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The Study of Crowdsourcing in Knowledge Management: The Role of Employees' Innovative Behavior on Job Performance

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THE STUDY OF CROWDSOURCING IN KNOWLEDGE MANAGEMENT: THE ROLE OF EMPLOYEES' INNOVATIVE BEHAVIOR ON JOB PERFORMANCE

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DISSERTATION APPROVAL FORM

This dissertation is approved as a credible and independent investigation by a candidate for the Doctor of Science in Information Systems degree and is acceptable for meeting the dissertation requirements for this degree. Acceptance of this dissertation does not imply that the conclusions reached by the candidate are necessarily the conclusions of the major department or university.

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I am dedicating this work to my mother, wife, children, and all my teachers. Thank you everyone!

ABSTRACT

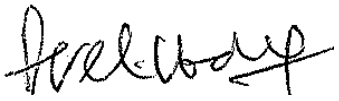
Employees are a main source of innovative ideas via their insights on companies' products, processes, customers, and competitors. Enterprise crowdsourcing systems (ECSs) are used to collect, refine, and realize ideas. However, only a small percentage of employees submit ideas – about 7.7% at Pfizer, 2% at HCL Technologies, and 3% at Polaris Industries. Why is employee participation low? More specifically, what factors can lead employees to actively use ECS to submit and share their innovative ideas for improving their job performance? In this research, we used a multi-actor dyadic survey to survey 183 employees and their managers and conducted data analysis to understand the impact of ECS factors on employees' job performance. Partial Least Squares (PLS) approach using Smart PLS was used to test both the measurement and structural models, and the results lend support for the proposed research model. The findings of the study confirm that knowledge sharing and employees' cognitive features have a positive effect on effective knowledge application (EKA), and in turn, EKA increases employees' ECS satisfaction, innovative behavior, and job performance. The study also confirmed that employees' ECS satisfaction and innovative behavior have a positive effect on their job performance. The findings of this study can help organizations refine their ECSs and innovation initiatives to increase employees' participation, innovative behavior, and job performance by enabling and supporting knowledge sharing among them, and implementing ECS with a solid, reward system meeting employees' intrinsic and extrinsic motivational factors.

DECLARATION

I hereby certify that this dissertation constitutes my own product, that where the language of others is set forth, quotation marks so indicate, and that appropriate credit is given where I have used the language, ideas, expressions or writings of another.

I declare that the dissertation describes original work that has not previously been presented for the award of any other degree of any institution.

Signed,



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CHAPTER 1

INTRODUCTION

Innovation helps create new products, improve existing products, and reduce expenses by improving operational efficiencies (Gardner, 2015; Seidel, Thapa, Plattfaut, & Niehaves, 2013). Traditionally, innovative ideas come from consultants outside the organization or a specific set of employees within the organization such as its R&D personnel (Wendelken, Danzinger, Rau, & Moeslein, 2014). Recently, with the development of Enterprise Crowdsourcing Systems (ECSs), all employees, not just R&D personnel, can submit innovative ideas to online repositories using their computers' web browsers. Organizations can then evaluate and implement the ideas to increase their profit (Youden, Lee, & Angsuwat, 2011) and reward employees for their submission of ideas. ECSs are the information systems that are used by organizations to harness the skills, input, information, and capabilities of all employees across all functional and hierarchical levels. With web technologies, ECSs enable easy contribution and interaction that can help increase the number of innovative idea submissions. Many of the ideas will later be implemented, thus benefiting not only organizations with increased profits but also employees with recognition and rewards. For instance, Polaris, a leading motor vehicles manufacturer, introduced four new vehicle models and improved its R&D process (Gardner, 2015) by implementing innovative ideas submitted by its employees to the ECS. Similarly, HCL Technologies, a global IT services company, offered seed funding to their employees for submitting and developing innovative ideas (Sood, 2014).

These enterprise crowdsourcing repositories, however, do not seem to be actively used by employees to submit innovative ideas, even though employees are usually rewarded for their ideas. For example, at Pfizer, only 7.7% of their 77,000 employees participated and submitted 650 ideas to Pfizer's ECS (Gardner, 2015). At HCL Technologies Limited, only

2% of their 200,000 employees participated (Sood, 2014), and at Polaris Industries, only 3% of their 7,000 employees submitted ideas (Laurin. n.d.). This lack of employee participation prompted us to investigate the following research question: What factors can lead employees to actively use ECSs to submit and share their innovative ideas to improve their job performance?

Understanding these influencing factors will help organizations improve their ECSs to encourage more employee participation in submitting and sharing innovative ideas. Since ECSs are nascent, there is no IS research exploring the role of ECS factors such as knowledge sharing and supporting support in enabling employees' innovative behavior. In this research, we develop hypotheses that examine the effects of ECS factors on employees' innovative behavior from a knowledge management perspective (i.e., knowledge sharing and knowledge application) with moderating effects including knowledge application, ECS satisfaction, and innovative behavior.

CHAPTER 2

LITERATURE REVIEW

Crowdsourcing and crowdsourcing systems

Crowdsourcing typically means the common contribution of the interested people (crowd) who are part of a non-hierarchical group to solve a common problem using their diversified knowledge (Seidel et al., 2013). Saxton, Oh, and Kishore (2013) defined crowdsourcing as "a sourcing model in which organizations use pre-dominantly advanced Internet technologies to harness the effort of a virtual crowd to perform specific organizational needs" (p. 5). The information systems that are used to harness the virtual crowd's effort are called crowdsourcing systems. Crowdsourcing systems are primarily hosted in two ways - organization hosted and third-party provider hosted. In our research, we focus on organization hosted crowdsourcing systems, also known as enterprise crowdsourcing systems (ECSs), in which the crowd is all their employees across various domains with different backgrounds that will participate to solve organizational problems innovatively.

Due to crowdsourcing's newness, studies in crowdsourcing are limited and differ greatly in various aspects such as the definition of crowdsourcing, its applications to individuals and organizations, suggestions to improve crowd participation and address challenges in their working conditions, and techniques to standardize design and processes of crowdsourcing systems to improve their performance. Although the application of crowdsourcing systems varies dramatically based on the complexity and outcomes of the tasks, researchers have agreed that turning to crowdsourcing provides quick access to a large pool of humans with diverse skills, knowledge, and perspectives that might not be available in traditional sourcing (Bernstein, Brandt, Miller, & Karger, 2011; Edgar, Murphy, & Keating, 2016; Geiger, Seedorf, Schulze, Nickerson, & Schader, 2011; Kittur, Chi, & Suh, 2008). A

large majority of existing research has focused on studying how businesses can harness the collective capability of outside experts or non-experts to facilitate innovation, growth, and success. For example, Bayus (2013) investigated whether the supply of quality ideas can be sustained by an ongoing crowdsourcing community over time in companies such as Dell that have repeatedly collected ideas for new products and services from a large, dispersed "crowd" of non-experts. Our research focuses on a different kind of crowdsourcing, namely enterprise crowdsourcing, and investigates factors that affect the applicability of crowdsourcing methodology within an enterprise in engaging internal networks of knowledge experts.

Table 1 and Table 2 show two different perspectives of current literature on crowdsourcing. Table 1 provides the initial categorization of crowdsourcing based on focus area. Table 2 provides a classification of crowdsourcing research based on the (Chiu, Liang, & Turban, 2014) framework. The framework groups research based on four components (task, crowd, process, and evaluation) and three levels of concern (managerial, behavioral, and technology and systems).

Table 1. An initial categorization of crowdsourcing literature

Focus area	**Special focus**	**Selected literature**
About crowdsourcing		Brabham, 2008; Estelles-Arolas & Gonzalez-Ladron-de-Gevara, 2012; Gressgard, Amundsen, Aasen, & Kansen, 2014; Howe, 2006; Howe, 2008; Yuen, King & Lueng, 2011; Zhao & Zhu, 2012
Uses	Innovation	Bonabeau, 2009; Brabham, 2008; Bretschneider, Rajagopalan, & Leimeister, 2012; Gressgard, Amundsen, Aasen, & Kansen, 2014; Howe, 2008; Majchrzak & Malhotra, 2013; Poetz & Schreider, 2012

	Enterprise	Nevo, Kotlarsky, & Nevo, 2012
	Mobile	Ali, Al-Yaseen, Ejaz, Javed & Hassanein, 2012; Vaish, Wyngarden, Chen, Cheung & Bernstein 2014
	Research	Behrend, Sharek, Meade & Wiebe, 2011; Sabou, Bontcheva & Scharl, 2012
	Routine work	Sabou, Bontcheva & Scharl, 2012; Zaidan & Callison-Burch, 2012
	Challenges and competitions	Afuah & Tucci, 2012; Archak & Sundararajan, 2009; Archak & Sundararajan, 2014
	3rd party platforms	Bayus, 2013; Chilton, 2009; Howe, 2008; Huberman, Romero & Wu, 2008; Kittur, Smus, Khamkar & Kraut, 2011; Kosonen & Henttonen, 2013; Saxton, Oh & Kishore, 2013; Trompette, Chanal & Pelissier, 2008
	Knowledge sharing	Allen, Ingham, Johnson, Merante, Noveck, Stock, Tham, Webbink & Wong, 2008; Bonabeau, 2009; Chilton, 2009; Howe, 2008; Jeppesen & Frederiksen, 2006; La Vecchia & Cisternino, 2010; Sullivan, Wood, Iliff, Bonney, Fink & Kelling, 2009; Yang, Adamic & Ackerman, 2008

To improve CS	Reasons for participation	Afuah & Tucci, 2012; Del Carpio, 2014; Deng & Joshi, 2013; Deng & Joshi, 2016; Deng, Joshi & Galliers, 2016; Durcikova & Fadel, 2012; Gan, Kosonen & Blomqvist, 2012; Kosonen & Henttonen, 2013; Leimeister, Huber, Bretschneider & Krcmar, 2009; Pilz & Gewald, 2013; Rogstadius, Kostakos, Kittur, Smus, Laredo & Vukovic, 2011; Sauermann & Franzoni, 2013; Seidel, Thapa, Plattfaut & Niehaves, 2010; Smith, Manesh & Alshaikh, 2013; Tonnessen, 2005; Zheng, Li & Hou, 2011
	Improve participation	Del Carpio, 2014; Huberman, Romero & Wu, 2008; Kosonen, Gan, Blomqvist & Vanhala, 2012; Moraes, Fonseca, Esteves, Schneider & de Souza, 2014; Richter, 2015; Tonnessen, 2005
Standardizing	Definitions and functions	Alt, Shirazi, Schmidt, Kramer & Nawaz, 2010; Doan, Ramakrishnan & Halevy, 2011; Hetmank, 2013; Pedersen, Kocsis, Tripathi, Tarrell, Weerakoon, Tahmasbi & de Vreede, 2013; Saxton, Oh & Kishore, 2013; Thuan, Antunes & Johnstone, 2016; Thuan, Antunes, Johnstone & Son, 2015; Yuen, King & Leung, 2011; Zhao & Zhu, 2012;

	Design	Allahbakhsh, Benatallah, Ignjatovic, Motahari-Nezhad, Bertino & Dustdar, 2013; Chiu, Liang & Turban, 2014; Deng, Galliers & Joshi, 2016; Geiger, Rosemann, Fielt & Schader, 2012; Geiger, Seedorf, Schulze, Nickerson & Schader, 2011; Hetmank, 2014; Moraes, Fonseca, Esteves, Schneider & de Souza, 2014; Sakamoto, Tanaka, Yu, Nickerson, 2011; Thuan, Antunes & Johnstone, 2016; Thuan, Antunes, Johnstone & Son, 2015; Yuen, King & Leung, 2011
	Processes	Cullina, Conboy & Morgan, 2015; Hetmank, 2014; Thuan, Antunes & Johnstone, 2016; Thuan, Antunes, Johnstone & Son, 2015
Improve performance	Algorithm and model	Archak & Sundararajan, 2009; Bernstein, Karger, Miller & Brandt, 2012; Hetmank, 2014; Karger, Oh & Shah, 2013; Kittur, Smus, Khamkar & Kraut, 2011; Kulkarni, Can & Hartmann, 2012; Lykourentzou, Vergados, Papadaki & Naudet, 2013; Moraes, Fonseca, Esteves, Schneider & de Souza, 2014; Pan, Yu, Miao & Leung, 2016; Sakamoto, Tanaka, Yu, Nickerson, 2011; Tarable, Nordio, Leonardi & Marsan, 2015; Vokovic, 2009

Challenges	Crowd workers' working conditions	Bayus, 2013; Deng & Joshi , 2013; Deng, Joshi & Galliers, 2016; Tonnessen, 2005
	Comparison to other IS	Lukyanenko & Parsons, 2012; Trompette, Chanal & Pelissier, 2008
	Issues	Bayus, 2013; Deng & Joshi, 2013; Richter, 2015

