

Three Essays on Knowledge Teams

(Final e - Thesis Submission)

Kyung Young Lee

Desautels Faculty of Management

Information Systems Area

McGill University, Montreal, Quebec, Canada

December 2012

**A thesis submitted to McGill University in partial fulfillment of the
requirements of the degree of Doctor of Philosophy**

© Kyung Young Lee 2012

Acknowledgements

In this section, I would like to acknowledge very important individuals who have greatly helped me finish my thesis. My first thanks are for my supervisor Geneviève Bassellier. She has always been a very kind, dedicated and professional supervisor for me. She has advised me to be successful in various aspects of a doctoral student's life. First of all, for my research, she has always been very prompt in reading my dissertation and other research papers and providing me with very constructive feedback. With her guidance, I have greatly progressed in my dissertation and other research papers. She has also helped me with other important aspects of my academic career, such as teaching and job searching.

I am also deeply thankful to my dissertation committee members, Dr. Samer Faraj and Dr. Anne Beaudry, for their careful reading of the thesis chapters and for their constructive feedback. I learned a great deal from both of them in various aspects of my dissertation essays. Their advice, guidance, and sense of rigor have made me a better researcher. I would also like to thank the internal and external examiners and those who have provided me with valuable feedback at my thesis defense.

I would like to thank all other members of the IS area in the Desautels Faculty of Management, including the faculty members, Ph.D. students, and staff, who have helped me in various ways and have provided me with such an exceptional experience during my tenure in this program. I also greatly thank the faculty members of the Williams School of Business at Bishop's University for

their support. A special thanks goes to my dear friends; Junsuck Lee, Sungbyung Yang, Seungyun Lee, Russell Seidle, Kimin Kim, Sungsoo Kim, Hyunjung Yu, Minwoo Lee, Changsoo Kim, Donghoon Shin, and Sungchul Rho for their precious advice and support for my dissertation. My success in the Ph.D. program would not have been possible without their help.

I would like to acknowledge the funding sources that have supported my Ph.D. work. I was funded by a grant from FQRSC. I am also indebted to both the Information Systems area and Ph.D. program of the Desautels Faculty of Management, for their direct financial aid through fellowships, awards, travel grants, and the funding for my survey research.

Finally, thanks to my family members, who have always believed in me and who have been with me through whatever challenges life has brought. To my wife Mihyun, my son Luke, my daughter Claire, and my parents Sangkil Lee and Ernyum Park, thank you for your sincere support and your understanding, and for letting me start and finish my Ph.D. degree.

Table of Contents

Acknowledgements	2
Table of Contents	4
Thesis Abstract.....	6
Résumé.....	8
Chapter 1 – Overview of Thesis	11
IT as drivers of new Forms of Collaboration in Organizations – Knowledge Teams	11
Knowledge Team Environment	12
Passion as an important psychological Input for Knowledge Teams	13
Objectives and an Overview of the Three-essay Dissertation	15
References: (see the end of thesis after chapter 5).....	21
Chapter 2 – Essay I: A Literature Review on Team Creativity and Individual Learning in Knowledge Teams	22
Abstract	22
Introduction.....	23
Part 1: The Key Properties of Knowledge Teams.....	27
Part 2: Identifying Antecedents for Team Creativity and Individual Learning Outcomes in Knowledge Team Environment.....	38
Part 2-1: Antecedents for Team Creativity of Knowledge Teams.....	39
Part 2-2: Antecedents for Individual Members’ Learning in Knowledge Teams.	76
Part 3: Conclusion – Identifying Venues for Future Research	89
References	95
Appendix, Table 3 and Table 4 List of Literatures Reviewed.....	105
Chapter 3 – Essay II: The Role of Shared Team Passion, Expertise, and Shared Norms of ICT Use on Knowledge Team Creativity	110
Abstract	110

Introduction.....	111
Theoretical Background.....	114
Research Model and Hypothesis.....	129
Methodology	144
Result	152
Discussion	159
Conclusion	165
Appendix 1: Survey Items	166
References.....	168
 Chapter 4 – Essay III: The Impact of Individual Passion on Learning Outcomes in Knowledge Teams	 176
Abstract	176
Introduction.....	177
Theoretical Background.....	180
Research Model and Hypothesis.....	192
Methodology	202
Result	208
Discussion	217
Conclusion	223
Appendix 1 Survey items.....	224
References.....	226
 Chapter 5 – Synthesis.....	 233
Synthesis of the Dissertation.....	233
Contributions of this Dissertation	238
Avenues for Future Research.....	242
Concluding Remarks.....	245
References of Chapter 1 (Overview of Thesis) and Chapter 5 (Synthesis)	247
Appendix: Ethics Certificate	250

Thesis Abstract

In contemporary organizations, it is common to encounter teams that are formed to create novel outcomes and that are supported by Information Communication Technologies (ICT). These knowledge teams are also formed by members with diverse expertise, in order to create new knowledge by working on complex, non-routine, open-ended, and interdependent tasks. As knowledge teams are often formed to create something novel there is an expectation that the outcomes reflects creativity. Also, individual team members can learn something new by participating in knowledge team activities. By focusing on these two outcomes (team creativity and individual learning), this dissertation identifies the key properties of knowledge teams, reviews the literature on the antecedents of knowledge team creativity and individual members' learning, and investigates the role of passion and knowledge management processes (behaviors) on team creativity and individual learning.

The dissertation consists of three essays. *The first essay (Chapter 2)* reviews the literature on knowledge teams, identifies the key properties of knowledge teams, and integrates the empirical findings on the antecedents of team creativity and individual learning in knowledge team environments in order to provide several future research topics. *The second essay (Chapter 3)* investigates the impact of shared team passion and team expertise on team creativity, and the mediation effect of team knowledge processes. Results from an empirical test with survey data suggest that 1) shared team passion is positively associated with internal knowledge sharing and external knowledge sourcing, 2) team expertise is

positively associated with internal knowledge sharing, 3) external knowledge sourcing and internal knowledge sharing positively influence team creativity, 4) shared norms of Information Communication Technologies (ICT) use positively moderates the relationship between shared team passion and external knowledge sourcing, and 5) the extent to which team tasks are explorative (exploration of team tasks) positively moderates the impact of external knowledge sourcing on team creativity. *The third essay (Chapter 4)* develops the role of individual-level passion concerning team activities on individual learning outcomes within knowledge team environments through individuals' knowledge sourcing and sharing and helping behaviors. It is found that 1) individual passion about team activities is positively associated with external knowledge sourcing, internal knowledge sharing, and OCB (organizational citizenship behavior)-helping behaviors, 2) internal knowledge sharing and OCB-helping behaviors positively influence individuals' learning outcomes, and 3) perceived psychological safety positively moderates the relationship between individual passion and internal knowledge sharing (or OCB-helping) behaviors within knowledge teams.

My dissertation contributes to several sub-fields of management research, such as passion for work, knowledge management, the role of IT on team processes, team creativity, learning, and OCB. A detailed discussion on the contribution of this dissertation and future research directions are presented at the end of each essay, as well as in the synthesis section (Chapter 5).

Résumé

Dans les organisations contemporaines, on rencontre fréquemment des équipes qui ont été formées pour créer de nouveaux résultats et qui sont supportées par les technologies de communication de l'information (TCI). Ces équipes-connaissances sont formées par des membres possédant une expertise diversifiée, afin de créer des nouvelles connaissances en travaillant sur des tâches complexes, non routinières, ouvertes et interdépendantes. Comme les équipes-connaissances sont souvent formées pour créer quelque chose de nouveau, on s'attend à ce que les résultats reflètent la créativité. En outre, les membres individuels de l'équipe peuvent apprendre quelque chose de nouveau en participant aux activités de l'équipe-connaissances. En se concentrant sur ces deux résultats (créativité de l'équipe et apprentissage individuel), cette thèse identifie les propriétés clés des équipes-connaissances, résume la littérature concernant les antécédents de la créativité de l'équipe-connaissances et de l'apprentissage des membres individuels, et étudie le rôle de la passion et des processus de gestion des connaissances (comportements) sur la créativité de l'équipe et l'apprentissage individuel.

La thèse se compose de trois essais. Le premier essai (chapitre 2) résume la littérature sur les équipes-connaissances, identifie les propriétés clés des équipes-connaissances, et intègre les résultats empiriques sur les antécédents de la créativité de l'équipe et l'apprentissage individuel dans les environnements d'équipes-connaissances, afin de fournir plusieurs sujets de recherche futurs. Le deuxième essai (chapitre 3) examine l'impact de la passion partagée de l'équipe et

l'expertise de l'équipe sur la créativité d'équipe, ainsi que l'effet de médiation des processus de connaissance de l'équipe. Les résultats d'une étude empirique avec les données de sondage suggèrent que: 1) la passion partagée de l'équipe démontre un lien positif avec le partage interne des connaissances et l'approvisionnement externe des connaissances, 2) l'expertise de l'équipe démontre un lien positif avec le partage interne des connaissances, 3) l'approvisionnement externe des connaissances et le partage interne des connaissances influencent de manière positive la créativité d'équipe, 4) les normes communes d'utilisation des technologies de communication de l'information (TCI) modèrent de façon positive la relation entre la passion partagée de l'équipe et l'approvisionnement externe des connaissances, et 5) la mesure dans laquelle les tâches de l'équipe sont exploratoires (exploration des tâches de l'équipe) modère positivement l'impact de l'approvisionnement externe des connaissances sur la créativité de l'équipe. Le troisième essai (chapitre 4) développe le rôle de la passion individuelle concernant les activités de l'équipe sur les résultats de l'apprentissage individuel au sein de l'environnement de l'équipe-connaissances à travers l'approvisionnement des connaissances et les comportements de partage et d'aide par les individus. On trouve que 1) la passion individuelle concernant les activités de l'équipe est positivement associée à l'approvisionnement externe des connaissances, le partage interne des connaissances, et les comportements d'aide du genre citoyenneté organisationnel, 2) le partage interne des connaissances et les comportements de citoyenneté organisationnel influencent positivement les résultats d'apprentissage des individus, et 3) la sécurité psychologique perçue modère positivement la relation

entre la passion individuelle et le partage interne des connaissances au sein des équipes-connaissances.

Ma thèse contribue à plusieurs sous-domaines de la recherche en gestion, telles que la passion pour le travail, la gestion des connaissances, le rôle de l'informatique sur les processus d'équipe, la créativité de l'équipe, l'apprentissage, et les comportements de citoyenneté organisationnel. Une discussion détaillée sur la contribution de cette thèse et les orientations futures de la recherche est présentée à la fin de chaque essai, ainsi que dans la section de synthèse (chapitre 5).

Chapter 1 – Overview of Thesis

IT as drivers of new Forms of Collaboration in Organizations –

Knowledge Teams

Information Technologies (IT) have enabled new forms of collaboration in contemporary organizations (Miles and Snow 1986), such as virtual (distributed) teams (Jarvenpaa and Leidner 1999), digitally enabled teams (Robert, Dennis, and Ahuja 2008), and IT-enabled distributed project teams (Kotlarsky and Oshri 2005). Although not referred to as “virtual or distributed” teams, IT enables all types of organizational (sub)units to have a certain degree of virtuality (Gibson and Gibbs 2006), such that organizational members can communicate via email, share ideas via electronic discussion boards, and even collaborate on web-based file hosting services. Among the different types of IT-enabled organizational units for collaboration, this dissertation focuses on *the IT-enabled teams that are formed to create new products or services by integrating diverse knowledge from different parts of organizations*, often referred to as knowledge teams (Faraj and Sproull 2000; Janz, Colquitt, and Noe 1997). There are also teams that are labeled differently, but can be regarded as a knowledge team, as long as the team is formed to produce something novel (so that new knowledge is embedded in the output of this team) with the diverse expertise of team members, namely, project teams (Katz and Allen 1982), new product development (NPD) teams (Akgun, Byrne, Keskin, Lynn, and Imamoglu 2005), research (& development) teams (R&D teams) (Cheng 1984), software development (SWD) teams (Curtis, Krasner, and Iscoe 1988; Faraj and Sproull 2000), information systems development (ISD)

teams (Henderson and Lee 1992), and consulting teams (Ancona 1990), to name a few. In this study, we use the term “knowledge team” as an umbrella term to include all types of teams for knowledge creation.

Knowledge Team Environment

More and more organizations are now using knowledge teams to leverage distributed expertise in different parts of an organization (or multiple organizations) (Janz et al. 1997). Knowledge teams work on complex, non-routine, open-ended, and interdependent *tasks for producing something new* (Ancona and Caldwell 1992; Faraj and Sproull 2000; Janz et al. 1997; Kraut and Streeter 1995; Madhavan and Grover 1998; Woolley 2009), under an *informal and less-hierarchical team structure* (Saunders and Ahuja 2006). In order to combine and coordinate knowledge from different members, *knowledge processes* (searching, sharing and integrating knowledge) and *cordination processes* (expertise and administrative cordination) are considered as important processes for team performance (Ancona and Caldwell 1992; Campion, Medsker, and Higgs 1993; Faraj and Sproull 2000; Faraj and Yan 2009; Wong 2004). A knowledge team is expected to deliver one or many outcomes at the end of their tenure (or by the project deadline). Key performance measures include not only effectiveness (e.g., quality of team outcome) and efficiency (e.g., adherence to time and a budget) (Faraj and Sproull 2000; Henderson and Lee 1992), but also *team creativity*, as knowledge teams are formed to produce novel (creative) outcomes (Akgun et al. 2005; Tiwana and McLean 2005), and *individual members' learning* as a

knowledge team provides team members with a good environment for situated learning (Sense 2011).

Based on a literature review on knowledge teams (Chapter 2), I found that that so far, more research effort has been devoted to investigate and integrate the antecedents of team effectiveness and efficiency, but fewer efforts have been devoted to understanding team creativity and individual team members' learning as aspects of knowledge team performance. Thus, this dissertation reviews the literature on the antecedents of knowledge team *creativity* and individual members' *learning* (Chapter 2), and identifies and tests the role of important inputs and processes (behaviors) on team creativity and individual learning (Chapters 3 and 4).

Passion as an important psychological Input for Knowledge Teams

In many cases, knowledge teams deal with tasks that are open-ended and non-routine activities for team members (Woolley 2009). Therefore, although there are some requirements for team outcomes (e.g., quality, time, scope, and budget requirements) set by an external entity (e.g., their sponsoring organization), team goals, detailed tasks needed for team outcomes, and milestones of ongoing team outcomes are usually set by each knowledge team itself. In this work environment, each team's (or each team member's) psychological attachment to and behavioral involvement in the knowledge team activities should vary among different teams (or team members). With a low level of psychological attachment and behavioral involvement, a knowledge team can set its team goal just to meet

the requirements set by its sponsoring organization and can still produce a team outcome that is enough to fulfill the minimum requirements. However, we argue that if knowledge team members have a high level of psychological attachment to their team activities, it should lead to a high degree of behavioral involvement by the team members (Cardon, Wincent, Singh, and Drnovsek 2009), which in turn, should produce more creative outcomes. In addition, individual members may learn more by engaging in team processes more actively.

In order to highlight teams' and individual members' psychological input, which entails strong psychological attachment to team activities and encourages a high level of participation in team processes within knowledge team environments, I propose that *passion about knowledge team activities*, which refers to "love, enthusiasm, and attachment to the activities of a knowledge team" (Baum and Locke 2004), be an important team- and individual-level input indirectly influencing team creativity and individual learning outcomes through team knowledge management processes (or individual team members' behaviors of knowledge sharing, sourcing and helping one another).

