, Decision Support Systems*, and *International Journal of Electronic Commerce*. He is Program Co-Chair of AMCIS 2013 and Senior Associate Editor of *European Journal of Information Systems*.

William J. Kettinger is a Professor and the FedEx Endowed Chair in MIS at the Fogelman College of Business and Economics at The University of Memphis. Dr. Kettinger previously served as Professor of Management Science and Moore Foundation Fellow at University of South Carolina. Bill has also taught at IMD in Lausanne, Switzerland, Wirtschaftsuniversität Wien, Vienna, Austria and at the Tecnologico de Monterrey in Mexico. He has published four books and numerous articles in such journals as *MIS Quarterly, JMIS, Decision Sciences, CACM, SMR, JAIS, EJIS, DataBase*, and *Long Range Planning*. He currently serves, or has served, on the editorial boards of *MIS Quarterly, ISR, JAIS*, and *MISQ Executive* and has twice served as a special quest editor for *JMIS*. He has been the recipient of numerous awards such as the Society of Information Management's best paper award. He consults with such companies as enterpriseIQ, IBM, and Accenture.

Mun Y. Yi is a Professor at KAIST (Korea Advanced Institute of Science and Technology). He earned his Ph.D. in information systems from University of Maryland, College Park. His current research focuses on knowledge management, information technology adoption and diffusion, computer training, and human-computer interaction. His work has been published in such journals as *Information Systems Research, Decision Sciences, Information & Management, International Journal of Human-Computer Studies*, and *Journal of Applied Psychology*. He is a former editorial member of *MIS Quarterly* and a current Associate Editor for *International Journal of Human-Computer Studies* and *AIS Transactions on Human-Computer Interaction*.

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Appendix A

Table A1 Measure development procedure

Pretest and Item Refinement: The three authors and two other researchers participated in the initial item generation of PIMM and PIMC, creating and discussing the new items. The initial scale of PIMM and PIMC was six items for each dimension of nine constructs, which resulted in 24 items in PIMM and 30 items in PIMC. The other construct items were seven items of performance, six items of IT self-efficacy, and six items of need-for-cognition. After the initial scale item generation, four Ph.D. students participated in a card sorting method for the reliability and construct validity. Cohen's Kappa was 89.8% and the average of degree of inter-judge agreement was 92%, indicating that items were generally placed as they were intended. Because the reasonable Cohen's Kappa was over 65%, and the inter-judge agreement over 90% (Churchill, 1979), overall pretests of initial items were proved to be reliable and valid. Following the recommendation of Churchill (1979), the present study retained all of the items and then performed the pilot test using these items.

First Pilot Test ($n = 50$): To purify the measurement items from the initial scale and finalize the items, the first pilot test was surveyed to MBA students with more than 5 years of average job experience. They had extensive knowledge work including system designer, financial analyst, general manager, teacher, and librarian. Given the characteristics of job style and various work experiences related to knowledge work, 50 MBA students with various job backgrounds were chosen randomly. The main objective of the first pilot test was to purify the items by rewording the initial items based on the reliability measured by Cronbach's alpha. The initial scales of PIMM and PIMC were revised and reworded to achieve higher reliability. Job performance, IT self-efficacy, sensing, and organizing constructs were reliable (alpha was more than 0.70), whereas some dimensions of PIMM and PIMC showed lower reliability, less than 0.70. Items with lower reliability were revised to provide the clear meaning based on participants' suggestions. After revising and rewording the items, 54 new items of PIMM and PIMC were prepared for the second pilot test.

Second Pilot Test ($n = 70$): In the second pilot test, two rules were used to arrive at the refined items for the final field test: (1) Cronbach's alpha should be more than 0.70 (Churchill, 1979); and (2) item-to-total correlations should be more than 0.60. The samples were 70 MBA students who had been knowledge workers for more than 5 years with the titles of senior manager, financial analyst, secretary, and technical manager. By eliminating low reliability (less than 0.70) and item-to-total correlation (less than 0.60) items of the second pilot test, the item numbers were reduced into 16 for PIMM, 16 for PIMC, three for IT self-efficacy, three for need-for-cognition, and six for performance. Detailed items retained after the second pilot test and used in the main test are shown in the following table of Appendix B. Every Cronbach's alpha in the second pilot test was over 0.70, showing higher reliability of the constructs than in the first pilot test. An 11-point Likert-type scale (0 = 'completely disagree'; 10 = 'completely agree') was used for all items.

Appendix B

Table B1 Questionnaire items in main study

Construct	*Measurement items*
PIMM: Proactiveness	1. I enjoy learning ways to improve the use of information with respect to my job. 2. I am comfortable asking people for information that would help me to do my job better. 3. I have to know all the facts before making a decision in my job.
PIMM: Sharing	1. I feel it is my duty to share information with others. 2. I always pass information to my co-workers to help them do better. 3. Sharing information to help others do well is as important as finishing my own work.
PIMM: Transparency	1. People view me as an open person who volunteers information about my mistakes on the job. 2. People come to me for information because I am willing to discuss my mistakes to help them learn. 3. Even if I report my mistakes, people will not lose respect for me. 4. I communicate my mistakes to other people because they can learn from my mistakes. 5. I communicate my mistakes to other people because I can learn from their feedback.
PIMM: Formality	1. When the information provided by the organization is easily accessible, I will use it instead of my own informal information. 2. When the organization's formal information systems are good, I use them over my own informal sources. 3. When I have a choice, I prefer using formal information over informal information for my job. 4. My job performance will be best when I rely on information provided by the organization rather than informal sources. 5. When the organization's information fits the need, I will definitely use it over my own informal sources.
PIMC: Sensing	1. I am good at recognizing potential problems and sensing information to address them. 2. I am good at detecting potential problems and finding the information that will eliminate problems. 3. I am good at evaluating changes in my environment and responding with the right information. 4. People seek my advice about defining new information needs. 5. I am good at sensing changes in our business that requires new information.
PIMC: Collecting	1. I am good at gathering the right information to prevent information overload. 2. I am good at filtering information for others to prevent information overload. 3. I significantly contribute to collecting information other people need to do their job.
PIMC: Organizing	1. In an emergency, my co-workers could find useful information in my files. 2. I frequently take time during my working day to classify new information for easy future retrieval. 3. I do not waste time looking for information as I have it well organized.
PIMC: Processing	1. Compared to my co-workers, I am better at processing information from many different sources to make the best decisions. 2. I know how to translate information into specific knowledge that can be used by others. 3. Once I have the information I need, it does not take much time for me to process information and solve problems.
PIMC: Maintaining	1. I am good at determining the future value of information for later use. 2. Compared to my co-workers, I am good at eliminating outdated information in my job.
Performance	Compared to my co-worker… I achieve the objectives of my job. 1. … I perform well in my job overall. 2. … I solve my job's problems. 3. … I provide the highest quality of performance in my job. 4. … My boss believes I provide the highest quality performance in my job. 5. … My co-workers believe I provide the highest quality performance in my job.
IT Self-Efficacy	I am confident in using IT to do my job … when I can call someone for help if I get stuck. 1. … as long as I have sufficient time to complete the task for which the software was provided. 2. … as long as I have help facilities in the software for assistance.
Need-For-Cognition	1. Thinking is not my idea of fun. (reverse) 2. I would rather do something that requires little or no thought than something that is sure to challenge my thinking ability. (reverse) 3. I only think as hard as I have to. (reverse)