Table 2. Classification of crowdsourcing research

Reference	**Research issue**	**Main focus**	**Category**
Afuah & Tucci (2012)	Factors influencing possibility of crowdsourcing	Task feasibility	Task-Managerial
Ali, Al-Yaseen, Ejaz, Javed & Hassanein (2012)	Mobile phones also as a special sensory equipment in transportation systems	Platform selection Collecting process data	Task-Technology Process-Technology
Allahbakhsh, Benatallah, Ignjatovic, Motahari-Nezhad, Bertino & Dustdar (2013)	Taxonomy of quality in crowdsourcing systems	Participants' reaction to system functions Crowd selection •Quality measurement •Evaluation metric •Task presentation •Task decomposition	Crowd-Technology Task-Managerial Evaluation-Managerial Crowd-Managerial
Allen, Ingham, Johnson, Merante, Noveck, Stock, Tham,	Using crowd as patent reviewers	Crowd selection	Crowd-Managerial

Webbink & Wong (2008)			
Alt, Shirazi, Schmidt, Kramer & Nawaz (2010)	Use of mobile web and clients to provide solutions	System functionalities Use of collaboration tools	Task-Technology Crowd-Technology
Archak & Sundararajan (2009)	Calculating prizes for crowdsourcing contest	Evaluation metrics	Evaluation-Managerial
Bayus (2013)	Issues in maintaining the pipeline of quality ideas	Diversity of the crowd Use of idea evaluation tool Crowdsourcing mechanism	Crowd-Managerial Evaluation-Technology Process-Managerial
Behrend, Sharek, Meade & Wiebe (2011)	Are crowdsourcing portals a comparable source for samples?	Platform selection	Task-Technology
Bernstein, Karger, Miller & Brandt (2012)	Improving real-time crowdsourcing	System functionalities	Task-Technology
Bonabeau (2009)	A framework for assessing Decision 2.0 applications	Legal issues (Intellectual property) Human biases Evaluation metrics	Process-Managerial Process-Behavioral Evaluation-Managerial
Brabham (2008)	Overview and crowdsourcing in innovation	Diversity of the crowd Crowd motives	Crowd-Managerial Crowd-

			Behavioral
Bretschneider, Rajagopalan & Leimeister (2012)	Effect of crowd motivation on idea quality	•Crowd motives •Participation intention and behavior	Crowd-Behavioral
Cullina, Conboy & Morgan (2015)	Measuring crowdsourcing process	Process monitoring	Process-Technology
Del Carpio (2014)	Effect of transactive memory systems on contributor of ideas	System functionalities Use of social network	Task-Technology Process-Technology
Deng & Joshi (2013)	Factors influencing the choice of crowd work as career	Incentive mechanisms Participation intention and behavior	Crowd-Managerial Crowd-Behavioral
Deng & Joshi (2016)	Factors influencing the continuance of crowd work	•Task suitability •Task complexity •Key capabilities involved •Use of collaboration tools •Participation reaction to system functions	Task-Managerial Crowd-Technology
Deng, Galliers & Joshi (2016)	Influence of system features in crowd working	Use of collaboration tools •Crowd's task selection behavior •Crowd motives	Crowd-Technology Crowd-Behavioral
Deng, Joshi & Galliers (2016)	Ways to empower crowd workers	System functionalities System Architecture Design •Human biases •Cheating in crowdsourcing	Task-Technology Process-Technology Process-Behavioral

Doan, Ramakrishnan & Halevy (2011)	Classification of crowdsourcing systems	System functionalities	Task-Technology
Durcikova & Fadel (2012)	Effects of evaluation and validation of ideas on participation	User attitude toward rating scale Outcome evaluation method	Evaluation-Behavioral Evaluation-Technology
Estelles-Arolas & Gonzalez-Ladron-de-Guevara (2012)	Standardizing crowdsourcing definitions and functions	System functionalities	Task-Technology
Gan, Kosonen & Blomqvist (2012)	Reasons for crowd participation	•Crowd's motives •Crowd's attitude toward participation Impact of task features on participants outputs	Crowd-Behavioral Task-Behavioral
Geiger, Rosemann, Fielt & Schader (2012)	Typology of crowdsourcing systems	System architecture design System functionalities Evaluation metrics Crowd selection	Process-Technology Task-Technology Evaluation-Managerial Crowd-Managerial
Geiger, Rosemann, Fielt & Schader (2011)	Classification of crowdsourcing systems	System functionalities Use of collaboration tools Evaluation metrics Crowd selection	Task-Technology Process-Technology Evaluation-Managerial Crowd-Managerial

Geiger, Seedorf, Schulze, Nickerson & Schader (2011)	Managing the crowd	Crowd selection •Accessibility of peer contribution •Legal issues (privacy protection)	Crowd-Managerial Process-Managerial
Gressgard, Amundsen, Aasen & Kansen (2014)	ICT tools in employee-driven innovation	System functionalities	Task-Technology
Hetmank (2013)	Components and functions of crowdsourcing systems	System architecture design	Process-Technology
Howe (2006)	Origin of crowdsourcing	System functionalities	Task-Technology
Howe (2008)	Applications of crowdsourcing	System functionalities	Task-Technology
Huberman, Romero & Wu (2008)	Improve crowd participation	Outcome evaluation method Accessibility of peer contributions	Evaluation-Technology Process-Managerial
Jeppesen & Frederiksen (2006)	Reasons to contribute in firm-hosted repositories	•Crowd's motives •Crowd's attitude toward participation	Crowd-Behavioral
Karger, Oh & Shah (2013)	Cost efficient task allocation	Task suitability System functionalities	Task-Managerial Task-Technology and Systems
Kittur, Smus, Khamkar & Kraut (2011)	Crowdsourcing complex work	Use of collaboration tools Task decomposition	Process-Technology / Crowd-Technology Task-Managerial

Kosonen & Henttonen (2013)	Third-party crowdsourcing platform	Crowd's motives	Crowd-Behavioral
Kosonen, Gan, Blomqvist & Vanhala (2012)	Crowd motivation to share knowledge	•Trust •Crowd's motives	Crowd-Behavioral
Kulkarni, Can & Hartmann (2012)	Workflow design, instantiation, experiments	•Task decomposition •Task presentation System functionalities System architecture design	Task-Managerial Task-Technology Process-Technology
La Vecchia & Cisternino (2010)	Enterprise crowdsourcing	Task decomposition Crowd selection Process monitoring Evaluator metrics	Task-Managerial Crowd-Managerial Process-Technology Evaluation-Managerial
Leimeister, Huber, Bretschneider & Krcmar (2009)	Motives, incentives, and activation	Crowd's motives Collecting process data Evaluator selection Use of idea evaluation tools	Crowd-Behavioral Process-Technology Evaluation-Managerial Evaluation-Technology
Lukyanenko & Parsons (2012)	Modeling crowdsourcing systems	System architecture design	Process-Technology
Lykourentzou, Vergados, Papadaki & Naudet (2013)	Guided crowdsourcing	Artificial intelligence	Process-Technology

Majchrzak & Malhotra (2013)	Crowdsourcing systems as shapers of innovation	System architecture design	Process-Technology
Moraes, Fonseca, Esteves, Schneider & de Souza (2014)	Model for data collection and participatory sensing	•Collecting process data •System architecture design	Process-Technology
Nevo, Kotlarsky & Nevo (2012)	Successful utilization of crowdsourcing	Key capabilities involved •Task variety •Task complexity •Crowd motives •Participation intention and behavior	Task-Managerial Crowd-Behavioral
Pan, Yu, Miao & Leung (2016)	Leveraging crowd expertise	System functionalities Crowd selection	Task-Technology Crowd-Managerial
Pedersen, Kocsis, Tripathi, Tarrell, Weerakoon, Tahmasbi & de Vreede (2013)	Crowdsourcing definition and model	System functionalities System architecture design	Task-Technology Process-Technology
Pilz & Gewald (2013)	Reasons for crowd participation	Crowd's motives	Crowd-Behavioral
Poetz & Schreier (2012)	Ideas quality between users and professionals	Quality measurements User participation in evaluation	Evaluation-Managerial Evaluation-Behavioral
Richter (2015)	Crowdcreation	Crowd selection Legal issues	Crowd-Managerial Process-Managerial

Rogstadius, Kostakos, Kittur, Smus, Laredo & Vukovic (2011)	Reasons for crowd participation	Crowd's motives	Crowd-Behavioral
Sabou, Bontcheva & Scharl (2012)	Crowdsourcing in science projects	Crowd selection Crowd's motives Legal issues (Privacy and ethical) •Cheating in crowdsourcing •Human biases Quality measurement	Crowd-Managerial Crowd-Behavioral Process-Managerial Process-Behavioral Evaluation-Managerial
Sakamoto, Tanaka, Yu, Nickerson (2011)	Design space for designing crowdsourcing systems	System architecture design	Process-Technology
Sauermann & Franzoni (2013)	Contribution dynamics in crowd science projects	Crowd's motives	Crowd-Behavioral
Saxton, Oh & Kishore (2013)	Control systems and mechanisms	Process monitoring Use of idea evaluation tools	Process-Technology Evaluation-Technology

Seidel, Thapa, Plattfaut & Niehaves (2010)	Citizens in public sector crowdsourcing	Task Complexity Impacts of task features on participants' outputs •Incentive mechanisms •Crowd selection	Task-Managerial Task-Behavioral Crowd-Managerial
Smith, Manesh & Alshaikh (2013)	Crowdsourcing for technology-entrepreneurs	Diversity of the crowd Crowd's motives Accessibility of peer contributions	Crowd-Managerial Crowd-Behavioral Process-Managerial
Sullivan, Wood, Iliff, Bonney, Fink & Kelling (2009)	Citizen-based bird observation	System functionalities Collecting process data Infrastructure	Task-Technology Process-Technology Process-Managerial
Tarable, Nordio, Leonardi & Marsan (2015)	Earnest in crowdsourcing systems	System architecture design Crowd selection	Process-Technology Crowd-Managerial
Thuan, Antunes & Johnstone (2016)	Integrated crowdsourcing processes	System functionalities	Process-Technology
Thuan, Antunes, Johnstone & Son (2015)	Business process crowdsourcing	System architecture design	Process-Technology

Tonnessen (2005)	Continuous enterprise innovation	•Crowd selection •Diversity of the crowd	Crowd-Managerial
Trompette, Chanal & Pelissier (2008)	Accessing external knowledge	Incentive mechanisms Use of collaboration tools Legal Issues (Intellectual property)	Crowd-Managerial Crowd-Technology Process-Managerial
Vaish, Wyngarden, Chen, Cheung & Bernstein (2014)	Twitch crowdsourcing	System functionalities	Task-Technology
Vukovic (2009)	Enterprise crowdsourcing	System architecture design	Process-Technology
Yang, Adamic & Ackerman (2008)	Strategic user behavior in crowdsourcing	Crowd's task selection behavior	Crowd-Behavioral
Yuen, King & Leung (2011)	Categorization of crowdsourcing systems	Cheating in crowdsourcing Use of idea evaluation tools	Process-Behavioral Evaluation-Technology
Zaidan & Callison-Burch (2011)	Crowdsourcing translation	System architecture design Quality measurement	Process-Technology Evaluation-Managerial
Zhao & Zhu (2012)	Motivation in crowdsourcing contest	Crowd's motives	Crowd-Behavioral
Zheng, Li & Hou (2011)	Effect of task design and motivation on participation intention	• Task variety • Task complexity • Crowd's motives	Task-Managerial Crowd-

		• Participation intention and behavior	Behavioral

ECS functions

The uniqueness of enterprise crowdsourcing systems (ECSs), compared to other information systems and E-Commerce, lies in their ability to provide knowledge management features to acquire, share, and apply knowledge. The primary functions of ECSs include user management, task management, contribution management, trust management, and workflow management (Hetmank, 2013). The user management function coordinates any required collaboration between employees. Task management handles the incoming submissions of tasks and their distribution to the crowd that will solve the task. Contribution management allows employees to submit their ideas and other employees to view the submitted ideas, provide their comments, cast votes, select the best ideas, and adapt and apply them in their domain [41]. ECSs that are open to everyone can facilitate an internal culture of openness and cooperativeness, which has been considered a key attribute of organizations that have succeeded at employee-driven innovation (EDI) (Smith, Kesting, & Ulhụi, 2008), using an idea submission portal/system capable of collecting, refining, and applying ideas (Jarle Gressgård, Amundsen, Merethe Aasen, & Hansen, 2014). The trust management function ensures that right compensation, recognition, and credit go to the contributing employees. Employees expect fairness in receiving appropriate rewards for their creative contribution, and their intention to share knowledge depends on this (Janssen, 2004). Finally, the workflow management function coordinate inputs and outputs of humans and machine functions in the process (Hetmank, 2013). An efficient workflow management is critical in ECSs as they are complex systems that require employees and enterprise systems' input and output.

Knowledge sharing and creative knowledge application

Knowledge sharing is the process of spreading organizationally relevant information, knowledge, and skills across organizations (Ngah & Ibrahim, 2011). Both tacit and explicit knowledge are shared across functional domains within an enterprise using ECSs. It is then important that the shared knowledge is used effectively to complete operational business processes in the enterprise. Using or integrating the shared knowledge in existing business processes is known as knowledge application (S. Y. Choi, Lee, & Yoo, 2010).