With the literature review (Chapter 2) on team creativity and individual learning in knowledge teams, we found that both cognitive inputs (e.g., expertise and experience) (Akgun et al. 2005; Dayan and Di Benedetto 2011; Reilly 2008) and psychological inputs (e.g., moods and psychological safety) (Edmondson 1999; Grawitch, Munz, and Kramer 2003; Tu 2009) should make a difference in the way they engage in team processes (or behaviors), as well as team- and individual-level outcomes. We also found that little effort so far has been made to propose and empirically test the role of passion on team creativity and individual

learning in knowledge team environments. However, both theoretical arguments (Amabile 2000; Faraj, Jarvenpaa, and Majchrzak 2011) and anecdotal evidence (Billow 2002; Hirschhorn 2003) have emphasized the role of passion on creativity and group collaboration.

Therefore, by using the input-process-output model of team creativity and individual learning (Webb 1982; Woodman, Sawyer, and Griffin 1993), I propose two research models involving the role of passion on team creativity and individual learning, and I empirically test these two research models in Essay II (Chapter 3) and Essay III (Chapter 4).

Objectives and an Overview of the Three-essay Dissertation

This dissertation focuses on two broad questions; 1) *What are the key properties of knowledge teams and the key factors for team creativity and individual learning in knowledge teams?* and 2) *What is the impact of team- and individual- level passion on team creativity and individual learning?*

To answer these research questions, this dissertation is composed of three different, but complementary essays. *Essay I (Chapter 2)* reviews the literature on team creativity and individual learning in the context of knowledge teams and integrates the antecedents of team creativity and individual learning. *Essays II and III (Chapters 3 and 4)* propose two research models that highlight the role of passion in team creativity and individual members' learning in knowledge team environments. The following is an introduction of the findings of three essays.

The *first essay* is composed of three parts. In part 1, the definition and key

characteristics of a “knowledge team” are identified. We identify the key characteristics of knowledge teams in terms of 1) team tasks, 2) team structure, and 3) team processes. In part 2, we review the empirical studies on the antecedents of team creativity and individual learning outcomes. For team creativity, we classified the antecedents from extant empirical studies into 1) inputs (cognitive, psychological, and structural inputs), 2) processes (internal interaction, knowledge management processes, tactical processes, conflict, and coordination), and 3) external influence. For individual learning, we classified the antecedents from extant empirical studies into 1) inputs (cognitive and psychological inputs), 2) behaviors (internal and external learning behaviors), and 3) external factors (team environment, technology support, and task characteristics). The findings on each of the two outcomes are listed in the Table 3 and Table 4; they are also integrated at the end of part 2. Finally, several future research topics are proposed in part 3. Thus, this essay answers the following research question with the literature review: *What are the key characteristics of knowledge teams? What are the main drivers of team creativity and individual learning in knowledge teams? and, What important research avenues should be explored in order to enhance our understanding of knowledge teams?*

Accumulated findings from empirical studies, the list of direct and indirect drivers of team creativity and individuals’ learning will provide practitioners with a set of factors to consider if they manage a knowledge team. Further, the review of empirical studies helps us identify new avenues for future research on team creativity and individual members’ learning in knowledge teams.

The ***second essay*** is an empirical study with field survey data from

knowledge teams in a large firm operating in an educational service industry in South Korea. The purpose of the second essay is to introduce the concept of shared team passion regarding team activities (Baum, Locke, and Smith 2001; Cardon et al. 2009), the existence of team expertise (Csikszentmihalyi 1996), and shared norms in Information Communication Technology (ICT) use (Caya 2008) as important inputs for creative team outcomes in the context of knowledge teams. It addresses the questions: *Under the environments of knowledge teams, what are the impacts of team passion and team expertise on team creativity through team knowledge processes? and, do shared norms of ICT and explorative tasks moderate the relationship between team inputs (passion and expertise) and team knowledge processes, and the relationship between team processes and team creativity, respectively?*

Using Woodman et al. (1993)'s input-process-output (creativity) framework, this study hypothesizes and tests 1) that shared team passion is positively associated with external knowledge sourcing (H1) and internal knowledge sharing processes (H2), and team expertise is positively associated with internal knowledge sharing processes (H3), and 2) that these two team knowledge processes (Wong 2004) positively influence the creativity of knowledge team outcomes (H4 and H5). It also tests 3) that the impacts of shared team passion on external knowledge sourcing (H6) and internal knowledge sharing (H7) processes are moderated by team members' shared norms of ICT use (Caya 2008) and 4) that the impact of external knowledge sourcing on team creativity becomes stronger when team tasks are explorative (H8) (Jansen, Van Den Bosch, and Volberda 2006; March 1991).

The result shows that all hypothesized relationships (H1~H6 and H8) were supported, except for the moderating impact of the shared norms of ICT use on the relationship between shared team passion and internal knowledge sharing processes (H7). The findings from the empirical study demonstrate the importance of 1) the team's psychological attachment with team activities (*shared passion*), 2) cognitive resources (*team expertise*), and 3) team-level norms about how ICT should be used for team processes (*shared norms of ICT use*). This study also highlights the importance of *team knowledge processes* for team creativity and proposes *the moderating role of a task characteristic in terms of exploration on team creativity*. This paper contributes to the body of knowledge on passion, team knowledge management, the role of ICT, and team creativity in the context of IT-enabled knowledge teams by providing an empirical demonstration of the key inputs and processes for team creativity with a large number of samples at the team level.

The third essay is also an empirical study with survey data at the individual level, introducing the role of *individual-level passion about knowledge team activities* for individuals' learning outcomes. It addresses the question: *is an individual's passion about the activities in her/his knowledge team associated with her/his learning outcomes through learning and helping behavior? and, does an individual's perceived psychological safety in a knowledge team improve the relationships between passion and knowledge sharing (and helping) behaviors?*

Using Webb (1982)'s theoretical framework of individuals' learning under a group environment, this study hypothesizes that individual passion regarding team activities is positively associated with individual members' activities of

external knowledge sourcing (H1), internal knowledge sharing (H2), and organizational citizenship behavior (OCB)-helping (H3), all of which will influence the degree of individual learning resulting from one's participation in team activities (H4~H6, H4: the impact of external knowledge sourcing on learning, H5: the impact of internal knowledge sharing on learning, and H6: the impact of OCB-helping on learning). It also hypothesizes that an individual's psychological safety within a knowledge team positively moderates the relationship between passion and internal knowledge sharing behaviors (H7), and the relationship between passion and OCB-helping behaviors (H8).

The result from a cross-sectional field survey from knowledge team members shows that all hypothesized relationships (H1~H3 and H5~H8) were supported, except for the impact of external knowledge sourcing and individuals' learning outcomes (H4). The findings from this study highlight the importance of individuals' passion about their team activities as a good starting point for individuals' situated learning from such team activities. This study also shows that under a psychologically safe environment, the impact of passion on individuals' internal (within a knowledge team) behaviors of learning (knowledge sharing) and helping others becomes stronger. Since this study shows a significant relationship between passion and OCB-helping, as well as a significant relationship between OCB-helping and learning, we can argue that passion could be a significant predictor of individuals' OCB in team environments, and that OCB, along with internal knowledge sharing, may link (mediate) the relationship between an individual's passion and learning outcomes in knowledge team environments. Table 1 summarizes the general information of the three essays.

Table 1 Summary of three essays			
	Essay I (Chapter 2)	Essay II (Chapter 3)	Essay III (Chapter 4)
Title	A literature review on Team Creativity and Individual Learning in Knowledge Teams	The Role of Shared Team Passion, Expertise, and Shared Norms of ICT use on Knowledge Team Creativity	The Impact of Individual Passion on Learning Outcomes in Knowledge Teams
Type	Literature Review Paper	Empirical Research Report	Empirical Research Report
Purposes	To define and identify the key properties of knowledge teams, and identify the key antecedents of team creativity and individual learning in knowledge team environment	To investigate the role of shared passion about team activities, team expertise, shared norms of Information Communication Technology (ICT) on knowledge team creativity, through team knowledge processes.	To introduce the role of individual passion about team activities on individual's learning outcome, through learning and helping behaviors in knowledge team environment.
Research questions	<ul style="list-style-type: none"> • What are the key characteristics of knowledge teams? • What are the main drivers of team creativity and individual learning in knowledge teams? • What important research avenues should be explored in order to enhance our understanding of knowledge teams? 	<ul style="list-style-type: none"> • What are the impacts of team passion and team expertise on team creativity through team knowledge processes? • Do shared norms of ICT and explorative tasks moderate the relationship between team inputs (passion and expertise) and team knowledge processes, and the relationship between team processes and team creativity, respectively? 	<ul style="list-style-type: none"> • Is an individual's passion about the activities in her/his knowledge team associated with her/his learning outcomes through learning and helping behavior? • Does an individual's perceived psychological safety in a knowledge team improve the relationships between passion and knowledge sharing (and helping) behaviors?
Research design	Literature Review	Statistical Analysis with survey data	Statistical Analysis with survey data
Units	NA	Teams	Individuals
Data collection method	Literature Search with ISI web of Science (SSCI-Indexed journals)	Survey data from the knowledge teams	Survey data from the members of knowledge teams
Analysis	NA	Partial Least Square (PLS)	Partial Least Square (PLS)
Key findings	<ul style="list-style-type: none"> • Inputs-processes (behaviors)-outcomes framework should be considered to study team creativity and individual learning in knowledge team environment. • Future research should identify and investigate a psychological inputs for individual learning and team creativity 	<ul style="list-style-type: none"> • Shared team passion is positively associated with external knowledge sourcing and internal knowledge sharing processes • Two team knowledge processes are positively associated with team creativity • Shared norms of ICT positively moderates the relationship between team passion and external 	<ul style="list-style-type: none"> • Individual passion about knowledge team activities is positively associated with her/his external knowledge sourcing, internal knowledge sharing and OCB-helping behaviors • Internal knowledge sourcing and OCB-helping behaviors positively influence individual learning outcomes. • Perceived psychological safety positively moderates

	<ul style="list-style-type: none"> • Role if ICT in knowledge team should be investigated 	knowledge sourcing <ul style="list-style-type: none"> • Explorative team tasks positively moderate the relationship between external knowledge sourcing and team creativity 	the relationship between passion and internal behaviors (knowledge sharing and OCB helping).
--	--	---	--

References: (see the end of thesis after chapter 5)

Chapter 2 – Essay I: A Literature Review on Team Creativity and Individual Learning in Knowledge Teams

Abstract

Organizational subunits for new knowledge creation (e.g., task-force teams, project teams, etc.), namely, *knowledge teams*, are now prevalent in contemporary organizations. Key performance measures of knowledge teams include effectiveness, efficiency (productivity), creativity, and individual members' learning. While there are several literature review articles on knowledge team effectiveness and efficiency measures (e.g., Campion, Medsker, and Higgs 1993), little effort has been made to integrate previous findings on the other two performance measures (team creativity and individual learning in the context of knowledge teams), although creativity of team outcomes and individual participants' situated learning are important outcomes of knowledge teams. Thus, the purpose of this paper is to advance our understanding of knowledge team performance by integrating the empirical findings on the antecedents of *team creativity and individual learning outcomes* in the context of knowledge teams. A literature review is conducted to identify the *key characteristics of knowledge teams* and the *key antecedents of team creativity and individual learning outcomes*.

This paper consists of three parts. The first part identifies the important properties of knowledge teams by reviewing the extant studies on knowledge teams and similar types of teams (e.g., knowledge teams, temporary teams, temporary virtual teams, and self-managed teams). The second part integrates the extant findings on the key antecedents of *team creativity and individual learning*

in knowledge team environments. This paper, therefore, provides an understanding of *what leads to creative outcomes and individual learning in the context of knowledge teams*. Finally, the paper suggests several future research areas, which include the instruction of key research questions in *Essay II* and *Essay III*.

Introduction

Knowledge teams in contemporary organizations

Teams are important subunits of organizations (Hackman 1987), and there are various types of teams in contemporary organizations (Putnam 1992). Nowadays, more and more organizations rely on the types of teams formed for specific knowledge creation purposes, which are often temporarily held. The members from different parts of an organization (or organizations) form a team for a limited time period in order to create novel outcomes. In this study, we will use the term “*knowledge team*” (Faraj and Yan 2009; Janz, Colquitt, and Noe 1997) as an umbrella term that refers to teams that are formed to create novel outcomes. The term “knowledge team” may include research (and development) teams (Cheng 1984), project teams (Shumate, Ibrahim, and Levitt 2010), software development teams (Curtis, Krasner, and Iscoe 1988; Faraj and Sproull 2000), IS design teams (Henderson and Lee 1992), new product development teams (Ancona and Caldwell 1992; Katz 1982; Katz and Allen 1985; Keller 1986; Madhavan and Grover 1998), and consulting teams (Ancona 1990). Based on extant studies that defined knowledge teams and similar types of teams, we define

knowledge teams as teams *that are formed by members with diverse expertise, to create new knowledge by working on non-routine, project-based, and complex tasks* (Faraj and Yan 2009; Janz et al. 1997; Shani, Sena, and Stebbins 2000).

Knowledge teams are ones of the fastest growing organizational subunits in contemporary organizations (Janz et al. 1997). Knowledge teams help organizations leverage the knowledge distributed in different parts of organizations and also allow them to produce something new without hiring extra personnel.

Overview of studies on knowledge teams and purpose of this study

According to an initial literature search for SSCI-indexed journals published until 2011, with the search strings of “knowledge teams” or other similar strings (Table 2 in part 2-1, page 40), 4,679 articles were located. Then, when this search result was refined with “performance,” the result of the refinement still yielded 980 articles, meaning that overall we have a good number of articles on knowledge team performance. As mentioned, knowledge team performance measures include effectiveness, efficiency (Faraj and Sproull 2000), and creativity (Paulus 2000). Through a literature search done in part 2 on knowledge teams, we found that our field has focused more on *effectiveness and efficiency outcomes* than any other types of outcomes. According to our literature search result with refinement (with efficiency or effectiveness vs. with creativity), the number of articles on effectiveness or efficiency (440 articles) outnumbered the number of articles on creativity (77 articles). For effectiveness and efficiency of knowledge teams, numerous studies including empirical studies and literature review articles (e.g. Champion et al. 1993; Faraj and Sproull 2000), investigated

the impacts of various factors (inputs, processes, external environments) on these two performance measures or integrated the findings of empirical studies on these measures (Lee and Basselliér, working paper). Whereas the studies on knowledge team effectiveness and efficiency have provided us with a good understanding about “how those factors affect effectiveness and efficiency of knowledge teams”, in this study we would like to focus on the other two important outcomes of knowledge teams (other than effectiveness and efficiency), namely *1) team creativity and 2) individual members’ learning outcome*, with the following reasons.

First, team creativity is an important team level outcome for knowledge teams, as the main purpose of forming knowledge teams is not only to produce effective outcomes efficiently, but also *to produce a novel and useful outcome (e.g. creative new products, novel ideas for new marketing plans)*. Also, quite a few studies on knowledge teams (project teams or NPD teams) look into team creativity as dependent variables (e.g. Akgun, Dayan, and Di Benedetto 2008; Park, Lim, and Birnbaum-More 2009), including the knowledge teams investigated in the Essay II of this dissertation.

Second, both anecdotal evidences from the members of knowledge teams (project teams, NPD teams, consulting teams, etc) and several studies on individual learning (e.g. Kudaravalli 2010) have emphasized that knowledge team environment can be a good place for individual participants’ situated learning by engaging in team activities (Sense 2011). While engaging in knowledge team activities, individual participants’ learning is situated in their active involvement in knowledge team tasks and in their interaction with other members of the

knowledge teams, so that individual participants of knowledge teams can acquire various types of task-related knowledge that they cannot acquire from their day-to-day routine tasks.

As such, *team creativity* and *individual learning outcomes* are also important outcomes from knowledge teams, but based on our literature review on the antecedents of knowledge team outcomes (Part 2), we found that less effort has been made to integrate the previous findings on *team creativity* and *individual participants' learning outcomes in knowledge team environment*. In order to contribute to the literature on knowledge team performance, this study first defines and identifies the key properties of knowledge teams and then reviews empirical articles on the antecedents of team creativity and individual learning, in order to suggest several areas of future research. Thus, this paper intends to solve the following research questions:

What are the key characteristics of knowledge teams?

What are the main drivers of team creativity and individual learning in knowledge teams?

What important research avenues should be explored in order to enhance our understanding of knowledge teams?

To answer these research questions, this paper is organized as follows. In part 1, based on reviewing the definitions and characteristics in the studies on knowledge teams and similar types of teams, we define knowledge teams and identify the key properties of knowledge teams in terms of team tasks, team structures, and team processes. In part 2, we conduct a literature review of the empirical studies on the antecedents of team creativity (part 2-1) and those of

individual learning outcomes (part 2-2) and integrate the findings of those antecedents in Table 3 and Table 4. In part 3, based on the literature review conducted in part 2, we suggest several topics for future research, including those covered in Essay II and Essay III of this dissertation.

Part 1: The Key Properties of Knowledge Teams

By reviewing thirty two (32) articles (the references with ‘*’) that provided the definitions and characteristics of knowledge teams and similar types of teams, we first provide a definition of knowledge teams and key properties of knowledge teams in terms of team 1) tasks, 2) structures and 3) processes, which will allow us to better understand the work environment of knowledge teams for creative team outcomes and individual members’ learning. Also, the key properties of knowledge teams eventually help us identify the key factors (e.g. passion and shared norms of information communication technology use) for team creativity and members’ learning under knowledge team environment, which will be included in the research model developed in essay II and essay III.

Defining knowledge teams

A handful of studies have suggested the conceptual definition of knowledge teams. For example, Janz et al. (1997) defined *knowledge workers in organizations* as “high-level employees who apply theoretical and analytical knowledge to developing new products or services.” They also defined *knowledge teams* as “a group of knowledge workers who are gathered to create new knowledge by developing new products and services” (Drucker 1994; Janz et al.

1997). Woolley (2009) also defined *knowledge worker teams* as those that frequently face complex and open-ended tasks. Although they did not explicitly define *knowledge teams*, Faraj and Sproull (2000) and Faraj and Yan (2009) use the term "knowledge teams," to refer to teams that are formed with knowledge workers (e.g., software developers) to produce something new (business application software) by combining expertise from different parts of organizations. As mentioned, we use the term *knowledge team* as an umbrella term for teams to create novel outcomes by knowledge workers, so that *knowledge team* may include research teams (Cheng 1983), information systems development teams (Campion et al. 1993; Faraj and Sproull 2000), new product development teams (Ancona and Caldwell 1992), consulting teams (Ancona 1990), problem-solving teams (Grawitch, Munz, Elliott, and Mathis 2003a), and idea-generation teams (Hender, Dean, Rodgers, and Nunamaker 2002). Based on the definitions of previous studies and common characteristics of the types of teams previously suggested, we define "knowledge teams" as teams *that are formed by members with diverse expertise, to create new knowledge by working on non-routine, project-based, and complex tasks* (Faraj and Yan 2009; Janz et al. 1997; Shani, Sena, and Stebbins 2000).

Key properties of knowledge teams

Three categories are emerged from our literature review on knowledge teams and the like (project teams, software development teams, new product development teams, research teams, and temporary teams); 1) team tasks, 2) team structure, and 3) team processes (Table 1).

Knowledge team tasks

Knowledge teams engage in highly knowledge-intensive tasks in order to create something novel (Madhavan and Grover 1998). Based on the literature review on knowledge team tasks, we identify four properties of knowledge team tasks: 1) *complexity*, 2) *open-ended topics*, 3) *non-routineness*, and 4) *interdependence*.

Complexity: First, knowledge team tasks are *complex* (Faraj and Yan 2009). Task complexity is high when there are many subtasks to combine and many information cues to process (Wood 1986). In a knowledge team, members with different expertise process their information collectively, and they also fulfill their subtasks and put them together into one (if not, a few) team-level novel outcome(s). Thus, knowledge team tasks are more complex than the ones in ongoing or administrative teams.

Open-ended tasks: Second, knowledge teams face tasks for which *a priori* specification of goals and work processes is not possible. Thus, knowledge team tasks are *open-ended* and *uncertain* (Woolley 2009).

Non-routineness: Third, knowledge team tasks are usually *non-routine* tasks for members, as knowledge teams are often formed temporarily by members from different parts of an organization (different functional teams) to create something new; then, the teams are dismissed after they accomplish the goals of the knowledge teams (Shani et al. 2000). For example, in the case of a knowledge team formed of sales associates from different regional offices to develop new marketing and distribution strategies, the members are supposed to generate ideas and develop new strategies for their work, which is different from their routine

tasks (generating new sales and managing current sales accounts).

Interdependence: Fourth, knowledge teams rely on members' *diverse expertise* (Faraj and Sambamurthy 2006), and the different expertise and subtasks of each member will be combined into one (or a few) team-level outcome(s) (Campion et al. 1993; Cheng 1983), so that the *interdependence* of tasks is high.

Knowledge team structure

Informal structure: As knowledge teams are formed by diverse members of different functional parts of an organization, the formation of teams are often less hierarchical than ongoing teams (Saunders and Ahuja 2006). Instead of hierarchical positions, members' role (or title) assignment is not strict, but fluid. If any, members' titles may be named after the task-roles for which they are responsible within the knowledge teams, and not hierarchical roles (Saunders and Ahuja 2006). For example, instead of saying, "I'm a senior manager in the Central-Ontario marketing team" (e.g., in a regular and ongoing team), a member of a knowledge team may identify her/himself as the following: "I'm the person who is responsible for tasks A and B in this team." Sometimes, initially defined roles can be modified in order to finish the team's tasks on time, or some roles can emerge during the lifecycle of the knowledge team. The impact of less-strict role clarity will be discussed in the following section. In general, higher role clarity is found to be beneficial for task accomplishment, but could be harmful for innovative outcomes (Goodman and Goodman 1976). That is, less-strict role clarity may be beneficial for the types of tasks carried out in knowledge teams.

Temporariness of team formation: Although it is not always the case, knowledge teams are often formed for a limited time period. Often, for specific

knowledge-creation purposes, members from different functional teams get together for a limited time, and when the team goal is accomplished, the team is dismissed and the members return to their functional teams. A literature review on temporary teams allows us to identify the characteristics of knowledge teams formed temporarily. First of all, Packendorf (1995) listed a set of structural characteristics of temporary teams: 1) a predetermined point in time or time-related conditional state; 2) expectation for its termination; and 3) an organized (collective) course of action aimed at evoking a non-routine process or completing a non-routine product. The temporariness of knowledge team formation influences the mental status of the team members. Working under temporarily formed teams, team members *feel 1) time pressure, 2) the sense of a “low shadow of the future” and 3) form swift trust.*

First, due to its limited duration (specified deadline), the members of knowledge teams (formed temporarily) confront time pressures, which sometimes make functions difficult (Janowicz-Panjaitan, Bakker, and Kenis 2009) or may help produce creative outcomes (Paulus 2000). Time pressures also cause a sense of dedicated urgency and stimulate scarcity (Packendorf 1995). Thus, in knowledge teams, there are behavioral patterns such as an inclination to emphasize consensus or to change the basic assumptions concerning the tasks when the members are aware of the deadlines (Gersick 1988; Janis 1972).

Second, members' awareness of the team's termination causes a low “*shadow of the future*” (Heide and Miner 1992), which is defined as the anticipation of future interaction. For example, in permanent (ongoing) teams, the members of teams are influenced by the fact that they will work together in the

future, so that they may increase the amount of personal information exchange, friendly self-presentations, and cooperation in negotiations within their group (Bouas and Arrow 1996). A low shadow of the future decreases members' efforts to make long-term social ties among one another (Miles 1964; Saunders and Ahuja 2006). Also, a low shadow of the future has several implications on team processes. For example, team members are not concerned with the long-term efficiency of team processes. Instead of creating internal work processes that require a significant amount of learning effort by team members that could eventually be helpful for the team's long-term efficiency, temporarily formed teams focus more on tasks and how to get things done with limited resources and within a deadline (Saunders and Ahuja 2006). Also, as members focus more on task and goal achievement, they often make less effort to build interpersonal relationships (Grabher 2004). Another implication of the low shadow of the future is the risk of knowledge dispersing. Because members know that the team will be terminated after the deadline, they are aware of the possibility that the knowledge accumulated during the temporary team activity may be dispersed to other members with whom they will not work again (Grabher 2004). The implication of knowledge dispersing can be twofold. If the overall environment of a company encourages team members to share knowledge within teams, even if there is a low shadow of the future, then knowledge dispersing will not be a problem. However, if team members feel that knowledge dispersing is not personally desirable, they may refrain from sharing important knowledge.

Third, the most widely studied property of temporary (short-lifespan) teams is that team members often form *swift trust* (Coppola, Hiltz, and Rotter

2004; Iacono and Weisband 1997; Jarvenpaa and Leidner 1999; Meyerson, Weick, and Kramer 1996), which refers to the state that team members assume others are trustworthy, and they begin working as if trust were already in place. In knowledge teams, where members are from different backgrounds and interdependence among members is high, it is quite necessary to build interpersonal trust so as to collaborate among one another. However, since there is not enough time to build real trust, members form swift trust in order to get to work and solve a number of problems as a result of team's short lifespan. It is argued that swift trust may solve problems of vulnerability and uncertainty by improving members' beliefs that others will care about what is being entrusted with goodwill. As a result, members will be more willing to suspend doubt of other members' knowledge and abilities related to the team activities (Coppola et al. 2004). Also, swift trust may increase members' willingness to take risks and may foster a positive expectation of benefits of temporary group activity (Coppola et al. 2004).

Knowledge team processes

There are many aspects of team processes, namely, mission analysis, goal specification, strategy formulation and planning, monitoring progress toward goals, communication, coordination, and conflict management (Marks, Mathieu, and Zaccaro 2001). Among these dimensions of team processes, we describe the properties of team processes specific to knowledge teams.

Self-managed teams for knowledge creation (goal-setting and planning):

The tasks of a knowledge team are open-ended, so that a large proportion of the initial planning and goal- setting is done internally by team members. Thus,

knowledge teams are often characterized as *self-managed teams* (Quinlan and Robertson 2010). Such self-managed teams are defined as teams whose members manage their work by themselves, assign jobs, plan and schedule work, make production- or service-related decisions, and take action on problems (Kirkman and Rosen 1999; Wellins, Wilson, Katz, Laughlin, Day, and Price 1990). This type of team is characterized by *high authority and high task interdependence*. First, each team is given significant authority and responsibility for many aspects of their subtasks for teams (Barry and Stewart 1997; Dobbelaere and Goeppinger 1993). Second, the members perform highly related or interdependent tasks. Thus, for most team activities, they brainstorm, share ideas, and make decisions together (Guzzo and Dickson 1996).

Coordination: Coordination has been defined as “the integration or linking of different parts of an organization to accomplish a collective set of tasks” or “team-situated interactions aimed at managing resources and expertise dependencies” (Faraj and Sproull 2000; Kraut and Streeter 1995). *Coordination* is said to be one of the key factors for successful knowledge team outcomes (Cheng 1984; Faraj and Sproull 2000). It is argued that in order to be successful, both administrative coordination (assigning tasks, allocating tasks, and integrating outputs) and expertise coordination (identifying, integrating, and applying team members’ expertise) should be achieved in the context of knowledge teams (Faraj and Sproull 2000). In knowledge teams (especially ones temporarily formed), coordination is not easy to achieve because of the lack of experience in working together (Saunders and Ahuja 2006). Also, since individuals have little time to sort out who knows what, expertise *coordination is even more difficult* to achieve

(Meyerson et al. 1996). With members from diverse backgrounds, *informal communication among team members* is a key factor for achieving team coordination (Kraut and Streeter 1995).

Communication: Due to temporariness (time constraints) of knowledge teams, communication among members is more *focused on tasks and goals*, rather than on other peripheral issues such as interpersonal relationships (Saunders and Ahuja 2006). Another important property of team communication in knowledge team contexts is *the reliance on Information Communication Technology (ICT)*. As knowledge teams have a shorter time to accomplish goals, or often the members of knowledge teams are not always co-located, these teams can benefit from virtual communication media (Beise, Carte, Vician, and Chidambaram 2010; Saunders and Ahuja 2006) in order to fulfill team tasks, coordinate team processes, and monitor the progress of team tasks. Gibson and Gibbs (2006) argued that in contemporary organizational environments, most teams have a certain level of virtuality (the extent to which team members are distributed and the extent to which they rely on ICT). In the environment of contemporary knowledge teams, where team members not only collaborate in face-to-face (f2f) interaction environments but also fulfill their own subtasks, which are eventually combined into a team-level outcome, ICT (e.g., electronic collaboration systems; WIKI, file-sharing systems, team-dedicated discussion board systems, emails, etc.) should be important tools for team collaboration. Thus, the proper use of ICT will help teams achieve coordination, eventually successful team performance.

Monitoring progress and conflict management: An explicit time limit for achieving knowledge team outcomes will cause *a sense of dedicated urgency and*

will stimulate scarcity. Thus, in knowledge teams, team members tend to show temporarily related behavior patterns, such as an inclination to emphasize consensus or change the basic assumptions concerning tasks. When team members are making decisions together, they tend *to reach agreement or consensus quickly in order to get team activity to move forward* (Gersick 1988; Packendorf 1995). Moreover, when members monitor team progress upon their designated due date, they sometimes modify initially made assumptions about the tasks so that they can finish their team outcomes in time. Because of the time constraints and the low shadow of the future, conflict management is somewhat different from that of the ongoing team. That is, members focus more on resolving *task-related conflict* rather than on interpersonal conflicts. Because members know that after the knowledge team is dismissed, they may not have to work again with the other members, interpersonal conflicts are often suppressed or ignored (Saunders and Ahuja 2006).