In this study, we define knowledge application as an employee's behavior that effectively applies their existing ECS knowledge to support their job. This definition, "effective knowledge application" (EKA), is based on the concept of "effective IS use" proposed in previous studies. Burton-Jones and Grange (2013) suggested an "effective IS use" concept and introduced related terms. According to them, effective IS use refers to using a system in a way that helps attain the goals for using the system. The concept focuses on consequences of IS use (i.e., successful/unsuccessful or effective/ineffective). It simply indicates the presence of use to the extent that it helps carry out the task (Burton-Jones & Straub, 2006). Thus, effective knowledge application refers to the extent to which users successfully employ their knowledge to carry out their job, as system usage should be linked to user performance (Burton-Jones & Grange, 2013). In this sense, EKA focuses more on employees applying the knowledge collected from colleagues in their organizations. Therefore, ECSs help them to apply their collected knowledge by sharing, assessing, adapting, and adopting their knowledge that subsequently contributes to producing or improving new products, services, and processes (Saxton et al., 2013).

In such a process, employees would tend to effectively/creatively improve current business processes or products or to enhance product development, procedures, etc. According to Rudowicz and Yue (2000), effective knowledge application in enterprises is influenced by unique characteristics of employees (individuals), teams (groups), organizations, products, and culture. For instance, existing research has shown that, as an individual characteristic, intrinsic motivation enables creativity more than extrinsic

motivation (Hennessey, 2015), and as an organizational characteristic, resource constraints can both positively and negatively impact creativity (Caniëls & Rietzschel, 2013; Shalley, Zhou, & Oldham, 2004; Jing Zhou & Jennifer M George, 2001).

Innovative and creative behavior

Innovation is the successful implementation of creative ideas (Amabile, 1988). Thus, in our study, effective knowledge application refers to finding new uses for existing knowledge shared by other people in ECSs, while innovative behavior is performance or production (not adoption) based on using novel ideas to conduct their job (Scott & Bruce, 1994). In this study, innovative ideas can be novel ideas proposed by employees to improve their work such as a product development or process. ECSs have features to collect new ideas, announce challenges requesting new ideas, enable employees to comment and rate the ideas, and allow employees to add to the submitted ideas. They could provide visibility to invisible knowledge to all employees, including employees who are not directly involved in specific ideas (Leonardi, 2014). This visibility can help increase collaboration among employees, thus resulting in increased new idea generation and innovative behavior. Innovative behavior is distinct from EKA in that it focuses on the implementation of employees' own innovative ideas coming out of individual thinking even though they are often developed based on the existing knowledge obtained from ECSs, while EKA is more dependent upon the shared knowledge posted by other employees in ECSs and focuses on combining existing knowledge, finding its proper uses, and adopting and adapting it to solve problems.

Creativity and innovation help create new products, improve existing products, and reduce expenses by improving operational efficiency (Gardner, 2015; Kleysen & Street, 2001; Seidel et al., 2013). Creativity and innovation have often been used interchangeably in research studies, and due to their closeness, several variations of these terms are used in studies interchangeably - creativity (Amabile, 1988), creative behavior (Carmeli, Sternberg, & Elizur, 2008), creative performance (Tierney & Farmer, 2011; J. N. Choi, 2004), innovation,

innovative behavior (Scott & Bruce, 1994), innovative work behavior (De Jong & Den Hartog, 2010), and problem solving (Vogl, Kummer, & Schunko, 2016). Recently, there is an agreement in their definitions – creativity or creative behavior is the production of novel and useful ideas, and innovation is production or adoption of useful ideas and idea implementation (Carmeli et al., 2008; Scott & Bruce, 1994). Based on the definition of innovation, creativity is considered as the root (Caniëls & Rietzschel, 2013) and seed for innovative activities (Amabile, Conti, Coon, Lazenby, & Herron, 1996).

Although creativity is key to all social and technical innovation (Batey, 2012), the study of creativity was historically faced with six roadblocks, namely, mystical approaches, pragmatic approaches, psychodynamic approaches, psychometric approaches, cognitive approaches, and social-personality (Sternberg, 1998). Creativity has been drawn from mystical interpretations, and many Greeks believed that creation and inspiration were the results of divine intervention (Sternberg, 1998; Batey & Furnham, 2006). Due to this, researchers were skeptical that creativity could be measured or comprehended (Batey, 2012). Eventually, Greeks moved on to believe that creativity relates to an individual's daemon or guardian spirit. By the time of Aristotle, people believed creativity was a natural event conforming to the laws of nature. Creativity research grew somewhat in the 1950's with the founding of a few research institutes focusing on creativity (Sternberg, 1998).

Currently, creativity literature has grown substantially in volume, scope, methodology and theoretical sophistication. This growth in publication outlets has resulted in fragmentation in creativity research, where researchers and theorists in one subfield are often unaware of others' work in another subfield (Hennessey & Amabile, 2010).

Creative behavior has unique characteristics in each of the dimensions - individuals, groups, organizations, products, and culture. Rudowicz and Yue (2000) identified creative characteristics in individuals as including creative, has original ideas, innovative, observant, good thinking, willing to try, flexible, has wisdom, self-confident, independent, imaginative, curious, changeable, individualistic, researches things, and enjoys life. Group characteristics include norms, group cohesiveness, size, diversity, roles, and task

characteristics. Organizational factors include motivation to innovate a basic orientation, resources available to help innovation, and management practices such as the allowance of freedom or autonomy (Amabile et al., 1996). Batey and Furnham (2006) identify characteristics of the product as a combination of attributes that are novel and useful, attributes of the persons who generate the product, attributes of persons assessing the creativity of the product or output, and attributes of the environment. Cultural characteristics include international, departmental, and group level (Hennessey, 2015).

In the past, creativity has been studied in various contexts including products, persons, resource constraints, neurological and biological basis, affect, cognition and training, individual differences/personality, individual differences in intelligence, gender differences, groups and teams, creativity in workplace groups, and workplace group diversity (Hennessey & Amabile, 2010). The last decade has seen substantial growth in creative research that is focused on the social environment and its factors that impact creators and serve to boost or inhibit their creativity (Hennessey, 2015). Due to globalization, a need has risen to study creativity at the cultural and societal levels including classroom, workplace, and at a larger cultural level (Hennessey, 2015). Recently, scholars of organizations, many trained as psychologists, have begun studying creativity in the workplace. Creativity research requires an interdisciplinary research based on a systems view of creativity that recognizes a variety of interrelated forces operating on multiple levels (Hennessey & Amabile, 2010). Example studies in this area include: a team creativity study which revealed that individuals from non-Western cultures might respond differently to organizational conditions than individuals from Western nations (Shalley et al., 2004); hundreds of empirical studies have confirmed that intrinsic motivation enables creativity more than extrinsic motivation (Hennessey, 2015); several researchers studied how constraints can both positively and negatively impact creativity and innovation (Caniëls & Rietzschel, 2013; Shalley et al., 2004; Zhou & George, 2001). Constraints can stimulate creativity because they energize employee efforts. For example, shoestring budgets can force employees to come up with the best ideas (Caniëls & Rietzschel, 2013). Creativity constructs are assessed from various perspectives – cognitive,

personality, humanistic, social, environmental, and psychoanalytical psychologies (Batey & Furnham, 2006; Shalley et al., 2004).

Several research models studied creativity as a dependent variable. Particularly, creativity was measured extensively in contextual-creativity using intrinsic motivation as the mediator, for example, how job dissatisfaction can influence employee creativity (Zhou & George, 2001). Some other mediators studied in creativity include: positive and negative mood states (Shalley et al., 2004), self-efficacy (Shalley et al., 2004), creative self-efficacy (Tierney & Farmer, 2002), and creative role identity (Farmer, Tierney, & Kung-Mcintyre, 2003).

Creativity has also been studied as the independent variable. For example, when ideas are processed to be implemented, creators associated with implementation when they are confident that their ideas can be implemented. This concept is referred to as implementation instrumentality and is a good moderator between creativity and implementation of ideas (Baer, 2012). Networking ability is another moderator between creativity and implementation, referring to the extent to which people are skilled in developing and using social networks to effect change at work. Personal creativity has influenced entrepreneurial intentions (Yar Hamidi, Wennberg, & Berglund, 2008). Creative behavior is a mediating linkage in the relationship between individual differentiation and individual effectiveness (Janssen, 2004).

ECS satisfaction and job performance

User satisfaction is an important criterion for measuring the success of IS. Though indirect, it is the most prevalent measure of IS success due to its applicability and ease of use (Melone, 1990). Ives et al. (1983) defined user satisfaction as the degree to which users believe that the IS at their disposal fulfills their needs. Au et al. (2008) defined user satisfaction as the sum of experiences the user acquires from his/her interaction with technology over time, and it represents users' cognitive evaluation of the entire IS user

experience. Adapting from definitions of user satisfaction and job satisfaction (Locke, 1976), we define ECS satisfaction as "a pleasurable or positive emotional state resulting from the appraisal of an ECS or experience using an ECS." Bhattacherjee (2001), in his expectation-confirmation framework, states that user satisfaction results when expected benefits of information system use are confirmed or realized. Employees using ECSs can feel satisfied when they realize that knowledge shared is applied and integrated into their work and organizational processes to improve efficiency, as originally intended by ECSs.

We follow Viswesvaran and Ones's (2000) definition of job performance as behavior and outcomes that employees engage in or bring about that is linked with and contribute to organizational goals. It includes factors such as productivity, work quality, improved job performance, and time save (Etezadi-Amoli & Farhoomand, 1996; Kositanurit et al., 2011).The impact of IS on individual performance has been well-researched. DeLone and McLean (DeLone & McLean, 1992) state that user performance impact is a good sign that the given IS has provided the user a good knowledge of the decision context, has enhanced the user productivity, or has evolved his or her perception of the value or effectiveness of the IS (Sharabati et al., 2015).

CHAPTER 3

RESEARCH MODEL AND HYPOTHESES

As has been elucidated in Chapter 1, the aim of this research is to understand what ECS factors can lead employees to actively use ECSs to submit and share their innovative ideas to improve their job performance. Understanding these influencing factors will help organizations to improve their ECSs to attract more employee participation in submitting and sharing innovative ideas. The research model is shown in the following figure.

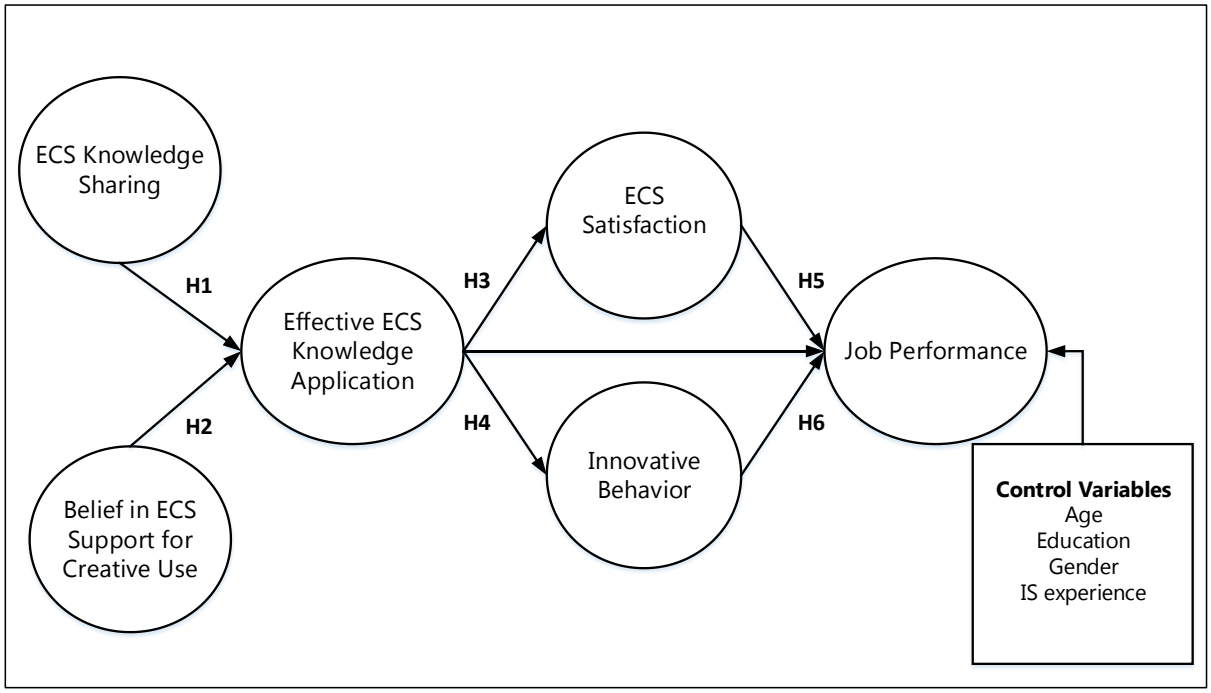


Figure 1. Conceptual model

Knowledge sharing and effective knowledge application

This study uses both knowledge sharing and knowledge application to study employees' innovative behavior. Knowledge sharing is the process in which organizationally relevant information, knowledge, and expertise are spread and exchanged among employees within an organization. The value of knowledge is realized when employees' highly tacit and subjective domain insights are tapped into and made available for sharing and applying across different domains. Tacit knowledge is a tremendous source for innovation (Ngah & Ibrahim, 2011). Moreover, when knowledge is shared, learning takes place, which could result in an improved pool of organizational knowledge (Nonaka & Takeuchi, 1995). Access and exposure to diverse knowledge will help employees improve opportunity recognition, enlighten new ways to solve problems, and nurture innovation activities (Svetlik, Stavrou-Costea, & Lin, 2007). Knowledge sharing can also increase the likelihood of combining existing and new knowledge to produce new products and improvements (Huang & Li, 2009), thus protecting knowledge from expropriation. Based on this, we hypothesize:

H1: Employees' knowledge sharing behavior will increase their effective knowledge application.