Table 1 shows the summary of the key properties of knowledge teams. First, as knowledge teams are formed to produce one (or a few) outcome(s) by combining distributed expertise from different parts of organizations (Faraj and Sambamurthy 2006), the nature of knowledge *team tasks* is complex, non-routine, open-ended, and cross-functional (Ancona and Caldwell 1992; Faraj and Sproull 2000; Janz et al. 1997; Kraut and Streeter 1995; Madhavan and Grover 1998; Woolley 2009). Second, the team structure of knowledge teams is rather informal and fluid (can easily be modified) and less hierarchical than ongoing teams (Saunders and Ahuja 2006). Also, in many cases, knowledge teams are formed temporarily (or team projects last for limited time period). Thus, team members

show some behavioral patterns related to the temporariness of teams (e.g. swift trust). Third, two key processes, namely, communication (both internal and external) and coordination (both administrative coordination and expertise coordination) are considered as important processes for team performance, in order to incorporate the knowledge of team members from different parts of organizations (Ancona and Caldwell 1992; Campion et al. 1993; Faraj and Sproull 2000). In this work environment (informal team structure with complex, non-routine, and open-ended tasks for limited time period), we suggest that *team's psychological involvement to team activities* should be important input for team members' engagement in team processes, which in turn affect creative team outcome and individual team members' learning from participating in team activities. In part 3, we will suggest that teams' psychological input, such as passion about team activities should be important inputs for team creativity and individual learning, which will be investigated in Essay II and Essay III.

Table 1 Key properties of knowledge teams		
Categories	Knowledge team characteristics	Key references
Tasks	Complexity Open-ended Non-routineness Interdependence	Faraj and Yan (2009) Woolley (2009) Shani et al. (2000) Faraj and Sambamurthy (2006) Campion et al. (1993)
Structure	Informal and Less-hierarchical Temporariness	Saunders and Ahuja (2006) Packendorf (1995), Coppola et al. (2004)
Processes	Self-managed teams Coordination Communication Virtuality and reliance on ICT Monitoring and conflict management	Quinlan and Robertson (2010) Cheng 1984; Faraj and Sproull (2000) Saunders and Ahuja (2006) Gibson and Gibbs (2006) Saunders and Ahuja (2006)

Part 2: Identifying Antecedents for Team Creativity and Individual Learning Outcomes in Knowledge Team Environment

Knowledge team outcomes

Based on our literature review, we identified that the key team-level performance measures of knowledge teams are effectiveness, efficiency, and creativity (Faraj and Sproull 2000; Goodman and Goodman 1976; Grawitch et al. 2003a; Saunders and Ahuja 2006). Also, we found that the most frequently studied knowledge team outcomes are the effectiveness and efficiency of team outcomes. While efficiency measures includes adherence to a schedule and budget, effectiveness measures include goal-fulfillment, the quality of team outcomes, and even the quality of team processes (the way teams operate during the period of the knowledge teams) (Faraj and Sproull 2000). Second, another important knowledge team outcome is team creativity, as teams are formed to create something novel (e.g., new products, services, work processes, and new policies) (Akgun et al. 2008; Grawitch et al. 2003a). Creativity measures include the *number and originality of ideas generated*, the *emergent creativity in team processes* and the *creativity embedded in team outcomes* (Moorman 1995; Sosik, Avolio, and Kahai 1998a; Tiwana and McLean 2005).

Other than team-level outcomes, several studies argue that members' learning is also an important outcome from participating in knowledge teams (Sense 2011). Because members from different backgrounds gather together even for short periods of time, share knowledge, make decisions, and fulfill tasks to create something novel, the participants of knowledge teams can learn something

that they could not learn from their ongoing teams. Learning measures include the degree of knowledge acquisition (or accumulation of knowledge), the achievement of a learning curve (productivity increased), and enhanced ability for problem solving (Alavi, Marakas, and Yoo 2002; Griffith and Sawyer 2006; Narayanan, Balasubramanian, and Swaminathan 2009; Tyre and von Hippel 1997).

In this study, we will focus on team creativity and individual members' learning in knowledge team context. In the following two sections (part 2-1 and part 2-2), we will review literature on the antecedents of team creativity (part 2-1) and those of individual team members' learning outcome (part 2-2) in knowledge team environment and integrates the empirical findings on these two outcomes. Then in part 3, based on the literature review in part 2, we will suggest several research topics on knowledge teams.

Part 2-1: Antecedents for Team Creativity of Knowledge Teams

Literature review method

Initial literature search with keywords and refinement

In order to get representative sample studies on knowledge teams, the literature search was started with 40 search strings by combining the search labels from category A (knowledge ~, knowledge workers' ~, new product development ~, ...) and the search labels from category B (team, teams, group, and groups) in Table 2, which yielded $10 \times 4 = 40$ concrete search strings. These search strings were inserted into the ISI Web of Knowledge. We also set the database limits with

the Social Sciences Citation Index (SSCI) only in order to ensure the minimum quality of journals.

At first, the search was done using those 40 keywords with the time published until 2011. A total of 4,679 articles were located. We then refined the search results with two important keywords: “Creativity” and “Knowledge.” Finally, we refined the results again with management disciplines and our reference disciplines in the Web of Science categories: Management, Business, Computer Science, Information Systems, Social Psychology, Applied Psychology, Operations Research, Management Science, Information Science, Library Science, and Business Economics. We ended up with 50 articles.

Second, another literature search was done to find articles on the focus of this chapter: team creativity. Two keywords (“Team Creativity” and “Group Creativity”) were used under the same condition (SSCI-indexed journals until 2011). Then the initial results were refined with the keyword “knowledge” in order to capture studies on team creativity under knowledge team environments. We also refined the results with the same Web of Science categories used for our previous search. We ended up with 61 articles.

Table 2. Journal search keywords for knowledge teams	
Keywords category A	Keywords category B
Knowledge	Team
Knowledge workers'	Teams
New product development	Group
Software development	Groups
Research	
Information systems	
Information systems design	
Temporary	
Project	
Virtual	

Article selection and snowballing method

With the sample of 111 articles (they are not unique, but overlap existed), we read the abstract and even the actual text of each paper in order to select the studies for this literature review, using the following selection criteria. First, only studies that took place in the context of knowledge teams and the like (teams that are formed to produce outcomes that embed new knowledge) were selected.

Although we searched articles with 40 different search strings that could be classified as knowledge teams, some types of teams (e.g., administrative teams) did not have much to do with the definition of knowledge teams as defined in this paper; thus, those studies were excluded. Second, only studies that investigated the impact of team-level antecedents on team creativity were selected for the review. Third, only empirical studies were included. That is, the findings of each study should be based on an analysis of either a large or small set of data, regardless of the research methods (i.e., the studies with surveys, experiments, and case studies were included, but literature review articles or conceptual papers were not included).

This literature search and selection strategy may have excluded a number of relevant studies within the context of knowledge teams, which are not recognized as studies on creativity in knowledge teams. That is, there are some studies on teams that take place in a knowledge team setting. However, as other topics (e.g., coordination, distributed team settings) are more emphasized, and the context of knowledge team settings was not considered important, some studies on knowledge team creativity might have been excluded from this literature search. In order to identify the empirical articles that investigate team creativity in

knowledge team contexts, but are excluded from our literature search, a snowballing method was performed to find referred articles of the articles found above (111 articles). This snowballing procedure was done simultaneously with the article selection procedure (reading the abstract and contents of the articles) above. While reviewing each article, we identify some important referred articles of each article and include them in our literature review list.

In all, the total sample of papers included in the literature review on knowledge team creativity is forty four (44). Despite the likelihood that some potentially relevant articles on creativity in the context of knowledge teams could be missed, we believe that the final list of papers are representative of the empirical work specifically on *the antecedents of team creativity in the context of knowledge teams*.

Classification of the antecedents of creativity of knowledge team outcomes

After reviewing and identifying the antecedents of team creativity in the context of knowledge teams, the antecedents were classified into three broad categories (inputs, processes, and external / contextual influences) based on the theoretical framework used in both Gladstein (1984) and Woodman, Sawyer, and Griffin (1993). *Team inputs* are further classified into three sub-categories (cognitive, psychological, and structural inputs); *team processes* are further classified into five sub-categories (internal interaction, knowledge management processes, tactical processes, conflict, and coordination); and *external influence* is not classified into any sub-category. These three broad categories of the antecedents of team creativity knowledge seem to be a thorough classification of the factors identified by this literature review. With these categories, the findings

on the antecedents of team creativity in knowledge teams will be discussed in the following sections.

Measures of creativity in knowledge teams

Before we describe the empirical findings on the antecedents of team creativity, let us define creativity in knowledge teams and discuss what aspects of creativity we are looking at in this paper. Creativity is defined as the creation of valuable, useful new product, service, idea, procedure, or process by individuals working together in a social system (Woodman et al. 1993, p. 293). Thus, in knowledge team environment, *team creativity* is defined as the creation of valuable and useful team outcomes (products, service, ideas, procedures, or processes) by a knowledge team.

Creativity is a multi-faceted construct. According to Amabile (1983), creativity can be measured in terms of *the creative process, the creative person, and the creative product*. This study focuses on the creativity of knowledge team *processes and products (outcomes)*, rather than creative individuals. According to the literature review, we found that knowledge team creativity is measured in three ways; 1) creativity of ideas generated, 2) creativity in team processes, 3) creativity of the outcomes produced by knowledge teams.

First, studies on idea-generation (brainstorming) teams usually measure creativity with some or all of the four dimensions suggested by Guilford (1950): 1) fluency: the number of ideas generated; 2) flexibility: the variety of ideas generated; 3) originality: the production of unusual ideas; and 4) elaboration: the development and building on other ideas. Especially, many studies using experiments measured team creativity in terms of the number and originality of

ideas (Grawitch et al. 2003a; Hender et al. 2002; Kohn, Paulus, and Choi 2011; Sosik et al. 1998a).

Second, some studies looked at the creativity embedded in team processes (Chirumbolo, Livi, Mannetti, Pierro, and Kruglanski 2004; Hemlin 2006; Tiwana and McLean 2005). For example, Chirumbolo et al. (2004) measured the creativity in expressed in team interaction and Tiwana and McLean (2005) also measured creativity of team processes as the extent to which the team's processes were creative.

Third, studies that focused on the final team outcomes after team members' collaboration (e.g., the outputs from new product development (NPD) teams or research teams) measured the creativity of team outcomes in terms of novelty and originality. For example, Akgun et al. (2008) measured new product creativity with the instrument developed by Moorman (1995) to assess the extent to which the product 1) challenged existing ideas, 2) offered new ideas, 3) spawned ideas for other products, and 4) encouraged fresh thinking. In addition, some studies used innovativeness and creativity interchangeably and measured innovativeness as team creativity, although innovativeness and creativity are different concepts, in that creativity is a subset of the broader domain of innovation (Amabile 1996; Woodman et al. 1993). In particular, when the studies measure creativity in the products generated from knowledge teams, the operationalization of innovativeness in new products generated by teams was very similar to that of outcome creativity (Pirola-Merlo and Mann 2004). Thus, we also looked at studies that measured the innovativeness of team outcomes as one of the measures of outcome creativity in knowledge teams.

In this literature review, we tried to review all aspects of creativity from knowledge team activities. While creativity measured in most studies in our literature review dealt with outcome creativity (whether the outcome was ideas generated or new product/service/project outcomes), some studies investigated the creativity of team processes and creativity expressed in interactions among team members. Throughout the literature review, we will describe which aspect of creativity was used in each study; however, we do not intend to classify the antecedents of creativity into the antecedents of different aspects (number of ideas, originality of ideas, product innovativeness, etc.) of creativity, as we focus on key team inputs, processes, and external influences that enhance all aspects of knowledge team creativity.

Key inputs for team creativity

Several sub-categories of key team inputs for team creativity are emerged from our literature review. We found that knowledge team inputs can be classified into the cognitive and psychological mental status of the team members and the structural characteristics of teams. Briefly, *cognitive team inputs* include *individual members' creativity, expertise, experiences, and cognitive abilities (absorptive capacity and collective efficacy)*, while *psychological team inputs* include *affect, mood, and the cultural status of teams*. *Structural team inputs* include the compositional characteristics of teams, such as *member diversity, anonymity, and team longevity*.

Cognitive inputs

Several cognitive factors in knowledge teams are found in this literature review, namely: 1) individual members' creativity, 2) expertise (knowledge), 3)

experience, and 4) other cognitive abilities (absorptive capacity and collective efficacy).

Individual members' creativity: Team creativity is not the simple aggregation of all team members' individual creativity, although team creativity can be a function of individual members' creativity in the team (Woodman et al. 1993). First of all, a couple of studies found a relationship between individual members' creativity and team creativity. Pirola-Merlo and Mann (2004) found that there is a significant relationship between individual members' creativity scores (aggregated) and team creativity scores. However, both Tagger (2002) and Pirola-Merlo and Mann (2004) argued that team creativity cannot be fully accounted for by simple aggregation of individual members' creativity. Rather, Tagger (2002) found that the impact of individual members' creativity on team creativity is mediated by creativity-relevant team processes (details explained later in this paper), which suggests that team creativity emerges from creativity-relevant team interaction among creative individual members. Pirola-Merlo and Mann (2004) found that the team climate for creativity (referring to "support for innovation and organizational encouragement of creativity") explains extra variance in team creativity, even after entering team members' aggregated creativity as a predictor. As such, although individual members' creativity may lead to team creativity, the best possible team creativity can be achieved by proper team processes or an overall climate that facilitates creative interaction of the team members.

Expertise: In order to be creative, teams should have adequate expertise to generate ideas and apply them into final team outcomes (Csikszentmihalyi 1996).

Thus, several studies argued that *expertise* significantly influences team creativity. Reilly (2008) found that the expertise of team members is positively related to team creativity and that shared expertise within a team (not the expertise embedded within a single person) is more important for team creativity. Akgun et al. (2008) also found that the existence of *task-related knowledge* within a team positively influences *team-level intelligence* (defined as a team's capability to process information – acquisition, dissemination, and utilization of information for project-related activities), which eventually improves team creativity. Suh, Bae, Zhao, Kim, and Arnold (2010) found that the existence of *experiential knowledge* positively influences the creativity of international marketing projects, and Park et al. (2009) found that the existence of team members with *multi-functional knowledge* (having knowledge of several functions) is positively associated with team creativity. As such, team creativity requires team-level expertise, whether the expertise directly influences creativity or indirectly influences creativity through mediating team processes (e.g., team intelligence in Akgun et al. (2008)).

Experience: Team experience is also found to be an important cognitive input for team creativity. Gino, Argote, Miron-Spektor, and Todorova (2010) found that team creativity is higher when teams have *direct experience in working together on their previous tasks* than when teams have indirect or no experience before, and that the relationship between team experience in working together and team creativity is mediated by transactive memory systems (TMS). That is, when a team has experience from previous tasks, team members form TMS of who knows what and who is good at which tasks, so that based on the TMS formed

with the experience of working together, the team can produce more creative outcomes in the next project.

Team experience plays a role in moderating the conditions for creativity, as well. Dayan and Di Benedetto (2011) found that team experience positively moderates the relationship between team decision-making and new product creativity. In detail, when teams have a high level of task-related experiences, the positive relationship between decision-making (based on a balanced level of intuition and data) and new product creativity becomes stronger. Not only a team's experience, but also a team's *openness to experience* is also found to be a significant factor for team creativity (Schilpzand, Herold, and Shalley 2011). As such, teams' experience is one of the important cognitive inputs for team creativity; however, it has a more indirect impact on team creativity. It either helps teams to form a transactive memory system, which will help produce creative outcomes, or it becomes a moderating condition for the role of team decision-making on team creativity.

Team collaboration capability: We identified that other team-level ability for team collaboration, which includes absorptive capacity, collective efficacy, and the team's collective focus on similar (or different) topics are significantly related to team creativity. Tiwana and McLean (2005) found that teams' *absorptive capacity* (defined as the ability of team members to interrelate with the expertise of their peer team members, p. 22) positively influences expertise integration within a team, which in turn, enhances team creativity in the context of IS development teams. *Collective efficacy* (defined as a sense of collective competence shared among individuals when allocating, coordinating, and

integrating their resources in a successful concerted response to specific situational demands, p. 309) (Zaccaro, Blair, Peterson, and Zazanis 1995) is also an important cognitive status of teams that positively influences the idea generation of a team (Zhang, Tsui, and Wang 2011). Finally, *team members' joint focus on related topics* is found to be significantly related to both the number of ideas generated and the originality of ideas (Baruah and Paulus 2008).

In sum, team' cognitive inputs (individual members' creativity, expertise, experience, absorptive capacity, collective efficacy, and collective focus on related topics) are found to be important inputs for the creativity of knowledge team outcomes. Team expertise and team efficacy tend to have rather direct impacts on team creativity, while individual members' creativity, experience and absorptive capacity have rather indirect impacts on team creativity.

Psychological inputs

In addition to cognitive team inputs, team members' psychological status also influences team creativity, either directly or indirectly. In general, at the individual level, research has suggested that creativity is best facilitated when an individual feels safe, has positive affective status, and is free from external pressure (Claxton 1998). However, the literature review on team creativity suggests that the impact of team members' psychological inputs on creativity is more complex than the impact of individual-level inputs on individual creativity, as shown below (e.g., the impact of team-level moods on the creativity of knowledge teams).

Moods: It is interesting to see that creativity is not always positively associated with the positive affective status of team members. At the individual

level, the positive affective status of an individual is found to be positively related to individual creativity (Estrada, Isen, and Young 1994; Isen 2000). However, Tu (2009) found that under the condition of high organizational support (managerial support or incentives) and low organizational control (less punishment for minor mistakes and the revision of strict rules), a negative mood (about their work fulfillment) of a team (i.e., team members feel that they are not working hard enough) positively leads to team creativity in the context of NPD teams, while a team's positive mood was found to have no effect on team creativity (self-rated creativity of team outcomes measured by team participants). On the other hand, Grawitch, Munz, and Kramer (2003b) found that team members' positive mood significantly influences the originality of the ideas generated within a team. These mixed results seem to originate from how two studies measure positive/negative mood and creativity. While Tu (2009) measured mood in terms of how individuals feel about their work, Grawitch et al. (2003b) manipulated mood conditions for team members by introducing them to a story that evoked individual members' positive mood. Also, Tu (2009) measured creativity with self-rated product creativity of NPD teams, while Grawitch et al. (2003b) measured creativity with the originality of ideas generated by individual team members (and aggregated them into a team-level measure). Grawitch et al. (2003b) also maintained that the positive relationship between a positive mood and creativity may stem from "its additive effects on the individuals within the group rather than a multiplicative effect on the group itself."

Thus, based on these findings, we found that a positive/negative mood may have differential effects on team creativity. While a positive mood may

enhance team creativity when team members' aggregated positive moods are reflected in team-level outcomes, negative moods could also have a positive impact on creativity when the team mood concerns their work fulfillment and is under organizational support. Also, the positive moods of individual members positively influence idea generation, and negative moods involving teamwork fulfillment will help improve the creativity of team outcome under a high level of organizational support and a low level of pressure. However, these arguments are based on only several empirical studies, which we think is not enough and it seems that the impact of team moods or other psychological status on team creativity is still much to be investigated. Therefore, future research may explore other psychological inputs that could lead to creativity or creativity-generating team processes.

Trust and relational capital among members: In part 1, we reported that *swift trust* is one of key characteristics of knowledge teams (especially those held temporarily). However, the impact of swift trust on team creativity has not been empirically investigated, although there are studies on the role of swift trust on overall team performance (Kanawattanachai and Yoo 2002). Instead, there are several studies that investigated the role of 'trust' or 'relational capital among team members' on team creativity. Rather than directly leading to team creativity, trust and relational capital among team members are found to play a role as the antecedents of team process variables, which in turn, enhance team creativity. *Team trust* positively influences the collaborative team culture, and this collaborative team culture positively affects team creativity in the context of research teams (Barczak, Lassk, and Mulki 2010). Further, *relational capital*

among team members positively influences collaborative expertise integration, which in turn, affects team creativity (Tiwana and McLean 2005). That is, good interpersonal relationships among team members indirectly influence team creativity through collaborative culture building and expertise integration.

Psychological safety: Although a number of studies argue that psychological safety within a team positively influences team creativity, it is surprising that to the best of our knowledge, we have not found empirical studies on the impact of psychological safety (or safety within team environment) on *team creativity*. For example, Paulus (2000) argued in his literature review that psychologically safe team environments facilitate team creativity. West (2002) also argued that psychological threat is detrimental for team creativity. Chen (2006) argued (but did not empirically test) that psychological safety is a moderating condition where task conflict is positively related to team creativity. As such, we found studies more theoretical than empirical in nature that discussed the role of psychological safety on team creativity.

Team stress and autonomy: Some psychological team inputs play a role as the moderating forces for the relationship between other antecedents and team creativity. For example, the level of *team stress* is a moderating factor for team creativity rather than a direct antecedent. Dayan and Di Benedetto (2011) found that a low level of team stress is found to be a moderating factor for the relationship between a team's *cognitive-and-intuitive balanced decision-making* (i.e., teams make a decision based firstly on intuition, but later find support for their decision with data) and new product creativity. Also, Grawitch et al. (2003b) found that *high autonomy* positively moderates the relationship between positive

mood and the originality of ideas generated by a group. As such, a low level of stress and high autonomy provides teams with a creativity- enhancing work environment.

Within team culture: Cultural aspects of a team affect team creativity.

Goncalo and Staw (2006) found that the *individualistic culture* of teams is better for team creativity than the collectivistic culture. Also, an activated *gender fault line* (defined as the “hypothetical dividing lines that may split a group into subgroups based on one or more attributes” (Lau and Murnighan 1998, p. 328)) is found to be negatively related to team creativity because such a fault line (i.e., gender subgroups are formed) impairs team participation and divergent thinking within a team (Pearsall, Ellis, and Evans 2008).

In sum, the roles of various psychological team inputs on team creativity have been investigated so far. Positive/negative (according to how mood is measured) moods, trust among team members (less interpersonal conflict), a psychologically safe environment, low stress and high autonomy, and an individualistic culture either directly or indirectly influence creativity in knowledge teams. Some psychological team inputs are found to be directly related to team creativity, but a larger number of studies found that psychological inputs are either a moderating force or inputs for team processes that will lead directly to team creativity.

Structural inputs

Structural team inputs include team diversity, anonymity, and longevity. Among these structural inputs, team diversity (also referred to as “heterogeneity,” “disparity,” or “variety”) is the most frequently investigated input for creative

team outcomes.

Diversity: Team diversity is a complex and multi-dimensional construct (Cummings 2004). According to several studies on diversity, diversity within teams can include demographic, geographic, functional, managerial, organizational, expertise, and cultural differences among team members (Cummings 2004; Stahl, Maznevski, Voigt, and Jonsen 2010).

Quite a few studies argue that diversity is beneficial to team creativity, as it brings diverse perspectives from different areas of expertise. For example, Stahl et al. (2010) found that the cultural diversity of a team is positively associated with team creativity, regardless of co-located vs. distributed teams, long vs. short tenured teams, and task complexity. Tiwana and McLean (2005) found that in the context of Information Systems Development (ISD) teams, expertise heterogeneity is positively related to team creativity. Also, diversity in terms of team members' external ties is positively related to team creativity (Chen, Chang, and Hung 2008). However, other studies found a detrimental impact of team diversity, as diversity sometimes causes conflict, high turnover, less social interaction, and more problems of communication among members (Nigel 2005).

Some scholars have suggested different explanation for these mixed (positive vs. negative) impacts of diversity on team creativity. First, it is argued that these inconsistent findings involving the impact of team diversity stem from different dimensions of team diversity. For instance, Curseu (2010) found that while team variety (defined as the horizontal knowledge differentiation among members) is beneficial for team creativity, team disparity (defined as the vertical asymmetry in the distribution of valued resources in the team) is detrimental for

team creativity. Second, other studies suggest a non-linear relationship between team diversity and team creativity. Akgun et al. (2008) argued that the functional diversity of a team has a curvilinear (inverted U-shape) relationship. To a certain point of team functional diversity, it has a positive impact on team intelligence because cross-functional diversity can bring a variety of information, but beyond a certain point, functional diversity increases decision complexity and eventually leads to a negative impact on team intelligence (which is a direct antecedent of team creativity.), although in the empirical test, they only find the positive relationship between team diversity and team intelligence. Goncalo, Flynn, and Kim (2010) also found that the number of narcissists in a team is related to team creativity with an inverted-U shaped relationship. Third, Miura and Hida (2004) suggested that both diversity and similarity are required for the best possible outcome in idea-generation teams. They found that a high level of diversity in terms of “*the number of unique idea categories generated in each group*” and a high level of similarity in terms of “*the rate of duplication of idea categories in each group*” together leads to the highest creativity scores within idea-generation teams. That is, both the number of unique idea categories and the level of consensus among members regarding the categories of ideas are important for the creativity in idea-generation phase in knowledge teams.

Anonymity: It is found that anonymity stimulates creative thinking because it helps reduce the fear of confronting others’ comments and also help individuals de-emphasize attachment to their own ideas, so that the individuals can easily abandon their old ideas in favor of new ones (Jessup, Connolly, and Galegher 1990; Sosik et al. 1998a). Rather than having a direct impact, team anonymity is

found to have a moderating impact on the relationship between other inputs and team creativity. Sosik et al. (1998a) found that under an anonymous environment, the impact of inspirational leadership and goal-setting on team creativity is higher than under identified conditions.

Team longevity: Team longevity is found to be detrimental for team creativity. Leenders, Engelen, and Kratzer (2003) found that task longevity is negatively related to team creativity in the context of NPD teams. This finding is somewhat inconsistent with the findings of Gino et al. (2010), who maintained that teams' experience in working together indirectly (mediated by transactive memory systems), but positively influence creativity. These mixed findings can be explained by the notion that simply spending a long time working together with the same members in a knowledge team may hinder the creative thinking of a team, as the team may lack an inflow of new ideas and insight. However, building a transactive memory system from previous work experience is helpful for team creative outcomes, as team members know who is good at which types of tasks.

To summarize the findings on structural inputs, diversity has a rather direct (vs. indirect) impact on team creativity. As shown, only Akgun et al. (2008) found that functional diversity of team indirectly (and positively) influence team creativity through team intelligence, while the remaining studies found a direct impact. Second, although team diversity is a key structural input for team creativity, an excessive level of team diversity may become a detrimental factor for team creativity, as it might reduce team interaction and may cause communication problems. Third, while quite a few studies have tried to reconcile

inconsistent findings involving the impact of diversity on team creativity, we suggest that there is still much to be done to investigate the impact of team diversity on team creativity. Briefly, future research is required to look into the impact of the different dimensions of team diversity on team creativity and the role of team diversity on the different phases (e.g., the impact of team diversity on the brainstorming phase vs. the closing phase of a project team) of knowledge teams. Fourth, anonymity increases team creativity in terms of the number and originality of ideas generated, but this might be detrimental if the team is supposed to produce a single integrated team outcome. These results imply that an anonymous idea-generation phase followed by identified face-to-face interaction would be good process coordination for creative team outcomes (Paulus 2000). Finally, simply having a long tenure of working together with the same team members can be detrimental to creative team outcomes, but it is important to form a transactive memory system within a team for team members who have experience in working together.

Key processes for team creativity

We classified team processes identified in the literature into five subcategories: internal interaction (internal communication), knowledge management, tactical processes, conflict, and coordination. In the previous section, we found that cognitive, psychological, and structural team inputs either directly or indirectly influence team creativity, depending on the scope and focus of each study that we reviewed. Nevertheless, we believe that in order to generate one (or a few) team-level outcome(s) by combining team members' expertise in knowledge teams, both team inputs and team processes are important. That is,

without the proper team processes, teams may not be able to produce the best possible creativity outcomes, even with a number of beneficial team inputs. In this section, we describe and integrate the extant findings regarding the impact of team processes on team creativity and their relationship with other antecedents (inputs and external factors).

Internal interaction among members

In the context of knowledge teams, internal interaction among team members is very important, as it enables the combination the expertise of the team members required to produce the final team outcomes.

Degree of internal communication: It is found that the amount of internal team communication has a curvilinear relationship with team creativity. Leenders et al. (2003, 2007) found that a moderate level of internal communication will lead to the best creativity in NPD teams. They also found that the existence of a central person (i.e. a person who often dominate team communication) within intra-team communication is detrimental for team creative outcomes. That is, it is better to have decentralized team communication. Further, just for the early idea-generation phase of knowledge teams, it might be even more beneficial if team members do not communicate at all. Some studies have found that nominal groups perform better in idea generation with respect to both the number of and the originality of ideas, and the group session after the individual session (no interaction among members) is good for idea generation (Paulus 2000; Rietzschel, Nijstad, and Stroebe 2006). Thus, these studies imply that the degree of internal team communication could be negatively associated with creativity in the idea-generation phase and has a curvilinear (inverted U shape) relationship with team

creativity.

Creativity-enhancing internal interaction: A handful of studies have suggested the role of “creativity-generating” team interaction. Instead of a simple amount of team communication, these studies focus on how team members interact within a team. Chen et al. (2008) argued that within-team social interaction (rather than just the amount of communication) enhances team creativity in the context of R&D project teams. Further, some studies have proposed sets of team-processes that are beneficial to team creativity. Taggar (2002) proposed that TCRP (Team Creativity-Relevant Processes) include *team citizenship* (volunteering to do things within teams), *performance management* (task/role assignment and deadline setting), *effective communication*, *involving others*, and *conflict management*; he found that this set of team processes moderates the relationship between individual members’ aggregated creativity and team creativity. Hargadon and Bechky (2006) have also found that team members’ *help seeking*, *help giving*, *reflective reframing*, and *reinforcing processes* enable a team to reach moments of collective creativity, so that the team can achieve creative team outcomes. Finally, Reilly (2008) found that *problem finding through social creativity processes* within a team (including raising new questions, hypothesizing, envisioning, and imagining) helps the team reach a moment of generating creative solutions.

In sum, in knowledge team contexts, it is important for team members to communicate among one another to share and combine expertise so as to produce novel outcomes. However, research suggests that while a simple amount (time spent) of communication is required for team creativity to a certain extent

(moderate level), creativity-enhancing interactions (Hargadon and Bechky 2006; Taggar 2002) seem to be more important for producing novel outcomes, as creativity-generating interactions magnify the impact of individual members' creativity on team creativity and help team members reach a collectively creative moment for generating novel outcomes.

Knowledge management processes within teams

In knowledge team contexts, *sharing knowledge within teams* and *acquiring external knowledge* are crucial for team outcomes (Wong 2004). This section focuses on how team knowledge processes affect team creative outcomes in the context of knowledge teams.

Internal knowledge sharing: First of all, research has found that sharing knowledge among team members should help team creativity in terms of both processes and outcomes, as long as there are beneficial inputs within a team (e.g., different expertise of members or transformational leadership). Park et al. (2009) found that *internal knowledge sharing* mediates the impact of the proportion of multi-knowledge individuals on product innovativeness in cross-functional knowledge teams. Additionally, Zhang et al. (2011) found that internal knowledge sharing positively mediates the relationship between transformational leadership and creativity in knowledge team contexts. Also, Tiwana and McLean (2005) found that the integration of expertise within a team positively influences creativity in team processes.