Belief in support for creative use

Past research defines support for creativity as an employees' perception of the extent to which supervisors and coworkers encourage employees to develop and refine creative ideas (Madjar, Oldham, & Pratt, 2002) or their organization stimulates, respects, rewards, and recognizes creativity (Scott & Bruce, 1994; Jing Zhou & Jennifer M. George, 2001). We adopt the definition of "perceived support for creative use" of an ECS (PSC) as "the extent to

which an employee believes that the ECS stimulates, helps, and motivates him/her to exhibit creative use of the systems" from past studies (Park, Al-Ramahi, & Cho, 2015).

When employees believe that an ECS will help them solve problems and improve work performance, they will increase its use (Park et al., 2015). In addition, when employees begin seeing that ECSs have the capability to help them be effective and creative, they will use them as a result of conscious attempts to improve habitual actions (Dalton, 2004). As employees use an IS as a part of their daily work, they become habitual users. This repeated use will increase their familiarity with the ECS. Employees will then identify creative uses of ECS features and functions, which could help them apply knowledge to improve organizational products, services, processes, etc. Based on this, we hypothesize:

H2: Employees' belief in ECS support for creative use will increase their effective knowledge application.

The impact of effective knowledge application

The benefits of technological innovations such as ECSs can be realized only when they are completely accepted and used (Grublješič & Jaklič, 2015). User satisfaction with an IS increases as the result of its effective use and is based on users' willingness to repeatedly use the system (Zviran & Erlich, 2003). Park et al. (2015) believe that employees' repeated use of an information system occurs when it is perceived to be useful in enhancing job performance but does not replace their work and skills.

Likewise, employees' satisfaction with an ECS improves as they voluntarily and repeatedly use it (Park et al., 2015), since its use is primarily optional and voluntary in comparison to operational IS (Grublješič & Jaklič, 2015). User satisfaction increases when employees realize that shared knowledge in ECSs can be applied and integrated into their work to improve efficiency, as originally intended by ECSs. Based on this, we hypothesize:

H3: Effective knowledge application is positively related to ECS satisfaction.

Idea realization culminates in behavior. Effective knowledge application may enable integrating shared knowledge to develop new products and prototypes or improve existing products. It also facilitates new innovative idea generation. Knowledge application is key for organizations to take full advantage of collective knowledge to achieve maximum performance (Alavi & Leidner, 2001). Organizations that have proficiency in generating and integrating knowledge are more likely to have the potential to sustain high levels of innovation. The openness of the ECSs across domains allows employees to effectively apply or adapt existing ideas and generate new ideas, either by collaborating with the submitter or by crediting them. Based on these, we hypothesize:

H4: Effective knowledge application is positively related to innovative behavior.

ECS satisfaction and job performance

Delone and McLean (2003) established that user satisfaction would result in net benefits for individuals and organizations. These net benefits include cost savings, expanded markets, incremental additional sales, reduced search costs, time saved, etc. The impact of user satisfaction on user performance has been well documented in the literature. Guimaraes and Igbaria (1997) found end-user satisfaction has a significant relationship to end-user job performance in server/client set up. Hou (2012) found that user satisfaction has a strong direct influence on users' performance in the Business Intelligence systems context. Based on these, we hypothesize that:

H5: ECS satisfaction is positively related to job performance.

Innovative behavior and job performance

Organizations and employees collect and possess intelligence about their customers' needs and competitors' product lines (Im & Workman Jr, 2004). Highly motivated, innovative employees transform this intelligence into creative ideas in various forums including ECSs

and develop new products and services, resulting in increased relative market share, relative sales, relative ROI, relative profitability, etc.

The goal for innovation in the workplace is to bring high-performance gains (Anderson, Potočnik, & Zhou, 2014). Individuals' innovative behavior resulting from companies' new technologies such as ECSs is expected to bring new ways of doing their job and bring about efficiency gains regarding increased productivity, work quality, decreased error rate, and increased ability. We hence hypothesize:

H6: Employees' innovative behavior is positively related to job performance.

CHAPTER 4

METHODOLOGY, DATA COLLECTION, AND ANALYSIS STRATEGY

Method

We conducted a field study utilizing a multi-actor dyadic survey method (Klein, Rai, & Straub, 2007) to avoid self-reported bias (common method bias) (Conway & Lance, 2010; Kim & Yukl, 1995). The subjects were employees in organizations that utilize enterprise crowdsourcing systems to innovate. To avoid participation bias (Wendelken et al., 2014), the sample was randomly selected to include subjects that have and have not used ECSs to submit innovative ideas. Data were collected online from employees of 15 IT-related companies in the U.S. between September and November 2016. Employees (N = 300) and their supervisors (N = 92) were invited to complete surveys. We received usable data from 183 dyads (effective response rate of 61%) who are familiar with their innovative behavior. The usable number of dyads is of an acceptable size and consistent with similar studies (Klein et al., 2007; Scandura & Schriesheim, 1994). Data regarding the subjects' personal attributes and their employers' support for innovation were also gathered. Most measurement scales for this study were adapted from existing measures that have been proved reliable and valid in prior studies. The surveys were initially pilot-tested, and the feedback was incorporated into the formal surveys. Formal surveys were completed by 183 employees and 74 supervisors from different domains. Thirty-nine supervisors, each with 1 employee, 10 supervisors, each with 2 employees, 4 supervisors, each with 3 employees, and 2 supervisors, each with 6 employees, responded to the surveys. Table 5 provides the demographic characteristics of respondents.

Measures

Knowledge sharing - Knowledge sharing is measured using a six-item scale adapted from (Koh & Kim, 2004). Sample items included, "I often help my coworkers requiring help from others in ECS" and "I take care about my coworkers participating in ECS."

Belief in ECS support for creative use - This construct is measured using a ten-item scale from creative behaviors measured by (Jing Zhou & Jennifer M George, 2001). Sample items included, "I found that ECS is s a good source of creative ideas" and "I found the new ways of using ECS to increase quality of my job."

Effective knowledge application - Creative knowledge application is measured using a five-item scale adapted from (Chen & Huang, 2009; S. Y. Choi et al., 2010). Sample items included, "Our team members apply knowledge learned from ECS" and "I effectively utilize knowledge gained from ECS into practical use."

Innovative behavior - Innovative behavior is measured by a ten-item scale adapted from (De Jong & Den Hartog, 2010). The sample included, "He/she suggests new ways to achieve goals or objectives of the project" and "He/she suggests me new ways to increase quality of the project."

ECS satisfaction - ECS satisfaction is measured using a four-item scale adapted from (Bhattacherjee, 2001; Sharabati et al., 2015). Sample items included, "I am satisfied with the reliability of information output from the ECS" and "I am satisfied with the accuracy of the outputs from the ECS."

Individual job performance - Individual job performance is measured using a three-item scale from (Kositanurit et al., 2011). The sample included, "I am satisfied with my job" and "In general, I like my job."

Control variables - Several control variables will be included to control for unknown effects, because some evidence indicates that these demographic factors might be related to some contextual and dependent variables included in the study. Four variables (i.e., age, education, gender, and experience) will be controlled because prior research has linked gender differences, age, job position, and education to the work environment and IS (Park et al., 2015).

Table 3 and Table 4 provide additional details on survey measures and items. Specifically, Table 3 lists all questions for each construct and related literature. Table 4 lists all survey items and variables.

Table 3. Survey measures items list

Constructs	Questions	Related literature
Job Performance	1. I am satisfied with my job. 2. In general, I like my job. 3. In general, I like working at this firm.	(Kositanurit et al., 2011)
ECS Satisfaction	1. I am satisfied with the reliability of information output from the ECS. 2. I am satisfied with the quality of online information and reports available. 3. I am satisfied with the time required for the ECS to give me output. 4. I am satisfied with the level of relevancy received from the ECS. 5. I am satisfied with the accuracy of the outputs from the ECS. 6. Overall, I am very satisfied with the ECS.	(Bhattacherjee, 2011; Sharabati et al., 2015)

Innovative Behavior	1. He/she suggests new ways to achieve goals or objectives of the project. 2. He/she comes up with new and practical ideas to improve the project performance. 3. He/she searches out new technologies, processes, techniques, and/or project ideas. 4. He/she suggests me new ways to increase quality of the project. 5. He/she is a good source of creative ideas. 6. He/she is not afraid to take risks. 7. He/she promotes and champions ideas to others. 8. He/she exhibits creativity on the project when given the opportunity to. 9. He/she develops adequate plans and schedules for the implementation of new ideas. 10. He/she often has new and innovative ideas. 11. He/she comes up with creative solutions to problems. 12. He/she often has a fresh approach to problems. 13. He/she suggests new ways of performing work on his/her part of the project. 14. He/she generates creative ideas.*	(De Jong & Den Hartog, 2010; Scott & Bruce, 1994)
Effective Knowledge Application	1. Our team members apply knowledge learned from ECS. 2. Our team members use knowledge from ECS to solve new problems. 3. Our team members apply knowledge from ECS to solve new problems. 4. I effectively manage knowledge gained from ECS into practical use. 5. I effectively utilize knowledge gained from ECS into practical use.	(Chen & Huang, 2009; Choi et al., 2010)
Knowledge Sharing	1. I take active part in our ECS. 2. I do my best to stimulate our ECS. 3. I often provide useful information/contents to my coworkers in ECS. 4. I eagerly reply to postings by the seeking help in our ECS. 5. I care about my coworkers participating in ECS. 6. I often help my coworkers who require assistance from others in ECS. 7. I share my work reports and official documents with coworkers in ECS.	(Koh & Kim, 2004)

	8. My coworkers share their manuals and methodologies with others in ECS. 9. I share my know-how and experience with my coworkers in ECS. 10. My coworkers share their know-how and experience with others.	
Belief in ECS Support for Creative Use	1. I found new ways of using ECS to achieve goals or objectives. 2. I found new and practical ideas from our ECS to improve performance. 3. I found new ways of using ECS to increase quality of my job. 4. I found that ECS is s a good source of creative ideas. 5. I found that ECS give me creative tips to solve problems. 6. I found a new way to perform my tasks through ECS.	(Zhou & George, 2001)
Note: * item has been removed for low factor loading.		

Table 4. Indicators (Survey items)

Construct	**Variable**	**Questions**
Email	Email	Your email address
Gender	Gender	Your gender?
Age	Age	Your age?
Education	Edu	Your education level?
Job Position	Job	Your job position?
Organizational Support for Innovation	OrgSup	Does your organization support innovation?
Idea	Idea	Have you ever submitted innovative idea(s) at your employment?
Experience	ExpYrs	How long have you been in current company?
Contribution Management	CONTR1	ECS clearly presents overall business problems/objectives.