In the idea-generation (brainstorming) phase as well, although it is found that teams with interaction may produce fewer ideas (Rietzschel et al. 2006), teams that share ideas may produce more novel and feasible ideas. Kohn et al.

(2011) found that building on others' ideas within groups actually enhances the novelty and feasibility of the ideas generated from a group. This finding is inconsistent with Rietzschel et al. (2006)'s finding that the originality of an idea is better in nominal (no interaction among members) groups than in face-to-face groups. Thus, it seems that nominal (or no-interaction) teams may produce more ideas, but in terms of the originality of ideas, proper internal interaction (the degree of team members' idea sharing to produce better ones rather than simple measure of team communication) might be helpful. A future study should be conducted to reconcile the impact of team interaction and the originality of ideas in the idea-generation phase.

External knowledge sourcing: It is not likely that all necessary knowledge is located in a focal team. Thus, knowledge from external sources may be required in order to fulfill the knowledge team tasks (Ancona and Caldwell 1992). Bringing in external expertise to knowledge teams should enhance team creativity, as external knowledge may help team members learn new perspectives and also help produce more creative ideas. Actually Teigland and Wasko (2003) found that at the individual level, external knowledge sourcing positively influences individual creativity. However, surprisingly, not many studies have empirically investigated the direct relationship between external knowledge sourcing and team creativity in the context of knowledge teams, as most studies on the impact of external knowledge sourcing or boundary spanning focus on team effectiveness as a dependent variable (Bresman 2010; Faraj and Yan 2009; Wong 2004; Zellmer-Bruhn 2003). As an example, Ancona and Caldwell (1992) found that external knowledge sourcing (external communication), mediates the relationship

between functional diversity and product innovation in NPD team contexts (The more functional diversity within a team, the more teams engage in external communication, which leads to product innovation). Paulus (2000) also suggested the importance of exposure to external ideas on the idea-generation within a team in his literature review article.

In sum, team knowledge processes are important for knowledge teams, as knowledge teams seeking external knowledge and sharing it within teams to fulfill team goals may end up with more creative outcomes. As described above, these knowledge processes seem to play a mediating role in the relationship between other beneficial inputs (multi-knowledge individuals, functional diversity, and transformational leadership) on team creativity.

Tactical processes

We define *tactical team processes* as some strategic actions and plans that are either exercised by team leaders or all team members for successful team outcomes. In this literature review, we identified that leadership, training, coaching, and decision making belong to the category of tactical processes.

Leadership: The most frequently studied tactical team processes are leadership activities. In knowledge team environments, appropriate activities of leaders are found to be important for team creativity (Amabile, Conti, Coon, Lazenby, and Herron 1996; Woodman et al. 1993). Chang (2011) found that team leaders play the role of evaluating, monitoring, encouraging, and guiding the processes of producing creative ideas. Hemlin (2006) found that proper leadership is considered to be a more important antecedent than organizational support for creativity processes in biotechnological team environments. Hemlin

and Olsson (2011) also proposed four distinct behaviors of team leaders that enhance team creativity in research teams; namely 1) expertise provision, 2) team coordination (e.g., leader-initiated getting together), 3) team support (e.g., proper rewards that increase intrinsic motivation), and 4) task assignment (structuring problems that permit followers to self-manage their task assignments).

Types of leadership also make a difference in team creativity. Zhang et al. (2011) found that *transformational leadership activities* (raising the team members' consciousness about the importance of team outcomes, encouraging followers to transcend their self-interests for the good of the team, and expanding team members' portfolios in order to improve themselves and explain what they are attempting to accomplish) help improve team creativity, while authoritarian leadership deteriorates team creativity. Sosik, Kahai, and Avolio (1998b) compared the different impacts of different leadership styles on team creativity. While transactional goal-setting (i.e., clarifying performance expectations and task purposes and by expressing "do-your-best creativity goals") and inspirational motivation (i.e., inspiring group members to elevate their goals and needs) is positively associated with team creativity, intellectual stimulation (i.e., questioning assumptions, reframing problems, and thinking about ideas and concepts using novel approaches) and individualized consideration (i.e., appreciating and integrating the different needs and viewpoints of members within a group) is negatively associated with team creativity in the context of electronic brainstorming groups. Sosik et al. (1998b) also found that teams working under higher levels of transformational leadership produced more idea elaboration and original solutions than those under lower levels of

transformational leadership. Finally, other types of leaders' activities that enhance team creativity include the application of well-defined thinking strategies in idea-generating processes, the provision of equal opportunities for all team members, and the timely appraisal and recognition of individuals' outputs (Chang 2011).

Other tactical team processes: Other tactical team processes (which may not be solely done by a team leader, but by multiple (or all) team members in knowledge team settings) are also found to be important for team creativity.

First, *coaching and training* team members are found to be related to team creativity. Mulec and Roth (2005) found that coaching intervention is positively associated to team creativity in the context of R&D teams. Moreover, Baruah and Paulus (2008) found that training on idea-generation skills also improves a team's ability to generate novel ideas. Also, giving stimuli to team members is found to make a difference in team-idea generation. Hender et al. (2002) found that in brainstorming groups, *an analogy* (many unrelated stimuli, many named dialogues, free movement among dialogues) generates fewer, but more creative ideas because of unrelated stimuli, while *assumption reversals* (many related stimuli, many named dialogues, and free movement among dialogues) generates a larger number of, but fewer creative ideas because of the fragmentation of team memory and cognitive inertia.

Second, *the proper method of decision-making* is also found to be important for team creativity. Dayan and Di Benedetto (2011) found that intuitive-cognitive balanced decision-making (i.e., decision-making based on intuition first and rationalized by using quantitative data afterward) is found to be a good decision-making process for creative team outcomes in the context of NPD

teams.

In sum, teams' tactical processes (leadership, training, and decision-making) are important for creative team outcomes, in both the idea-generation and outcome-creation phases. Especially, as knowledge teams are often formed by members who did not have experience working together, proper exercises of team leadership on goal-setting, decision-making and training should make a difference in outcome creativity.

Team conflict

Basically, the instruction for knowledge teams to have a certain level of debates and critiques of others' ideas has been found to be an important tactical process for creative idea generation (Nemeth, Personnaz, Personnaz, and Goncalo 2004). However, research has found that conflict within teams has a mixed impact on team creativity. Some studies have found that conflict within a team is beneficial for team creativity, while others have found that conflict deteriorates team creativity. On the other hand, some types of conflict (e.g., task-related conflict) have been found to be beneficial, while other types (e.g., interpersonal conflict) are found to be detrimental to team creativity.

This mixed relationship has been explained in various ways. First of all, the research suggests the impact of different types of intra-team conflict. Chen (2006) and Curseu (2010) looked at two different types of intra-team conflict (task conflict and relationship conflict (Jehn 1995)) to explain the inconsistent relationship between conflict and team creativity with various contingent factors. Both found that *task-related conflict* is positively related to team creativity in the context of project teams. In terms of relationship conflict (or interpersonal

conflict), Curseu (2010) argued that if task conflict has a low correlation with relationship conflict, then task conflict is beneficial for team creativity, while relationship conflict among members is detrimental to team creativity. However, only Chen (2006) found a significant (negative) relationship between relationship conflict and team creativity in the case of service-oriented project teams.

Second, the mixed relationship between team conflict and creativity was also reconciled by introducing environmental factors or team processes as moderators. Chen (2006) found that the relationship between task-conflict and team creativity is contingent on *the types of project teams (technology-driven vs. service-driven)* and the *project lifecycle*. For example, in technology-driven teams (e.g., NPD Teams), the impact of task conflict on team creativity is highest in the design stage, as members experience the highest task conflict. Also, De Dreu (2002) found that minority dissent (another type of within-team conflict) is positively associated with creative team outcomes only when there is a high level of team reflexivity (*defined as the tendency to overtly reflect upon the group's objectives, strategies, and processes and adapt them to current or anticipated circumstances, p. 285*). Farh, Lee, and Farh (2010) found that the curvilinear relationship between task conflict and team creativity is strongest in the early stages of Information Systems project teams. As such, the dynamics among team creativity, conflict types, team types, and other contingent factors still seem to be arguable and require future research efforts.

Third, two studies from our literature review found that intra-team conflict (or disagreement) has a curvilinear relationship with team creativity, but it is interesting to see that their finding is completely the opposite. While Farh et al.

(2010) found that task conflict (defined as the disagreements among team members about the content of the task) have an inverted U-shaped relationship with team creativity (teams can obtain the highest creativity with a moderate level of tasks conflict, Leenders, van Engelen, and Kratzer (2007) found that the level of disagreement (on team members' opinions about output success) among team members have a U-shaped relationship with team creativity (teams can obtain the highest creativity when there is little or a great deal of disagreement). These completely opposite findings seem to have originated from the way conflict and disagreement was operationalized. Farh et al. (2010)'s task conflict was measured as "overt team-level disagreement perceived by individual members of a team," while Leenders et al. (2007)'s disagreement was measured as "covert individual members' disagreement – measured with the standard deviations of individual members' feeling on their project success." Thus, these mixed results show the importance of openly sharing disagreement on task-related issues and also the detrimental impact of an excessive level of conflict within teams on team creativity.

In sum, as mentioned, a certain level of conflict on tasks within teams is necessary for team creativity, since task conflict is related to cognitive disagreement from different perspectives of team members, which may lead to move diversified views (Chen 2006). However, relationship conflict is found to be more detrimental than beneficial because relationship conflict is related to affective disagreement arising from personal disaffection; such conflict will cause reduced interaction and communication among members. As in knowledge teams, members are usually from different backgrounds; as a result, there is more chance

of task and interpersonal conflict among members. This structural characteristic highlights the contingent factors (e.g., reflexivity) that make task-related conflict more beneficial to team creativity.

Team coordination

Although team coordination has been considered as the most important (and most frequently studied) team process for effective knowledge team outcomes (e.g., Cheng 1983; Faraj and Sproull 2000; Katz and Allen 1985; Kraut and Streeter 1995), only a handful of studies have investigated the impact of *team coordination* on team creativity.

Coordination has been divided into two distinct types: 1) administrative coordination and 2) expertise coordination (Faraj and Sproull 2000). Administrative coordination includes the activities of task assignment, resource (time, budget, personnel) management, planning and scheduling, and output integration (Faraj and Sproull 2000). Expertise coordination refers to the team processes that coordinate task-based skill and knowledge dependencies (Faraj and Sproull 2000) and includes the activities of finding novel associations and linkages among the diverse ideas, perspectives, and domain expertise that individual team members hold (Tiwana and McLean 2005, p. 19).

For expertise coordination, Tiwana and McLean (2005) found that expertise integration is a key process for team creativity. They found that relational capital and absorptive capacity within a team is positively associated with expertise integration, which in turn, influences team creativity in the context of ISD teams. For administrative coordination, Curseu (2010) found that *team planning* mediates the relationship between team diversity (as variety) and

creativity, which means that proper planning activities help teams get the best possible outcomes from diverse team members' knowledge. Coordination of team meetings is another important team process for generating creative team outcomes. Individuals' idea-generation sessions followed by team meeting sessions are actually more beneficial to team creativity than group-to-individual sessions because they allow individual members to generate as many ideas as possible without production blocking, and then they can share and exchange the ideas they individually generated (Baruah and Paulus 2008; Paulus 2000). In electronic brainstorming environments, the social comparison process (i.e., a continuous public display of ideas generated by anonymous group members projected at the front of the electronic meeting room, p. 16) helps members create more novel ideas by building on other ideas, and is found to be beneficial to team creativity (Michinov and Primois 2005).

In sum, although several studies have investigated the role of expertise integration, planning on team schedules and meetings, and social comparison on team creativity, the impact of coordination on creativity in knowledge team contexts still seem to be under-studied. Future research may explore this topic in more detail by identifying the role of other coordinative processes in knowledge teams.

External factors for team creativity

In addition to team inputs and processes, external (or environmental) factors also influence team creativity (Woodman et al. 1993). Basically, support from external entities (e.g., organizations) is found to be beneficial for team creativity, whereas strict rules, norms and controls are found to be negative

factors for team creativity.

Pressure and control: As conventional knowledge, creative thinking is best facilitated when there is no pressure (West 2002). At the individual level, time pressure set by others inhibit creative problem-solving because it may increase the rigidity of thinking on work-related issues (West 2002). However, research has found a mixed relationship between externally set deadlines (time pressure) and team creativity. While Andrews and Farris (1972) found that a certain level of (but not too excessive) time pressure is positively associated with team creativity if team members consider the time pressure as a challenge rather than as workload pressure, Chirumbolo et al. (2004) found that time pressure (the need for closure) is negatively associated with team creativity. As such, the impact of time pressure on team creativity is still arguable and requires further research.

Second, conformity pressure (another type of external control) hinders team creativity. If team members feel pressured to conform to team choices, norms, ideas and solutions proposed by other group members or external entities (e.g., organizational norms), then the output of teams is found to be less creative (Chirumbolo et al. 2004).

Organizational support: On the other hand, organizational support is found to be an important factor for team creativity. Hemlin (2006) found that although the impact of organizational support on creativity is weaker than the impact of leadership, there is a significant relationship between organizational support and team creativity. Also, Tu (2009) found that organizational support generates a good environment for the impact of teams' affective status on team

creativity. They found that when organizational support is high, but organizational control is low, the impact of negative affective moods (about team task fulfillment) of teams on creativity is highest, meaning that organizational support enables a creative environment for team members.

Summary of findings on team creativity

Table 3 in the Appendix (pp 105 ~ 108) summarizes the findings on the antecedents of team creativity from this study. Each input, process, and external factor was classified into one of the (sub-) categories of the antecedents. Some repetitions of antecedents exist, as one line in the table describes the role of inputs and the repeated line describes the role of processes, but these roles of inputs and processes are significantly associated in the same study. For example, the second line on page 105 and the fourth line on page 107 are the same, but the former describes the role of individual members' creativity (Tagger 2002), while the latter describes the role of "TCRP (Team Creativity Relevant Processes)" (Tagger 2002). No sign is added to the antecedents that have a positive relationship with their consequences, but the signs that describe negative (-), U-shaped (U), or inverted-U shaped (\cap) relationships are added to each antecedent. Here are some discussions about the findings on team creativity.

First, as for the measure of team creativity, we found that outcome measures can be classified into three groups: 1) creativity (originality, numbers, elaboration, and feasibility) of *ideas* generated; 2) emergent creativity in *team processes and team interactions*; and 3) creativity of the *outcomes* of knowledge teams. Out of 44 studies investigated, 16 studies investigated the ideas generated in teams, 7 studies focused on creativity in team processes and interactions, and

21 studies investigated the outcomes of knowledge teams. This simple count of the dependent variables in this particular literature review does not necessarily mean that the focus of the field is more on outcome creativity of knowledge teams. However, this finding implies that all three aspects of team creativity could be considered when we investigate team creativity in the context of knowledge teams. These three aspects of team creativity can be complementary and even sequential in the following ways. When knowledge teams gather for a specific knowledge-creation goal(s), team members generate ideas together, whether in f2f settings or in nominal-group settings (*creativity in the idea-generation phase*). Based on these ideas generated, team members choose the best ideas for their team goal and move on to the next phase — generating team-level (collective) outcomes. While they collaborate on team tasks, they reach a moment of collective creativity (Hargadon and Bechky 2006) (*creativity in team processes*). Finally, after they produce team-level outcomes, the creativity of this team outcome is usually measured by peers or raters (*creativity in team outcomes*). Most studies have focused on one of these three aspects of team creativity in our literature review. Therefore, we suggest that a future study investigate the salient antecedents (inputs and processes) for each of these three aspects of knowledge team creativity.