Contribution Management	CONTR2	ECS clearly published idea evaluation procedures.
Contribution Management	CONTR3	Ideas are chosen purely on merit and not any other undue pressure.
Contribution Management	CONTR4	ECS has effective incentive mechanism.
Contribution Management	CONTR5	ECS has effective rating mechanism.
Collaboration Management	COLLA1	ECS at my work provides tools to perform innovation activities to achieve desired business goals.
Collaboration Management	COLLA2	ECS at my work collects innovative ideas and suggestions consistently.
Collaboration Management	COLLA3	ECS at my work sends quick reaction/feedback from other employees relating to my ideas and suggestions.
Collaboration Management	COLLA4	ECS at my work facilitates colleagues to work collaboratively to implement new ideas.
Collaboration Management	COLLA5	ECS at my work enables me to promptly receive answers to my questions and problems from other employees.
Collaboration Management	COLLA6	ECS at my work helps me to share collaborative norms such as reciprocity and fairness.
Collaboration Management	COLLA7	ECS at my work motivates me to be a responsible and contributing member.
Trust Management	TRUST1	ECS has enough safeguards to make me feel comfortable using it to submit innovative ideas.
Trust Management	TRUST2	ECS has enough safeguards to make me feel comfortable using it to collaborate with my colleagues on innovative ideas.
Trust Management	TRUST3	ECS is competent and effective in facilitating innovation.
Trust Management	TRUST4	ECS performs its role of facilitating innovation very well.
Trust Management	TRUST5	ECS provides access to view details of all ideas and feedbacks.
Trust Management	TRUST6	ECS maintains and publishes status and progress of all submitted ideas.
Intrinsic Motivation	INMO1	I enjoy helping my coworkers by sharing my knowledge in ECS.
Intrinsic Motivation	INMO2	It feels good to help my coworkers by sharing my knowledge

Intrinsic Motivation	INMO3	No matter what the outcome of the innovative ideas submitted in ECS, I am satisfied if I feel I gained a new experience participating/contributing
Intrinsic Motivation	INMO4	What matters most to me is enjoying what I contribute in ECS
Intrinsic Motivation	INMO5	Curiosity is the driving force behind much of what I contribute in ECS
Intrinsic Motivation	INMO6	I want to challenge myself to solve the problems submitted in ECS
Intrinsic Motivation	INMO7	I want to find out how good I really can be in solving problems submitted in ECS
Job Stress	STRESS1	I feel a great deal of stress because of my job.
Job Stress	STRESS2	My job is extremely demanding.
Job Stress	STRESS3	Very few stressful things happen to me at work.
Job Stress	STRESS4	My work is stress free.
Job Stress	STRESS5	My job seems more stressful than most.
Job Stress	STRESS6	Stress is a big part of my job.
Extrinsic Motivation	EXMO1	I will receive a higher salary in return for my knowledge sharing in ECS
Extrinsic Motivation	EXMO2	I will receive a higher bonus in return for my knowledge sharing in ECS.
Extrinsic Motivation	EXMO3	I will receive increased promotion opportunities in return for my knowledge sharing in ECS.
Extrinsic Motivation	EXMO4	I will receive increased job security in return for my knowledge sharing in ECS.
Conscientiousness - Personality Trait	CONTR1	I concentrate on completing my work tasks correctly to increase my job security.
Conscientiousness - Personality Trait	CONTR2	At work I focus my attention on completing my assigned responsibilities.
Conscientiousness - Personality Trait	CONTR3	Fulfilling my work duties is very important to me.
Conscientiousness - Personality Trait	CONTR4	At work, I strive to live up to the responsibilities and duties given to me by others.
Conscientiousness - Personality Trait	CONTR5	At work, I am often focused on accomplishing tasks that will support my need for security.
Conscientiousness - Personality Trait	CONTR6	I do everything I can to avoid loss at work.

Conscientiousness - Personality Trait	CONTR7	Job security is an important factor for me in any job search.
Conscientiousness - Personality Trait	CONTR8	I focus my attention on avoiding failure at work.
Conscientiousness - Personality Trait	CONTR9	I take chances at work to maximize my goals for advancement.
Conscientiousness - Personality Trait	CONTR10	I tend to take risks at work in order to achieve success.
Conscientiousness - Personality Trait	CONTR11	If I had an opportunity to participate on a high-risk, high-reward project I would definitely take it.
Conscientiousness - Personality Trait	CONTR12	If my job did not allow for advancement, I would likely find a new one.
Conscientiousness - Personality Trait	CONTR13	A chance to grow is an important factor for me when looking for a job.
Conscientiousness - Personality Trait	CONTR14	I focus on accomplishing job tasks that will further my advancement.
Participative Leadership	LEAD1	My manager helps me understand how my objectives and goals relate to that of the company.
Participative Leadership	LEAD2	My manager helps me understand the importance of my work to the overall effectiveness of the company.
Participative Leadership	LEAD3	My manager helps me understand how my job fits into the bigger picture.
Participative Leadership	LEAD4	My manager makes many decisions together with me.
Participative Leadership	LEAD5	My manager often consults me on strategic decisions.
Participative Leadership	LEAD6	My manager solicits my opinion on decisions that may affect me.
Participative Leadership	LEAD7	My manager believes that I can handle demanding tasks.
Participative Leadership	LEAD8	My manager believes in my ability to improve even when I make mistakes.
Participative Leadership	LEAD9	My manager expresses confidence in my ability to perform at a high level.
Participative Leadership	LEAD10	My manager allows me to do my job my way.
Participative Leadership	LEAD11	My manager makes it more efficient for me to do my job by keeping the rules and regulations simple.

Participative Leadership	LEAD12	My manager allows me to make important decisions quickly to satisfy customer needs.
Organizational Support for Innovation	CLIM1	Creativity is encouraged here.
Organizational Support for Innovation	CLIM2	Our ability to function creatively is respected by the leadership.
Organizational Support for Innovation	CLIM3	Around here, people are allowed to try to solve the same problems in different ways.
Organizational Support for Innovation	CLIM4	This organization can be described as flexible and continually adapting to change.
Organizational Support for Innovation	CLIM5	This organization is open and responsive to change.
Organizational Support for Innovation	CLIM6	The reward system here encourages innovation.
Organizational Support for Innovation	CLIM7	This organization publicly recognizes those who are innovative.
Organizational Support for Innovation	CLIM8	Assistance in developing new ideas is readily available.
Organizational Support for Innovation	CLIM9	There are adequate resources devoted to innovation in this organization.
Organizational Support for Innovation	CLIM10	This organization gives me free time to pursue creative ideas during the workday.
Knowledge Sharing Behavior	KS1	I take active part in our ECS.
Knowledge Sharing Behavior	KS2	I do my best to stimulate our ECS.
Knowledge Sharing Behavior	KS3	I often provide useful information/contents to my coworkers in ECS

Knowledge Sharing Behavior	KS4	I eagerly reply to postings by the seeking help in our ECS
Knowledge Sharing Behavior	KS5	I take care about my coworkers participating in ECS
Knowledge Sharing Behavior	KS6	I often help my coworkers requiring help from others in ECS
Knowledge Sharing Behavior	KS7	I share my work reports and official documents with coworkers in ECS
Knowledge Sharing Behavior	KS8	My coworkers share their manuals and methodologies with others in ECS
Knowledge Sharing Behavior	KS9	I share my know-how and experience with my coworkers in ECS
Knowledge Sharing Behavior	KS10	My coworkers share their know-how and experience with others
Creative Knowledge Application	KAPP1	I take active part in our ECS
Creative Knowledge Application	KAPP2	I do my best to stimulate our ECS
Creative Knowledge Application	KAPP3	I often provide useful information/contents to my coworkers in ECS
Creative Knowledge Application	KAPP4	I eagerly reply to postings by the seeking help in our ECS
Creative Knowledge Application	KAPP5	I take care about my coworkers participating in ECS
Creative Knowledge Application	CUSE1	Using the ECS enables me to accomplish job-related tasks more quickly.
Creative Knowledge Application	CUSE2	Using the ECS improves my job performance.
Creative Knowledge Application	CUSE3	Using the ECS in my job increases my productivity.

Creative Knowledge Application	CUSE4	Using the ECS enhances my effectiveness on the job.
Creative Knowledge Application	CUSE5	Using the ECS makes it easier to do my job.
Creative Knowledge Application	CUSE6	I find the ECS useful in my job.
Support for Creative use of ECS	SUPP1	I found the new ways of using ECS to achieve goals or objectives.
Support for Creative use of ECS	SUPP2	I found the new and practical ideas from our ECS to improve performance.
Support for Creative use of ECS	SUPP3	I found the new ways of using ECS to increase quality of my job.
Support for Creative use of ECS	SUPP4	I found that ECS is s a good source of creative ideas
Support for Creative use of ECS	SUPP5	I found that ECS give me creative tips to solve problems.
Support for Creative use of ECS	SUPP6	I found a new way from ECS to perform my tasks
Support for Creative use of ECS	CSAT1	I am satisfied with the reliability of information output from the ECS.
Support for Creative use of ECS	CSAT2	I am satisfied with the quality of online information and reports available in the ECS.
Support for Creative use of ECS	CSAT3	I am satisfied with the time required for the ECS to give me output.
Support for Creative use of ECS	CSAT4	I am satisfied with the level of relevancy received from the ECS.

Support for Creative use of ECS	CSAT5	I am satisfied with the accuracy of the outputs from the ECS.
Support for Creative use of ECS	CSAT6	Overall, I am very satisfied with the ECS.
State of mind	TURN1	As soon as I can find a better job, I'll quit.
State of mind	TURN2	I often think about quitting my job in this company.
Job Satisfaction	JOBS1	I am satisfied with my job.
Job Satisfaction	JOBS2	In general, I like my job.
Job Satisfaction	JOBS3	In general, I like working at this firm.
Organizational commitment	COMM1	My team member appears to be highly committed to the organization.
Organizational commitment	COMM2	My team member appears to be emotionally attached to the organization.
Organizational commitment	COMM3	My team member views the organizational problems as his or her own.
Organizational commitment	COMM4	My team member really cares about the fate of this organization.
Innovative Behavior	CREA1	He/she suggests new ways to achieve goals or objectives of the project.
Innovative Behavior	CREA2	He/she comes up with new and practical ideas to improve the project performance.
Innovative Behavior	CREA3	He/she searches out new technologies, processes, techniques, and/or project ideas.
Innovative Behavior	CREA4	He/she suggests me new ways to increase quality of the project.
Innovative Behavior	CREA5	He/she is a good source of creative ideas
Innovative Behavior	CREA6	He/she is not afraid to take risks
Innovative Behavior	CREA7	He/she promotes and champions ideas to others.
Innovative Behavior	CREA8	He/she exhibits creativity on the project when given the opportunity to.
Innovative Behavior	CREA9	He/she develops adequate plans and schedules for the implementation of new ideas.
Innovative	CREA10	He/she often has new and innovative ideas.

Behavior		
Innovative Behavior	CREA11	He/she comes up with creative solutions to problems.
Innovative Behavior	CREA12	He/she often has a fresh approach to problems
Innovative Behavior	CREA13	He/she suggests a new ways of performing work his parts of the project.
Innovative Behavior	CREA14	He/she generates creative ideas.
Job Commitment	JOB1	He/she always completes the duties specified in his/her job description.
Job Commitment	JOB2	He/she meets all the formal performance requirements of the job.
Job Commitment	JOB3	He/she fulfills all responsibilities required by his/her job.
Job Commitment	JOB4	He/she never neglects aspects of the job that he/she is obligated to perform.
Job Commitment	JOB5	He/she often fails to perform essential duties. (reversed)
Attendance	ATTE1	Exhibits punctuality in arriving at work on time after break.
Attendance	ATTE2	Begins work on time.
Attendance	ATTE3	Attendance at work is above the norm.
Attendance	ATTE4	Gives advance notice when unable to come to work.
Innovative Behavior	IBEH1	Creating new ideas for improvements
Innovative Behavior	IBEH2	Mobilizing support for innovative ideas
Innovative Behavior	IBEH3	Searching out new working methods, techniques, or instruments
Innovative Behavior	IBEH4	Acquiring approval for innovative ideas
Innovative Behavior	IBEH5	Transforming innovative ideas into useful applications
Innovative Behavior	IBEH6	Generating original solutions to problems
Innovative Behavior	IBEH7	Introducing innovative ideas in a systematic way
Innovative Behavior	IBEH8	Making important organizational members enthusiastic for innovative ideas
Innovative Behavior	IBEH9	Thoroughly evaluating the application of innovate ideas

Data collection and analysis strategy

The research strategy adopted in this study was causal-predictive analysis in nature. By reviewing the relevant literature, the hypotheses are deducted and tested from the data collection through a multi-actor dyadic survey. Data was collected from employees and their supervisors, who received separate questionnaires. A seven-point Likert scale was used. The employees and their supervisors worked for organizations that have used ECSs. The respondents' anonymity in the survey has been maintained to ensure unbiased responses to get true reflections of respondents' attitudes towards the above-mentioned constructs.

Partial least squares (PLS), as implemented in SmartPLS version 2.0, is used for data analysis (Ringle, Wende, & Will, 2005). The PLS approach allows researchers to assess measurement model parameters and structural path coefficients simultaneously (Park et al., 2015). PLS is used for several reasons: (1) this study was primarily intended for causal-predictive analysis; (2) PLS requires fewer statistical specifications and constraints on the data than the covariance-based strategy of LISREL (e.g., assumptions of normality); and (3) PLS is effective for those early-theory testing situations that characterized this study. Therefore, PLS is an appropriate statistical analysis tool for the current study. It focuses on a prediction-oriented and data-analytic method, seeking to maximize the variances that are explained in the constructs (Barclay, Higgins, & Thompson, 1995).

Descriptive analysis has been used to provide a demographic profile of the respondents, including gender, age, job title, job experience, education, and idea submission status. The research questions studying the relationship between constructs have been established using standard statistical measures.

Reliability and validity tests have been conducted for each construct with measures. Reliability is a measure of the degree to which the set of indicators of a latent construct is internally consistent based on how highly interrelated the indicators are with each other. As

reliability goes up, the relationship between a construct and the indicators is greater, meaning that construct explains more of the variance in each indicator and the amount of measurement error decreases (Hair & Anderson, 2010). Two estimates of reliability are Cronbach's Alpha and composite reliability. Cronbach's Alpha (α) reliability estimates will be used to measure the internal consistency. To ensure that the instrument has reasonable construct validity, confirmatory factor analyses with the help of SmartPLS has been used.