Second, we found that overall a larger number of studies investigated the cognitive inputs for team creativity than psychological or structural inputs. The literature review suggested that individual team members' creativity, expertise, experience, and capability of team collaboration (absorptive capacity, collective efficacy and members' joint-focus on team topics) do have a significant and direct

impact on team creativity. However, the literature has also highlighted the importance of team processes (creativity-relevant team processes, building team intelligence, internal knowledge sharing, expertise integration, actions of transformational leaders, team-planning, and transactive memory systems) and team environments (team climate for creativity, high-support and low-control, collaborative culture, and low-stress) for the best possible team creativity with the given team inputs. We cannot deterministically conclude whether the inputs-processes-output model is better than the inputs-output model when explaining knowledge team creativity from our literature review because some studies did find a significant relationship between team inputs and team creativity (e.g., Suh et al. 2010). However, we believe that in knowledge team contexts, simply having the proper inputs (e.g., team members' creativity, expertise, and experience) may not lead to the best possible creativity in team outcomes. As such, slightly more findings in Table 3 (pages 105 ~ 106) suggest that the impact of team inputs on team creativity are moderated or mediated by either team processes or environmental factors.

Third, although scholars have empirically investigated the impact of several psychological inputs (moods, trust, stress, autonomy, and culture in teams), there are more psychological inputs that could be relevant in knowledge team processes; namely, *passion, motivation, emotion, and other psychological aspects of teams*. For example, at the individual level, the roles of motivation (Amabile 1985; Woodman et al. 1993), passion (Amabile 2000), emotion (Lubart and Getz 1997), and other individual affective states (Baas, De Dreu, and Nijstad 2008) on creativity have been investigated. According to the studies in this review, much

more research effort seems to be required to investigate the impact of those psychological inputs (at the team level) on team creativity. We believe that team members' collective passion, motivation, emotions, and other affective states should make a difference, not only to the extent to which team members are engaged in creativity-generating interaction, but also in the creativity of outcomes produced by knowledge teams.

Fourth, we found that team structure also affects team creativity. Although we have observed a negative or curvilinear relationship between team diversity and creativity, in general, diversity is beneficial as long as 1) it is not too excessive; 2) this diversity brings new perspectives into teams; and 3) there are team processes that help integrate each member's variety of knowledge. Anonymous team structure may help generate more ideas, but team members' experience in working together should help produce the final team outcome, as long as this experience leads to the team's transactive memory system.

Fifth, in knowledge team environments, where the final outcomes of teams should not be limited to simple ideas, but should be final project outcomes (completed products or services, detailed planning for new products and services, project outcomes – software and research reports, etc.), *internal interaction* is important for creative team outcomes. Our literature review suggests that while a simple amount of team communication has a curvilinear relationship with team creativity (an inverted U-shape, which means a moderate level of internal communication is the best for team creativity), *team members' creativity-generating interactions* (Hargadon and Bechky 2006; Taggar 2002) and *internal sharing of knowledge* are important team processes that are found to be positively

associated with both the processes and outcomes of team creativity (Park et al. 2009; Tiwana and McLean 2005; Zhang et al. 2011). Also, a number of articles suggested that knowledge sourcing from external sources and boundary-spanning activities are important for creativity (Ancona and Caldwell 1992; Paulus 2000). Therefore, we suggest that future studies on knowledge team creativity consider both internal and external team processes that mediate the link from beneficial team inputs and team creativity.

Sixth, other than internal interaction and external knowledge-sourcing, we found that the proper actions of *leadership* (goal-setting, expertise provision, guiding, coaching, and decision-making), *task conflicts* (that generate active discussion within teams on team tasks), and *coordination* are also important team processes for knowledge team creativity. Among these tactical processes, to our surprise, little effort has been made to investigate the impact of team coordination on creativity, although (expertise and administrative) coordination processes are the most important (frequently studied) team processes for knowledge team performance (e.g., Cheng 1984; Espinosa, Kraut, Lerch, Slaughter, and Herbsleb 2001; Faraj and Xiao 2006; Majchrzak, Jarvenpaa, and Hollingshead 2007). Future research could investigate how the two dimensions of coordination (administrative and expertise) are differentially associated with knowledge team creativity.

Finally, the literature also suggests that organizational support is beneficial, and organizational pressure and control are detrimental to team creativity. High support, but low control from an organization even moderates the positive relationship between team members' negative moods and team creativity. One

interesting point is the curvilinear relationship between time pressure and outcome creativity (Andrews and Farris 1972). This finding implies that in knowledge team environments (in many cases, teams work under a certain level of time pressure), the psychological status of team members may make them consider a moderate level of time pressure as a good challenge (rather than ‘a pressure or control’), which positively influences team creativity.

Part 2-2: Antecedents for Individual Members’ Learning in Knowledge Teams

Literature review method

The literature review on individual learning in knowledge team environments was conducted with the same methods used in Part 2-1. The literature search was started by extracting a number of keywords from the labels listed in Table 2. The first search was done with 40 search strings, combining the search labels from category A and those from category B. We also set the database limits with the Social Sciences Citation Index (SSCI) – indexed journals and those published until 2011. We then refined the search results with two important keywords: “learning” and “knowledge.” Finally, we refined the results again with management and our reference disciplines in the Web of Science categories, as listed in Part 2-1. We found a total of 80 studies.

Second, another search was done to find articles on “individual learning.” We used “individual learning” as a search string under the same condition beforehand (SSCI journals published until 2011). The initial results were then

refined with the keyword “team” in order to capture studies on individual learning within team environments. We also refined the results with the same Web of Science categories used for our previous search. We ended up with 25 articles.

Article selection and snowballing methods

Articles for the literature review were selected using the same manner as that was used in Part 2-1. With these 105 articles searched (overlap existed), the first author read the abstract and actual text of each paper in order to select the studies for this literature review, using the following selection criteria. First, only studies that took place in the context of knowledge teams and the like (Project teams, NPD teams, Research Teams, Temporary Teams, etc.) were selected. Second, only studies that investigated individual learning outcomes were selected for the review. Third, only empirical studies were included. Furthermore, a snowballing procedure of finding the referred articles of searched articles was used to capture important studies to review, which might have been excluded from the keyword search methods above. Again, the snowballing method was done simultaneously with the article selection procedure.

In all, the total sample of papers included in the literature review on individual learning outcomes in the context of knowledge teams amounted to only 14 works. The reason why only a small number of studies remained after our literature selection is that we are only interested in *individual’s learning outcomes in the context of knowledge teams*. Thus, although there are more studies on the impact of individuals’ cognitive and psychological inputs and learning behavior outcomes in various contexts, they were screened from our literature search because we look into only the antecedents of individuals’ learning in *knowledge*

team contexts. This said, we believe that the final list of papers can be representative of the work specifically on *the antecedents of individual learning in the context of knowledge teams*.

Classification of the antecedents of individual learning outcomes in knowledge team contexts

Based on Webb (1982)'s framework of learning under group environments and the identified antecedents from selected articles, we decided to classify the antecedents into three broad categories (inputs, behaviors, and external factors). Inputs are further classified into two sub-categories (cognitive and psychological inputs). Individual behaviors are also sub-categorized into two sub-categories (internal and external learning behaviors). External factors are further classified into three categories (team environment, technology support, and task characteristics). We believe that these three broad categories of the antecedents of individual learning within knowledge teams seem to be a proper classification of the factors identified in the list of articles within this review. The factors identified from this literature review are summarized in the Appendix, Table 4.

Individuals' learning outcomes can be classified into two types of learning outcomes, although these two types of learning outcomes are interrelated. First, individual learning can be achieved when individuals learn *how to do things faster and better*. In this case, individuals' learning means "*increased productivity*" or a "*learning curve achieved*" (Boh, Slaughter, and Espinosa 2007; Narayanan et al. 2009). Second, individual learning can be achieved when team members gather new knowledge or get to know something. In this case, individuals' learning means "*accumulation of knowledge*" (Alavi et al. 2002; Kudaravalli 2010; Lynn,

Reilly, and Akgun 2000). This literature review covers both types of learning. Therefore, this study finds the inputs, processes, and external factors for both “increased productivity” and “accumulation of knowledge” as learning outcomes.

Key inputs for individual learning

In knowledge team environment, individual members get to learn something by working on team tasks (engaging in knowledge team activities). In other words, their learning is situated in their task-fulfilling interactions, which includes setting their own goals, brainstorming to generate new ideas, sharing their ideas, experiences, and information they obtained from various information sources, and combining each member’s sub-tasks and ideas into the team’s final outcome. Thus, we believe that individuals’ inputs (abilities and characteristics) should influence their learning interaction (learning behaviors) first, then those learning behaviors, in turn, result in their learning outcomes (Webb 1982), although a number of studies on the impact of individuals’ experience on learning shows a rather direct relationship.

Cognitive inputs

Cognitive attitude: Individuals’ learning may start with their cognitive attitudes and abilities. As for the cognitive attitude, Gray and Meister (2004) found that an individual’s *intellectual demands* (defined as the normal cognitive load perceived by individuals in performing their work, p. 824) and *learning orientation* (defined as a type of dispositional goal orientation that cues individuals to believe that their competence can be improved, p. 825) positively influence their knowledge-sourcing behaviors, which in turn, influence learning outcomes. Also, in NPD team environments, providing clear visions on team tasks

provide individual members with guidance for the types of knowledge to be gathered, so that vision clarity is found to be positively related to information-acquisition behavior, which in turn, influences the implementation of the information into new product development (Lynn et al. 2000).

Cognitive ability: The key cognitive ability for learning in teams is an individual's experience in the tasks related to team activities. Experience in related tasks is found to be beneficial, especially to learning as "enhanced productivity," which means that by having experience in related tasks, individuals will be able to finish the similar kinds of jobs more quickly and efficiently. Research has also found evidence of the impact of experience on "shorter resolution time" and "improved productivity" (Boh et al. 2007; Narayanan et al. 2009; Reagans, Argote, and Brooks 2005).

Psychological inputs

Psychological input (Psychological safety): To the best of our knowledge, psychological inputs for individual *learning in the context of knowledge teams* have not been empirically investigated much in the extant literature. We believe that "psychological safety," defined as a shared belief that the team is safe for interpersonal risk-taking (Edmondson 1999, p. 354), is one of the most important antecedents of individuals' learning in knowledge team contexts. Because individual members' perceived psychological safety within a team reduces their concerns about other members' reactions to their behaviors that might cause embarrassment or threat, they can engage in learning behaviors more actively, which in turn, leads to improved learning outcomes. Edmondson (1999) found that psychological safety is positively associated with learning behaviors.

However, this study is conducted at the team level. Other than this study, we did not find any psychological inputs (at least in the context of knowledge teams) for individuals' learning behaviors or outcomes.

Key behaviors for individual learning

Knowledge embedded in an individual and codified knowledge in knowledge contents (searched articles from the Intranet) are seldom sufficient for producing new products/services, generating new ideas, or solving business problems (Tyre and Orlikowski 1994). Thus, in knowledge team settings, new knowledge is created from informal story swapping among team members about their experiences, best practices, and information found from external sources (Brown and Duguid 1991). These individuals' knowledge sharing and sourcing behaviors for knowledge teamwork help them achieve so-called "situated learning" (Lave and Wenger 1991). Scholars who have investigated "situated learning" argued that individuals' learning in team settings is achieved by their engagement in team activities. Also, knowledge team environments are regarded as the place for individual learning and are similar to community of practice environments. Lave and Wenger (1991) argued that learning results from participation in a community of practitioners. In knowledge teams, as well, individual participants of knowledge teams learn from engaging in team activities and even from having social interaction, as part of their role in teams. Orlikowski (2002) also proposed that organizational learning (knowing) emerges from organizational members' ongoing and situated actions of engagement in organizational activity.

Therefore, the literature on knowledge teams also suggests that learning behaviors in knowledge teams include various types of individual members'

interaction behaviors within and across knowledge teams. We classified these interaction behaviors into internal vs. external learning behaviors. *Internal learning behaviors* refer to individuals' interaction with other members of a focal knowledge team, while *external learning behaviors* refer to their external knowledge/ information-sourcing behaviors, both of which will lead to individuals' learning outcomes.

Internal learning behaviors

Individual team members' activity of sharing knowledge, having dialogues about their tasks, and reviewing their teamwork will eventually improve their individual learning outcomes in knowledge team environments. Gray and Meister (2006) found that group- or dyadic- knowledge sharing (both via email communication and via co-located meetings) is positively associated with individual learning outcomes. Lynn et al. (2000) also found that reviewing activity on their previous and ongoing work in knowledge teams positively influences information acquisition and implementation.

In addition to this direct impact of internal learning behaviors, within-team interaction can be a moderating impact on the relationship between knowledge sources and learning outcomes. Kudaravalli (2010) found that *dialogic practice* (defined as the extent to which team members interact with other team members through brainstorming, discussing team tasks, reviewing previous work, and clarifying various issues) within a knowledge team positively moderates the impact of interactive knowledge sourcing (knowledge sourcing activity with interactive knowledge sources) and individual members' learning. As such, within-team interaction among other members not only helps team-level

collaboration, but also increases individual participants' learning outcomes.

External learning behaviors

Knowledge team members should search new knowledge to achieve their team goals, as it is not likely that all necessary knowledge required to create something new is located within a team (Wong 2004). Thus, they should engage in knowledge-sourcing activities with external knowledge sources. This external knowledge sourcing (or external learning) activities within teams is found to be important for team performance in various studies (Ancona and Caldwell 1992; Bresman 2010). Besides, it should help individual participants achieve learning from knowledge team activities. Only a few number of studies have discussed the direct impact of individual team members' external learning (or knowledge-sourcing) activities on their learning outcomes, as most studies on the impact of external learning have focused on team effectiveness as the dependent variable. Three studies in this literature review consistently found that knowledge-sourcing behaviors from various external knowledge sources (published sources, external communities of practice meetings, searchable archives and video sources) are significantly associated with individuals' learning in a team setting (Gray and Meister 2006; Griffith and Sawyer 2006; Kudaravalli 2010).

Key environmental factors for individual learning

The environmental factors of a knowledge team influence individuals' learning outcomes in various ways. We found various factors in the literature and classified them into three categories: 1) within team environments, 2) learning support, and 3) task environments.

Team environment

Actually, diversity, learning climate and liminality (time limit) could be treated as structural characteristics of teams at the team level, but at the individual members' perspectives, they are environmental factors embedded in their knowledge teams. Thus, we regard diversity, learning climate and liminality as 'environmental factors for the individuals who achieve individual learning under their team environment'.