CHAPTER 5

DATA ANALYSIS AND RESULTS

Sample description

The sample for this study consisted of 183 dyads that included 183 employees and 74 supervisors working in various domains. Employees (N = 300) and their supervisors (N = 92) were invited to complete surveys. We received usable data from 183 dyads (effective response rate of 61%). These employees and supervisors are familiar with innovative behavior. The scale for the survey was a 7-point Likert scale. Employees and their supervisors completed separate questionnaires, and their responses were kept private.

Demographic data

The demographic characteristics of the sample included gender, age, job title, job experience, education, and employee ever submitted ideas as shown in Table 5.

There were 53.6% male respondents and 46.4% female respondents. The majority (41.5%) were older than 40, 32.2% were aged 31 to 40 years old, 24.6% were 21 to 30 years old, and 1.7% were younger than 21. As far as their job title, 15.3% of them were executives, 50.2% were managers, and 34.5% were others. When asked about the years of experience, 4.5% had less than one year of experience, 39% had 1-5 years of experience, 32.8% had 6-10 years of experience, 12.6% had 11-15 years of experience, 5.6% had 16-20 years of experience, and the remaining .5% had more than 20 years of experience. Regarding education, 3.8% of the respondents had a doctorate, 29% had a professional degree, 40.4% had a 4-year degree, 9.2% had a 2-year degree, 10.3% had some college education, and 8.1% had completed high school. Finally, 77.6% of the respondents had submitted at least one

innovative idea to the ECS, and the other/remaining 22.4% had never submitted innovative ideas.

Table 5. Demographic characteristics (N=183)

Gender	**Age**	**Job Title**
Male: 98 (53.6%) Female: 85 (46.4%)	<21 years:3 (1.7%) 21-30 years: 45 (24.6%) 31-40 years: 59 (32.2%) >40 years: 76 (41.5%)	Executive: 28 (15.3%) Manager: 92 (50.2%) Other: 63 (34.5%)
Job Experience	**Education**	**Ever Submitted Ideas?**
<1 year: 8 (4.5%) 1 – 5 years: 71 (39%) 6 – 10 years: 60 (32.8%) 11 – 15 years: 23 (12.6%) 16 – 20 years: 11 (5.6%) >20 years: 10 (5.5%)	Doctorate: 7 (3.8%) Professional Degree: 53 (29%) 4-year degree: 74 (40.4%) 2-year degree: 17 (9.2%) Some college: 19 (10.3%) High school graduate: 15 (8.1%) Less than high school: 0	Yes – 142 (77.6%) No – 41 (22.4%)

Data analysis

Partial least squares (PLS), as implemented in SmartPLS version 2.0, is used for data analysis (Ringle et al., 2005). The PLS approach allows researchers to assess measurement model parameters and structural path coefficients simultaneously (Park et al., 2015).

Results

Measurement model

PLS generates statistics to test the validity and reliability of latent constructs that include composite reliability (CR), average variance extracted (AVE), Cronbach's alpha

(CA), intercorrelations among variables, and the square root of AVE on the diagonal. First, by examination, all factor loadings of indicators associated with each construct are > 0.6. Second, the CR, an internal consistency estimate that is similar to CA, is > 0.7 for each construct. Third, the AVE exceeded the recommended criterion of 0.5 for all measures (Chin, 2010; Fornell & Larcker, 1981; Hair, Babin, & Anderson, 2009; Vinzi, Trinchera, & Amato, 2010).

In PLS, convergent and discriminant validity is assessed using criteria requiring that the construct representing items should share more variance with its items that with other constructs in the model (Chin, 1998). The diagonal elements in the matrix in Table 6 shows the square root of the AVE by each construct with its indicators. Sufficient convergent and discriminant validity was obtained based on examination of the values.

Structural model

Figure 2 depicts the PLS results. The hypothesized paths from knowledge sharing (H1) and support for the creative use of ECS (H2) have a significant impact on knowledge application, supporting both. As expected, knowledge application has a significant impact on ECS satisfaction (H3) and a positive impact on innovative behavior (H4). ECS satisfaction has a significant impact on job performance, supporting (H5). Innovative behavior also has a positive impact on job performance (H6). The relationship between knowledge application and job performance is not found to be significant. None of the control variables have a significant impact on job performance.

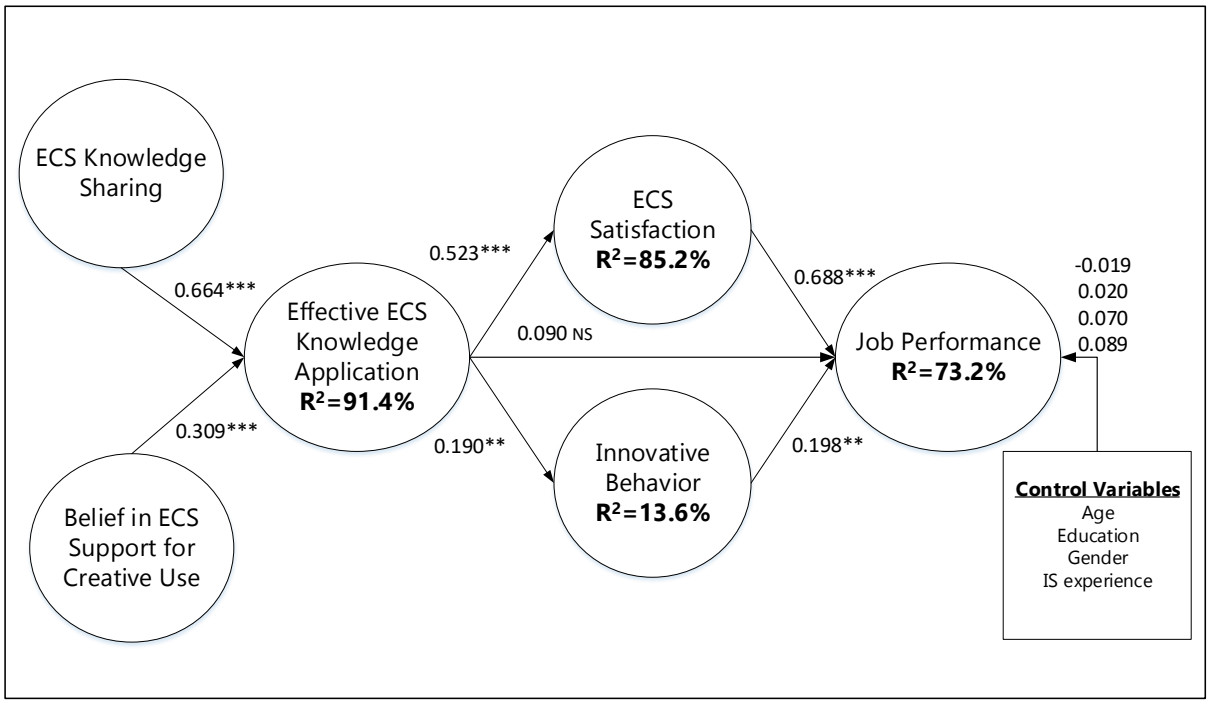


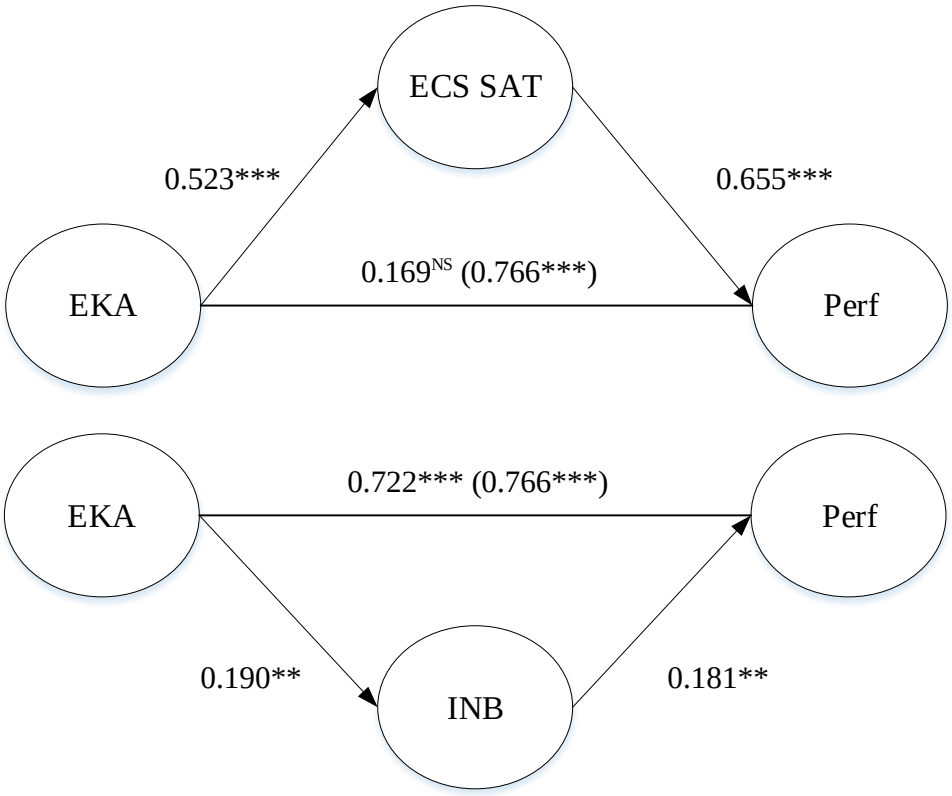
Figure 2. Path coefficients

Post hoc Analysis

The purpose of the post hoc analysis is to further investigate the mediating effects of ECS satisfaction and innovative behavior on the relationship between KA and job performance. While the correlation results showed the high relationship between creative knowledge application with ECS and employees' job performance, the results indicated no significant relationship that led us to further explore the roles of ECS satisfaction and innovative behavior on the relationship. To test our mediation effect, in the post hoc analysis we employed Baron and Kenny's mediation test (1986). Due to the multiple mediators (ECS satisfaction and innovative behavior), we investigated the effect of each respective mediator on the relationship. This allowed us to explore a specific mediated path, which provided information on the unique effect of the respective mediator, while controlling for the other mediator (Kenny, Kashy, & Bolger, 1998).

We first identified whether EKA was significantly related to job performance when the mediator is not added to job performance. The result showed a significant relationship (β =0.766, p < 0.001). Next, the mediators and job performance were significantly related to each other as shown in Figure 3. Lastly, to infer a full/partial mediation effect, the direct relationship between EKA and job performance should be nonsignificant.

Figure 3 shows the results of mediation analysis. When ECS satisfaction was added into the direct relationship, this variable was significantly related to job performance (β = 0.655, p < 0.001). When innovative behavior was added into the direct relationship, this mediator had a significant but relatively weak relationship with job performance (β = 0.181, p < 0.01).



Note: EKA: Effective Knowledge Application, ECS SAT: Satisfaction, INB: Innovative Behavior, Perf: Job Performance.
The value in parentheses is direct path coefficient

Figure 3. Post hoc model

Conversely, the direct effect of EKA on job performance ($\beta = 0.766$, $p < 0.01 \rightarrow \beta = 0.169$, $p > 0.10$) became nonsignificant for CS satisfaction, indicating the presence of the full mediation effect, while innovative behavior showed partial mediation effect ($\beta = 0.766$, $p < 0.01 \rightarrow \beta = 0.722$, $p < 0.001$). The results of the post hoc analysis showed that ECS satisfaction is a more important factor mediating the effect of EKA on job performance than innovative behavior. The possible explanation could be the work environment - employees who work with crowdsourcing systems are highly likely to consider satisfaction with the crowdsourcing system as a critical factor enhancing their job performance. That is, employees' creative use behavior of the crowdsourcing system for applying knowledge in their work could be overlooked because ECS satisfaction absorbs the effect of it on job performance. This result provides additional insight into contributing factors to the social network adoption levels.

Reliability

Reliability is a measure of the degree to which a set of indicators of a latent construct is internally consistent based on how highly interrelated the indicators are with each other. As reliability goes up, the relationship between a construct and the indicators is greater, meaning that construct explains more of the variance in each indicator and the amount of measurement error decreases (Hair & Anderson, 2010).

Two estimates of reliability, Cronbach's Alpha and Composite Reliability, are shown in Table 6. The agreed upon lower limit for Cronbach's Alpha is 0.70, although it may decrease to 0.60 in exploratory research (Hair & Anderson, 2010). In analyzing our study, Table 5 shows the lower limit of Cronbach's Alpha is 0.96 and the Composite Reliability is 0.82 for each latent construct; an upper limit of 1.0 for both indicates the reliability of the measurement model. High construct reliability indicates that internal consistency exists (Hair & Anderson, 2010).

Table 6. PLS component-based analysis: cross loadings

Constructs	Items	Job Perf	ECS Sat	Innovation	EKA	KS	Support	CA	CR	AVE
Job Perf.	JSAT1	**0.975**	0.826	0.322	0.787	0.756	0.781	0.961	0.975	0.928
	JSAT2	**0.982**	0.829	0.307	0.789	0.757	0.786			
	JSAT3	**0.934**	0.727	0.254	0.693	0.654	0.693			
ECS Satisfaction	ESAT1	0.814	**0.975**	0.122	0.899	0.879	0.908	0.988	0.990	0.947
	ESAT2	0.818	**0.974**	0.123	0.899	0.872	0.906			
	ESAT3	0.811	**0.982**	0.165	0.895	0.873	0.905			
	ESAT4	0.787	**0.976**	0.130	0.901	0.881	0.915			
	ESAT5	0.806	**0.983**	0.145	0.898	0.879	0.913			
	ESAT6	0.786	**0.951**	0.186	0.898	0.870	0.911			
Innovative Behavior	CREA1	0.258	0.117	**0.882**	0.151	0.130	0.134	0.974	0.977	0.757
	CREA2	0.263	0.105	**0.889**	0.134	0.109	0.131			
	CREA3	0.217	0.087	**0.886**	0.142	0.132	0.106			
	CREA4	0.190	0.013	**0.814**	0.051	0.005	0.015			
	CREA5	0.206	0.050	**0.880**	0.082	0.080	0.091			
	CREA6	0.197	-0.014	**0.675**	0.007	-0.005	-0.007			
	CREA7	0.292	0.158	**0.901**	0.197	0.194	0.183			
	CREA8	0.258	0.102	**0.937**	0.154	0.135	0.125			
	CREA9	0.334	0.212	**0.890**	0.265	0.264	0.236			
	CREA10	0.347	0.235	**0.922**	0.268	0.244	0.226			
	CREA11	0.296	0.145	**0.954**	0.186	0.176	0.173			
	CREA12	0.316	0.196	**0.937**	0.220	0.193	0.202			
	CREA13	0.267	0.099	**0.945**	0.135	0.114	0.124			
Effective Knowledge Application	EKA1	0.763	0.894	0.177	**0.974**	0.912	0.885	0.987	0.989	0.951
	EKA2	0.772	0.900	0.204	**0.979**	0.912	0.890			
	EKA3	0.772	0.912	0.175	**0.983**	0.917	0.900			
	EKA4	0.765	0.898	0.188	**0.972**	0.945	0.912			
	EKA5	0.766	0.897	0.184	**0.969**	0.942	0.908			
Knowledge	KS1	0.727	0.872	0.210	0.917	**0.949**	0.886	0.988	0.989	0.905

Sharing	KS2	0.736	0.897	0.200	0.929	**0.966**	0.906			
	KS3	0.731	0.881	0.175	0.924	**0.971**	0.903			
	KS4	0.703	0.834	0.197	0.881	**0.937**	0.873			
	KS5	0.715	0.879	0.169	0.920	**0.972**	0.902			
	KS6	0.709	0.873	0.165	0.922	**0.970**	0.904			
	KS7	0.685	0.816	0.139	0.869	**0.931**	0.842			
	KS8	0.703	0.831	0.094	0.886	**0.940**	0.850			
	KS9	0.735	0.853	0.162	0.913	**0.960**	0.890			
	KS10	0.710	0.822	0.122	0.867	**0.920**	0.835			
Belief in ECS Support for Creative Use	SUPP1	0.763	0.893	0.192	0.900	0.903	**0.966**	0.989	0.991	0.950
	SUPP2	0.750	0.910	0.185	0.897	0.903	**0.979**			
	SUPP3	0.753	0.904	0.169	0.881	0.888	**0.975**			
	SUPP4	0.777	0.912	0.153	0.902	0.902	**0.972**			
	SUPP5	0.766	0.921	0.125	0.909	0.904	**0.977**			
	SUPP6	0.773	0.927	0.163	0.903	0.905	**0.980**			

Table 7. Inter-correlation of constructs

	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**
(1) JPerf	**1.000**								
(2) Sat.	0.826	**1.000**							
(3) IB	0.307	0.149	**1.000**						
(4) EKA	0.787	0.923	0.190	**1.000**					
(5) KS	0.752	0.900	0.172	0.949	**1.000**				
(6) PSC	0.783	0.935	0.169	0.922	0.924	**1.000**			
(7) Age	-0.135	-0.182	-0.010	-0.187	-0.167	-0.187	**1.000**		
(8) Edu	-0.235	-0.250	0.029	-0.223	-0.216	-0.221	0.061	**1.000**	
(9) Exp	0.069	-0.013	-0.005	-0.033	-0.040	-0.031	0.403	-0.035	**1.000**
(10) Gen	0.239	0.235	-0.138	0.245	0.191	-0.238	-0.085	-0.321	-0.011

Bolded values along the diagonal are the SQRT of AVE for each latent construct

Table 8. Convergent validity (Communality > 0.5)

	Communality
Job Perf.	0.9288
ECS Satisfaction	0.9471
Innovative Behavior	0.7579
EKA	0.9515
KS	0.9057
PSC	0.9503
Age	1.0000
Education	1.0000
Experience	1.0000
Gender	1.0000

CHAPTER 6

IMPLICATIONS AND CONCLUSION

This study responds to the fundamental yet unanswered question of whether ECS factors such as knowledge sharing and support for the creative use of ECS impact employees' active use of ECS to submit and share their innovative ideas to improve their job performance. The findings show that two features of enterprise crowdsourcing systems lead employees to creatively apply knowledge via/through ECS to do their work. Our finding that the technical feature (i.e., KS) and employees' cognitive feature (i.e., CS support) have positive impact on EKA aligns with the findings and studies of S. Y. Choi et al. (2010) and Park et al. (2015) in transactive memory systems and virtual communities. One of the findings also reveals that EKA with ECS increases employees' satisfaction with ECS and their innovative behavior. Also, noting the strong relationship between EKA and job performance, the post hoc findings showed that the effect of EKA on job performance is mediated mainly by ECS satisfaction, consistent with past study (See, Petter, DeLone, & McLean, 2008). A weaker relationship between EKA and innovative behavior is possible since all submitted ideas don't get implemented (Baer, 2012) for both financial and political reasons in organizations.

Enterprises can be satisfied that existing ECS factors help improve employees' job performance but should find ways to improve innovative behavior. They can improve innovative behavior by first understanding employees' intrinsic and extrinsic motivational factors, then implementing or strengthening a solid reward system (Bretschneider, Rajagopalan, & Leimeister, 2012). Executives should show support for knowledge application and new product development (Baer, 2012), and acknowledge and provide social recognition for implementing innovative behavior (Yuan & Woodman, 2010).

Theoretical implications

Overall, this study responds to the fundamental yet unanswered question of whether crowdsourcing systems enhance employees' knowledge sharing and application. Based on this goal, a key contribution of this study is providing evidence that ECSs enhance knowledge sharing and EKA, based on creativity theory. In terms of the evidence, this study contributes to a new perspective on ECS usage in organizational settings. The traditional point of view from past research on IS use has adhered to the thought that it is a proxy of IS users' performance (DeLone & McLean, 1992; Seddon, 1997). Since ECS satisfaction is considered as a type of post-acceptance IS use (Li, Hsieh, & Rai, 2013), a better explanation is that employees perceive ECSs as a creative tool to enhance their job performance. In addition, by investigating effective knowledge application using ECSs, this study suggests that the role of ECS satisfaction and innovative behavior for job performance in the post-acceptance stage would be dependent upon crowdsourcing systems.

The current study also contributes theoretically to the existing ECS literature by introducing a new construct, EKA, and its implications for CS satisfaction, innovative behavior, and eventually job performance. Knowledge application was studied extensively by itself and in several variations. As predicted, this study found that the relationship between EKA and CS satisfaction, and then job satisfaction, is much stronger than EKA to innovative behavior to job performance. The mediating analysis found that innovative behavior strengthens the relationship between EKA and job performance, and CS satisfaction does not have a strong effect of EKA on job satisfaction. The results also revealed that the relationship between EKA and job satisfaction is not strong.

In addition, our study confirmed that knowledge sharing among employees across the organization would improve organizational creativity (Svetlik et al., 2007), and employees' (users) would use the IS when they believe in its usefulness to them. We have confirmed that the satisfaction of using IS can result in improved employee performance (Guimaraes & Igbaria, 1997; Hou, 2012).

Managerial implications

Given the importance of employees' innovation and improved job performance to the complex challenges faced by organizations to stay competitive in the marketplace, our study provides interesting implications to managers, which are of paramount importance because organizations make significant investments in time, money, and personnel when they introduce ECSs.

First, effective knowledge sharing among employees is the basis for any possible creativity. Knowledge sharing is effective when employees are motivated that their sharing will benefit them and the organization, and also feel safe and comfortable in sharing freely. Some of our advice to managers implementing ECS is: 1) invest in efforts to understand employees' intrinsic and extrinsic motivation and implement a sound reward package, 2) establish a superior security mechanism to provide a sense of security to their shared knowledge and their privacy, as needed, and 3) actively promote that ECS is capable of helping in employees' creativity through various organizational media and leadership.

Once knowledge keeps flowing within the organization, it is important to apply it in creating new products, improving existing products and processes, etc. Effective knowledge application is not only important for creating and improving products, but also will make (more) employees trust ECS and encourage them to use and contribute further. We advise managers to establish a process that keeps tabs on knowledge flow use, documenting and sharing it with the employee community. A well-designed dashboard in ECS can be an effective communication tool.

Effective knowledge application will result in employee satisfaction with using ECSs and improvement in innovative behavior when employees realize that innovation through the ECS helped them be more efficient in their work. When employees are satisfied with using the ECS in their work, their job performance will improve. The objective of an IS implementation is to ensure that the system is used by its users (employees) to the fullest and as often as possible. Our advice to managers in this regard is to establish a dedicated team to

ensure that innovation from ECS is continuously integrated into other organizational systems and processes, tracked, and communicated back to the employee community to gain more confidence in ECS.

Limitations

This study, with some limitations, is a preliminary step toward the deep understanding of ECS factors impacting employee participation and sharing of innovative ideas. First, the sample size is small and might not be representative of all the players who might be effective users of ECS. Like many other studies employing a dyadic methodology, the number of matched supervisor-subordinates responses is relatively small, 74. As Ellram and Hendrick (1995) mentioned, this research sacrifices a potentially larger response from organizations but gains richer and more insightful data, which includes the perspectives of supervisors. For future research, the sample size may have to be increased to get better representation. Second, we are restricted in generalizing our findings by studying limited industry types in the U.S. Future research will aim for statistical generalization by including samples from various industries, including non-profit and government organizations, across the globe.

Conclusion

It is evident that ECS is a valuable tool for organizations to collect innovative ideas from employees via their insights on company products, processes, customers, and competitors. We found that increased employee ECS use and contribution of innovative ideas could improve employees' job performance, which will eventually benefit organizations. Overall, the research profiled in this paper contributes to understanding the relationship between ECS factors and employees' job performance through innovative behavior in terms of knowledge application and ECS satisfaction in organizations using ECSs for innovation. The results call attention to how ECS factors influence employees' innovative behavior and listed managerial implications to help organizations fine tune their ECSs to attract more employee participation. We hope that this study serves as encouragement for future research endeavors that include larger sample sizes from various domains, geographical locations, and industries, including non-profit and government organizations.

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APPENDICES

APPENDIX A: LETTER TO SUPERVISORS

I, Vetri Vel, am conducting a research project entitled "All Hands on Deck: Key to Successful Enterprise Innovation Initiatives" as part of a ***doctoral dissertation*** at Dakota State University.

The purpose of the study is to investigate what Ideas for Innovation Portal (ECS) factors can make employees to use ECS actively to submit and share their innovative ideas.

You are invited to participate in the study by ***using a system and then completing an online survey.*** We realize that your time is valuable and have attempted to keep the requested information as brief and concise as possible. It will take you approximately ***10-20*** minutes of your time. Your participation in this project is voluntary. You may withdraw from the study at any time without consequence.

You will be required to submit your email address and your team members' who can potentially be part of the survey. Email addresses are required only to link your responses to your team members' survey responses. ***Your team members will not know your survey responses***. Only researchers will be able to view your responses.

There are ***no known risks*** to you for participating in this study. Also, there are ***no direct or indirect benefits*** to you as a participant***.***

Your participation is voluntary. Your decision whether or not to participate will not affect your relationship with Dakota State University. If you decide to participate, you are free to withdraw your consent and discontinue participation at any time without penalty.

Please assist us in our research and submit the completed survey online. Your consent is implied by the return of the completed questionnaire. Please keep this letter for your information. If you have questions related to the content of this study, you may contact me at vetrivadivel@hotmail.com. If you have questions regarding your rights as a research participant in this study, you may contact the DSU Office of Sponsored Programs at 605-5100 or at irb@dsu.edu.

Sincerely,
Vetri Vel
155 Fringetree Dr
West Chester, PA 19380
Vetrivadivel@hotmail.com
302-521-1337

APPENDIX B: LETTER TO EMPLOYEES

I, Vetri Vel, am conducting a research project entitled "All Hands on Deck: Key to Successful Enterprise Innovation Initiatives" as part of a ***doctoral dissertation*** at Dakota State University.

The purpose of the study is to investigate what Ideas for Innovation Portal (ECS) factors can make employees to use ECS actively to submit and share their innovative ideas.

You are invited to participate in the study by ***using a system and then completing an online survey.*** We realize that your time is valuable and have attempted to keep the requested information as brief and concise as possible. It will take you approximately ***20-30*** minutes of your time. Your participation in this project is voluntary. You may withdraw from the study at any time without consequence.

Please note that your email address was provided by your supervisor or manager. You will be required to submit your email address as part of the survey. Your email address is required only to link your responses to your supervisor's survey response. ***Supervisor will not know if you have responded to the survey and your survey response***.

There are ***no known risks*** to you for participating in this study. Also, there are ***no direct or indirect benefits*** to you as a participant***.***

Your responses are strictly confidential. Only researchers will be able to view your responses.

Your participation is voluntary. Your decision whether or not to participate will not affect your relationship with Dakota State University. If you decide to participate, you are free to withdraw your consent and discontinue participation at any time without penalty.

Please assist us in our research and submit the completed survey online. Your consent is implied by the return of the completed questionnaire. Please keep this letter for your information. If you have questions related to the content of this study, you may contact me at vetrivadivel@hotmail.com. If you have questions regarding your rights as a research participant in this study, you may contact the DSU Office of Sponsored Programs at 605-5100 or at irb@dsu.edu.

Sincerely,
Vetri Vel
155 Fringetree Dr
West Chester, PA 19380
Vetrivadivel@hotmail.com
302-521-1337

APPENDIX C: SUPERVISOR QUESTIONNAIRRE

1. Please enter your email address

2. Please enter your team member's email address
   1st Member:
   2nd Member:
   3rd Member:
   4th Member:
   5th Member:

Scale: 1–Strongly Disagree; 2-Disagree; 3-Somewhat Disagree; 4-Neither Agree nor Disagree; 5-Agree; 6-Somewhat Disagree; 7-Strongly Agree

Scale – 1-Lowest; 7-Highest

	Items	Member 1	Member 2	Member 3	Member 4	Member 5
1	...Appears to be highly committed to the organization.					
2	...Appears to be emotionally attached to the organization.					
3	...Views the organization's problems as his or her own.					
4	...Really cares about the fate of this organization.					

	Items	Member 1	Member 2	Member 3	Member 4	Member 5
1	He/she suggests new ways to achieve goals or objectives of the project.					
2	He/she comes up with new and practical ideas to improve the project performance.					
3	He/she searches out new technologies, processes, techniques, and/or project ideas.					
4	He/she suggests me new ways to increase quality of the project.					
5	He/she is a good source of creative ideas					
6	He/she is not afraid to take risks					
7	He/she promotes and champions ideas to others.					

8	He/she exhibits creativity on the project when given the opportunity to.					
9	He/she develops adequate plans and schedules for the implementation of new ideas.					
10	He/she often has new and innovative ideas.					
11	He/she comes up with creative solutions to problems.					
12	He/she often has a fresh approach to problems					
13	He/she suggests a new ways of performing work his parts of the project.					
14	He/she generates creative ideas.					
15	He/she suggests new ways to achieve goals or objectives of the project.					

	Items	Member 1	Member 2	Member 3	Member 4	Member 5
1	He/she always completes the duties specified in his/her job description.					
2	He/she meets all the formal performance requirements of the job.					
3	He/she fulfills all responsibilities required by his/her job.					
4	He/she never neglects aspects of the job that he/she is obligated to perform.					
5	He/she often fails to perform essential duties. (reversed)					

	Items	Member 1	Member 2	Member 3	Member 4	Member 5
1	Exhibits punctuality in arriving at work on time after break.					
2	Begins work on time.					
3	Attendance at work is above the norm.					
4	Gives advance notice when unable to come to work.					

	Items	Member 1	Member 2	Member 3	Member 4	Member 5
1	Creating new ideas for improvements					
2	Mobilizing support for innovative ideas					
3	Searching out new working methods, techniques, or instruments					
4	Acquiring approval for innovative ideas					
5	Transforming innovative ideas into useful applications					
6	Generating original solutions to problems					
7	Introducing innovative ideas in a systematic way .					
8	Making important organizational members enthusiastic for innovative ideas					
9	Thoroughly evaluating the application of					

	innovate ideas					

APPENDIX D: EMPLOYEE QUESTIONNAIRRE

1. Your email address?

2. Your Gender?
    - Male
    - Female

3. Your Age?

4. Your education level?
    - Less than high school
    - High school graduate
    - Some college
    - 2 year degree
    - 4 year degree
    - Professional degree
    - Doctorate

5. Your Job Position?
    - Executive
    - Manager
    - Other

6. Have you ever submitted innovative idea(s) at your employment?
    - Yes
    - No

7. How long have you been in current company?

Scale: 1–Strongly Disagree; 2-Disagree; 3-Somewhat Disagree; 4-Neither Agree nor Disagree; 5-Agree; 6-Somewhat Disagree; 7-Strongly Agree

Scale – 1-Lowest; 7-Highest

8. Does your organization support innovation?

	Item	7	6	5	4	3	2	1
1	Does your organization support innovation?							

9. Please indicate your level of agreement or disagreement on Ideas for Innovation Portal (ECS) at your work

	Item	7	6	5	4	3	2	1
1	ECS clearly presents overall business problems/objectives.							
2	ECS clearly published idea evaluation procedures.							
3	Ideas are chosen purely on merit and not any other undue pressure.							
4	ECS has effective incentive mechanism.							
5	ECS has effective rating mechanism.							

10. Please indicate your level of agreement or disagreement on Ideas for Innovation Portal (ECS)

	Item	7	6	5	4	3	2	1
1	ECS at my work provides tools to perform innovation activities to achieve desired business goals.							
2	ECS at my work collects innovative ideas and suggestions consistently.							
3	ECS at my work sends quick reaction/feedback from other employees relating to my ideas and suggestions.							
4	ECS at my work facilitates colleagues to work collaboratively to implement new ideas.							
5	ECS at my work enables me to promptly receive answers to my questions and problems from other employees.							
6	ECS at my work helps me to share collaborative norms such as reciprocity and fairness.							
7	ECS at my work motivates me to be a responsible and contributing member.							

11. Please indicate your level of agreement or disagreement on Ideas for Innovation Portal (ECS)

	Item	7	6	5	4	3	2	1
1	ECS has enough safeguards to make me feel comfortable using it to submit innovative ideas.							
2	ECS has enough safeguards to make me feel comfortable using it to collaborate with my colleagues on innovative ideas.							
3	ECS is competent and effective in facilitating innovation.							
4	ECS performs its role of facilitating innovation very well.							
5	ECS provides access to view details of all ideas and feedbacks.							
6	ECS maintains and publishes status and progress of all submitted ideas.							

12. Please indicate your level of agreement or disagreement on your motivation to using Ideas for Innovation Portal (ECS)

	Item	7	6	5	4	3	2	1
1	I enjoy helping my coworkers by sharing my knowledge in ECS							
2	It feels good to help my coworkers by sharing my knowledge							
3	No matter what the outcome of the innovative ideas submitted in ECS, I am satisfied if I feel I gained a new experience participating/contributing							
4	What matters most to me is enjoying what I contribute in							

	ECS							
5	Curiosity is the driving force behind much of what I contribute in ECS							
6	I want to challenge myself to solve the problems submitted in ECS							
7	I want to find out how good I really can be in solving problems submitted in ECS							

13. Please indicate your level of agreement or disagreement.

	Item	7	6	5	4	3	2	1
1	I feel a great deal of stress because of my job.							
2	My job is extremely demanding.							
3	Very few stressful things happen to me at work.							
4	My work is stress free.							
5	My job seems more stressful than most.							
6	Stress is a big part of my job.							

14. Please indicate your level of agreement or disagreement on using Ideas for Innovation Portal (ECS)

	Item	7	6	5	4	3	2	1
1	I will receive a higher salary in return for my knowledge sharing in ECS							
2	I will receive a higher bonus in return for my knowledge sharing in ECS.							
3	I will receive increased promotion opportunities in return for my knowledge sharing in ECS.							
4	I will receive increased job							

	security in return for my knowledge sharing in ECS.							

15. Please indicate your level of agreement or disagreement

	Item	7	6	5	4	3	2	1
1	I concentrate on completing my work tasks correctly to increase my job security.							
2	At work I focus my attention on completing my assigned responsibilities.							
3	Fulfilling my work duties is very important to me.							
4	At work, I strive to live up to the responsibilities and duties given to me by others.							
5	At work, I am often focused on accomplishing tasks that will support my need for security.							
6	I do everything I can to avoid loss at work.							
7	Job security is an important factor for me in any job search.							
8	I focus my attention on avoiding failure at work.							
9	I take chances at work to maximize my goals for advancement.							
10	I tend to take risks at work in order to achieve success.							
11	If I had an opportunity to participate on a high-risk, high-reward project I would definitely take it.							
12	If my job did not allow for advancement, I would likely find a new one.							

13	A chance to grow is an important factor for me when looking for a job.							
14	I focus on accomplishing job tasks that will further my advancement.							

16. Please indicate your level of agreement or disagreement about your manager

	Item	7	6	5	4	3	2	1
1	My manager helps me understand how my objectives and goals relate to that of the company.							
2	My manager helps me understand the importance of my work to the overall effectiveness of the company.							
3	My manager helps me understand how my job fits into the bigger picture.							
4	My manager makes many decisions together with me.							
5	My manager often consults me on strategic decisions.							
6	My manager solicits my opinion on decisions that may affect me.							
7	My manager believes that I can handle demanding tasks.							
8	My manager believes in my ability to improve even when I make mistakes.							
9	My manager expresses confidence in my ability to perform at a high level.							
10	My manager allows me to do my job my way.							
11	My manager makes it more efficient for me to do my job by keeping the rules and							

	regulations simple.							
12	My manager allows me to make important decisions quickly to satisfy customer needs.							

17. Please indicate your level of agreement or disagreement on climate for innovation at your work

	Item	7	6	5	4	3	2	1
1	Creativity is encouraged here.							
2	Our ability to function creatively is respected by the leadership.							
3	Around here, people are allowed to try to solve the same problems in different ways.							
4	This organization can be described as flexible and continually adapting to change.							
5	This organization is open and responsive to change.							
6	The reward system here encourages innovation.							
7	This organization publicly recognizes those who are innovative.							
8	Assistance in developing new ideas is readily available.							
9	There are adequate resources devoted to innovation in this organization.							
10	This organization gives me free time to pursue creative ideas during the workday.							

18. Please indicate your level of agreement or disagreement with your and coworkers' participation and contribution in Ideas for Innovation Portal (ECS)

	Item	7	6	5	4	3	2	1
1	I take active part in our ECS							
2	I do my best to stimulate our ECS							
3	I often provide useful information/contents to my coworkers in ECS							
4	I eagerly reply to postings by the seeking help in our ECS							
5	I take care about my coworkers participating in ECS							
6	I often help my coworkers requiring help from others in ECS							
7	I share my work reports and official documents with coworkers in ECS							
8	My coworkers share their manuals and methodologies with others in ECS							
9	I share my know-how and experience with my coworkers in ECS							
10	My coworkers share their know-how and experience with others							

19. Please indicate your level of agreement or disagreement

	Item	7	6	5	4	3	2	1
1	Our team members apply knowledge learned from ECS.							
2	Our team members use knowledge from ECS to solve new problems.							
3	Our team members apply							

	knowledge from ECS to solve new problems.							
4	I effectively manage knowledge gained from ECS into practical use							
5	I effectively utilize knowledge gained from ECS into practical use							

20. Please indicate your level of agreement or disagreement in using Ideas for Innovation Portal (ECS)

	Item	7	6	5	4	3	2	1
1	Using the ECS enables me to accomplish job-related tasks more quickly.							
2	Using the ECS improves my job performance.							
3	Using the ECS in my job increases my productivity.							
4	Using the ECS enhances my effectiveness on the job.							
5	Using the ECS makes it easier to do my job.							
6	I find the ECS useful in my job.							

21. Please indicate your level of agreement or disagreement in using Ideas for Innovation Portal (ECS)

	Item	7	6	5	4	3	2	1
1	I found the new ways of using ECS to achieve goals or objectives.							
2	I found the new and practical ideas from our ECS to improve performance.							
3	I found the new ways of using ECS to increase quality of my job.							
4	I found that ECS is s a good							

	source of creative ideas							
5	I found that ECS give me creative tips to solve problems.							
6	I found a new way from ECS to perform my tasks							

22. Please indicate your level of agreement or disagreement.

	Item	7	6	5	4	3	2	1
1	I am satisfied with the reliability of information output from the ECS.							
2	I am satisfied with the quality of online information and reports available in the ECS.							
3	I am satisfied with the time required for the ECS to give me output.							
4	I am satisfied with the level of relevancy received from the ECS.							
5	I am satisfied with the accuracy of the outputs from the ECS.							
6	Overall, I am very satisfied with the ECS.							

23. Please indicate your level of agreement or disagreement.

	Item	7	6	5	4	3	2	1
1	As soon as I can find a better job, I'll quit.							
2	I often think about quitting my job in this company.							

24. Please indicate your level of agreement or disagreement.

	Item	7	6	5	4	3	2	1
1	I am satisfied with my job.							

2	In general, I like my job.							
3	In general, I like working at this firm.							