Diversity: Team diversity is an important environment for an individual's learning. In particular, *expertise diversity* is found to be significantly associated with learning behaviors by team members, which are moderated by *collective team identification* (defined as the emotional significance that members of a given group attach to their membership in that group), such that under a high level of collective team identification, the impact of expertise diversity is positively associated with team members' learning behaviors, which leads to team performance (Van der Vegt and Emans 2000). Thus, simply working for a diverse group is not enough for team members' learning; rather, it is important to have a collective identification of team members in order for the diversity to take effect on team learning behavior.

Active learning climate: Another team environment component is the active learning climate of a team. Katz-Navon, Naveh, and Stern (2009) found that if medical team members work for a team with an active learning climate, then individual team members will learn better from team activities, which is reflected as reduced numbers of errors in their practices.

Liminality: In addition, Tempest and Starkey (2004) found that "*liminality*"

(defined as being situated “betwixt and between” in terms of existing at the limits of existing structures) is a condition that possibly improves or deteriorates individual team members’ learning. Liminality in the context of a team refers to an alternative to regular or full-time employment contracts. If an individual works for a knowledge team with “liminality” (with a limited contract period and expectation to be dismissed after the project), which is often the case in knowledge teams, it is possible that they can learn more from a breadth of skills and knowledge by performing broader ranges of roles in different projects in which they can be involved, while this work environment might be detrimental to individual learning if the individual is reluctant to become deeply involved in each project because they will later move on to other projects (Tempest and Starkey 2004). Thus, we believe that a structural characteristic of liminality does take effect on an individual’s learning in knowledge teams, but there could be other factors that influence the individual learning of an individual who work for a team with liminality.

Team support

Mentoring: Organizational-level or team-level learning support are certainly important factors for individuals’ learning under knowledge team environments. Lankau and Scandura (2002) found that mentoring (the vocational, psychosocial, and role-modeling aspects of mentoring) helps individual team members improve their job-related learning and skill development.

Technology support: In addition to cognitive and psychological support, in distributed team environments, technology support also improves individual members’ learning outcomes. Alavi et al. (2002) found that in distributed team

environments, different levels of group supporting systems (GSS) tools have different impacts on individual members' learning outcomes. In detail, they found that individual members who used GSS with simple message exchange capability actually learn better than those who used more sophisticated GSS (that support not only information exchange tools, but also task structuring tools), because the team members with more sophisticated GSS spent their limited cognitive and time resources on understanding the more sophisticated technology, at the expense of the topics that they should have been learning for their tasks. This result implies that group supporting technology with requirements that exceed the cognitive ability (or needs) of a knowledge team may be detrimental to team members' learning, and that in knowledge team environments, where diverse team members often work on team tasks under time pressure, using rather simpler technologies might be more helpful than using more sophisticated tools.

Task characteristics

Task characteristic is one of the most important factors for team performance. Thus, various aspects of task characteristics (e.g., uncertainty, interdependence, complexity, etc.) have been investigated as important factors for team performance (Faraj and Yan 2009; Joshi, Pandey, and Han 2009). However, we found only one study that investigates the relationship between task characteristics and individuals' learning in knowledge team environments. Narayanan et al. (2009) found that task variety has an inverted U-shaped relationship with individuals' learning as productivity, which means that a proper balance between the specialization of tasks and exposure to various tasks will be best for individual learning.

Summary of findings on individual learning outcomes in knowledge teams

Table 4 in the Appendix (p 109) summarizes the findings on the antecedents of individual learning in knowledge teams. With only 14 studies in this literature review, we cannot suggest that the antecedents of individual learning found in this paper represent a proper list of the antecedents of individual learning in team contexts. However, as we limit our literature search for empirical articles on individual learning outcomes ‘*under knowledge team environments*,’ the findings described in this literature review can at least describe our current knowledge about which inputs and processes lead to individual team members’ situated learning outcomes in knowledge team environments. That said, below are interesting points found in this literature review.

First, we found that the psychological inputs for individuals’ learning in *knowledge team contexts* are under-investigated empirically in the field of management. For certain, in other fields (especially in the field of education), the impact of psychological inputs (mood, emotion, and motivation) on individuals’ learning has been frequently investigated (e.g. Kelly and Barsade 2001; Pintrich 2003). According to our literature search, which is limited to empirical studies on individuals’ learning outcomes in the context of knowledge teams, we did not find any studies regarding the impact of psychological inputs on individual learning outcomes under knowledge teams (Edmondson (1999) investigated the impact of psychological safety in “team-level” learning behavior). However, we believe that in knowledge team environments, individuals’ psychological inputs, such as passion, motivation, moods, and emotions should make a difference in individuals’ engagement in their learning behaviors, as well as their learning outcomes. A

future study could investigate the role of these psychological inputs on individuals' learning in knowledge team environments.

Second, just like the processes for team creativity suggested at the end of part 2-1, both internal knowledge sharing and external knowledge sourcing behaviors are found to influence individual learning outcomes. According to Webb (1982), individuals' input will help them engage in learning behaviors, and these behaviors will lead to learning outcomes. As such, although quite a few studies have investigated the direct impact of individuals' cognitive inputs (e.g., experience) on learning, in knowledge team environments, we should consider the role of individuals' knowledge sourcing and sharing behaviors (or learning behaviors) as mediating behaviors that link individuals' inputs with their learning outcomes.

Third, it is not very surprising to note that external support (such as active learning climates, group supporting systems, and mentoring) help individuals learn better. One interesting point from our findings on external influence is the role of liminality. As previously mentioned, in many cases knowledge team members work on team tasks under liminality (a limited duration of involvement in knowledge teams, or project-based tasks in knowledge teams). The mixed findings about the relationship between liminality and individual learning outcomes suggest that we may identify the factors that could make individuals learn better under teams with liminality. We propose that several psychological factors such as passion, emotion, and motivation may be interesting to investigate.

Part 3: Conclusion–Identifying Venues for Future Research

This study is intended to identify the key properties of knowledge teams and to integrate the findings on team creativity and individual learning in the context of knowledge teams. We have identified knowledge team properties in terms of 1) team tasks, 2) team structure, and 3) team processes. Briefly, knowledge teams deal with complex, non-routine, open-ended, and interdependent tasks under an informal structure and time-constrained environment. To fulfill team goals, internal and external communication, coordination, and conflict management are important team processes.

In Part 2, we review the literature on the antecedents of team creativity and individual learning. The findings of empirical studies on team creativity are integrated into three broad categories: 1) inputs (cognitive, psychological, and structural), 2) processes (internal interaction, KM processes, tactical processes, conflicts, and coordination), and 3) external factors (external support and pressure) using the framework suggested by Gladstein (1984), while those on individual learning are also integrated into three categories: 1) inputs (cognitive and psychological inputs), 2) behaviors (internal and external learning behaviors), and 3) external influences, modified from Webb (1982)’s framework. At the end of Part 2-1 and Part 2-2, we describe interesting points from our literature review and provide several future research directions.

To conclude, we now discuss how these findings help us identify the venues for future research on creativity and learning in knowledge teams.

First, we suggest the model of the input – process (behaviors) – output

framework to study creativity and individual learning in knowledge teams. The key properties of knowledge teams, such as diverse members' expertise, informal team structure, open-ended, non-routine, and complex tasks, and liminality provide a good environment for creative outcomes and individuals' situated learning. Teams can generate more creative outcome by engaging in complex and open-ended tasks under an informal structure than functional teams. Also, individual members' situated learning should happen when they engage in interaction with other members and work on team tasks. As such, the best possible creativity of team outcomes and individual learning will come not only from beneficial team inputs (e.g., diverse members, knowledge-creating tasks, and expertise), but also from team processes and individual members' participation in team processes. Therefore, when we look into any topics in knowledge team creativity and learning, *we recommend that future research take a research framework of the input – process (behaviors) – output model, in order to better explain the phenomena in knowledge teams.* In the following chapters, we used input-processes-output framework for team level study (Essay II) and input-behaviors-output framework for individual level study (Essay III).

Second, this literature review on team creativity and individual learning suggested that psychological inputs, which should lead to teams' creativity-generating processes and individuals' learning behavior, are under-studied in the context of knowledge teams. As suggested at the end of Part 2-1, a number of psychological inputs are found to be relevant to individual-level creativity. In knowledge team environments, as well, team members' collective psychological inputs, such as passion, emotions, or motivation about their teamwork should

make difference in their creativity-generating team processes, as well as their outcomes. Also, we suggest that in knowledge team environments, where individuals engage in non-routine tasks, their psychological attitudes about team tasks will influence the ways in which they engage in situated learning behaviors. Thus, we suggest that *future research identify new psychological factors that affect both creativity-relevant team processes and individuals' situated learning behaviors*. In the following chapters of this dissertation, we focus on passion as an important team level – and individual level – inputs, which indirectly influence team creativity and individual learning, through knowledge management behaviors of team members.

Third, this literature review suggests that knowledge management processes are found to be important for both creativity and learning in knowledge teams. As mentioned, the key outcome of a knowledge team is to achieve an effective outcome in time with the given resources. In order to achieve team goals, knowledge team members from diverse backgrounds should bring in knowledge from external sources and share it with other members to achieve team goals. While engaging in these knowledge processes, team members may reach creativity-generating moments, and they could also achieve situated learning. Therefore, team knowledge processes, which may include various processes shown in this literature review (knowledge sourcing, knowledge sharing, reflective reframing, expertise integration, problem finding, etc.), should be considered as important mediating variables that link knowledge team inputs and outcomes (creativity and learning). *We suggest that future research investigate how team knowledge processes (or individual's knowledge management*

behaviors) might link new psychological factors (suggested in the previous paragraph) and outcome variables in knowledge team contexts. In the following chapters of this dissertation, we hypothesize and test the role of team knowledge processes and individual knowledge sharing and sourcing behaviors that link ‘passion at the team level and at the individual level’ and ‘team creativity and individual members’ learning’.

Fourth, we found that *team creativity* can be measured in three stages of knowledge teams: 1) creativity in the idea-generation phase, 2) emergent creativity in team processes, and 3) creativity of team outcomes. Most studies have looked into the phenomenon of one of these three aspects of team creativity. *A longitudinal approach of looking into the phenomena of team creativity and the salient antecedents for creativity at each team stage could be an interesting research topic.*

Fifth, the impact of task-characteristics on team creativity and individual learning is under-investigated. However, we have suggested that knowledge team tasks are complex, open-ended, non-routine, and interdependent, so that in many cases of knowledge teams, we might not be able to see much variance in task complexity, non-routineness, and independence. Nevertheless, since knowledge team tasks are open-ended, the topics and team goals are self-decided by the team members. As such, we can see much variance exists in the topics of the knowledge teams under the same organizational environment. Thus, the task characteristics that vary according to different topics set by each team should influence the creativity of outcomes and the way that the team members achieve their learning. *Therefore, we suggest that future research find tasks*

characteristics that are relevant in open-ended knowledge team environments and investigate the role of tasks on team creativity and individual learning. In Essay II, we propose ‘explorative team tasks (the extent that team tasks is explorative)’ as a team task characteristic that is relevant to open-ended knowledge team tasks and test its moderating role on the relationship between team knowledge process (external knowledge sourcing) and team creativity.

Finally, as mentioned in part 1, contemporary knowledge teams rely on Information Communication Technologies (ICT) for collaboration, whether the team members are distributed or not. ICT help team works in various ways. That is, ICT help team members communicate among each other (using emails, team e-bulletin, messengers, or video-conferencing), share digitalized documents (using team knowledge sharing systems or file sharing systems), coordinate team resources (using team e-bulletin or file sharing systems), search new knowledge from external knowledge sources (using search engines), and eventually achieve better team outcomes (Zammuto, Griffith, Majchrzak, Dougherty, and Faraj 2007). As such, the use of ICT is embedded in the processes of most contemporary knowledge teams. Thus, the *extent to which teams know how to use ICT* or the *extent to which teams actually use ICT* for team collaboration should be relevant to team outcomes. Research on the role of ICT on knowledge team creativity and individual’s learning in knowledge teams has focused more on the role of GSS (Group Support System) on team idea generation (e.g. Alavi et al. 2002; Hender et al. 2002; Nunamaker Jr., Applegate, and Konsynski 1987). Therefore, we suggest that *future research investigate the role of ICT (or the role of teams’ shared norms of ICT) on knowledge team processes, team creativity, or even*

individual members' learning. In Essay II, we test the role of shared norms of ICT use on the relationship between shared team passion about team activities and team knowledge processes, which highlight the importance of having shared norms about how to use ICT in knowledge teams in knowledge teams.

References

- Akgun, A. E., Dayan, M., and Di Benedetto, A. "New product development team intelligence: Antecedents and consequences," *Information & Management* (45:4), Jun 2008, pp 221-226.
- Alavi, M., Marakas, G. M., and Yoo, Y. "A Comparative Study of Distributed Learning Environments on Learning Outcomes," *Information Systems Journal* (13:4) 2002, pp 404-415.
- Amabile, T. M. "The social psychology of creativity; A componential conceptualization," *Journal of Personality and Social Psychology* (45) 1983, pp 357-376.
- Amabile, T. M. "Motivation and creativity: Effects of motivational orientation on creative writers," *Journal of Personality and Social Psychology* (48:2) 1985, pp 393-399.
- Amabile, T. M. "Creativity and Innovation in Organizations," *Harvard Business Review* 1996.
- Amabile, T. M. "Stimulate Creativity by Fueling Passion," in: *Handbook of Principles of Organizational Behavior*, E.A. Locke (ed.), Wiley, 2000.
- Amabile, T. M., Conti, R., Coon, H., Lazenby, J., and Herron, M. "Assessing the work environment for creativity," *Academy of Management Journal* (39:5) 1996, pp 1154-1184.
- *Ancona, D. "Outward bound: Strategies for team survival in an organization," *Academy of Management Journal* (33) 1990, pp 334-365.
- *Ancona, D. G., and Caldwell, D. F. "Bridging the boundary: External activity and performance in organizational teams," *Administrative Science Quarterly* (37) 1992, pp 634-665.
- Andrews, F. M., and Farris, G. F. "Time pressure and performance of scientists and engineers: A five-year panel study," *Organizational Behavior and Human Performance* (8) 1972, pp 185-200.
- Baas, M., De Dreu, C. K. W., and Nijstad, B. A. "A meta-analysis of 25 years of mood-creativity research: Hedonic tone, activation, or regulatory focus?," *Psychological Bulletin* (134:6) 2008, pp 779-806.
- Barczak, G., Lassk, F., and Mulki, J. "Antecedents of Team Creativity: An Examination of Team Emotional Intelligence, Team Trust and Collaborative Culture," *Creativity and Innovation Management* (19:4), Dec 2010, pp 332-345.
- Barry, B., and Stewart, G. L. "Composition, Process, and Performance in Self-Managed Groups: The Role of Personality," *Journal of Applied Psychology* (82:1) 1997, pp 62-78.
- Baruah, J., and Paulus, P. B. "Effects of training on idea generation in groups," *Small Group Research* (39:5), Oct 2008, pp 523-541.
- *Beise, C., Carte, T., Vician, C., and Chidambaram, L. "A Case Study of Project Management Practices in Virtual Settings: Lessons from Working in and Managing Virtual Teams," *ACM SIGMIS Database* (41:4) 2010.

- Boh, W. F., Slaughter, S. A., and Espinosa, J. A. "Learning from experience in software development: A multilevel analysis," *Management Science* (53:8) 2007, pp 1315-1331.
- Bouas, K. S., and Arrow, H. "The development of group identity in face-to-face and computer-mediated groups with membership change," *Computer Supported Cooperative Work* (4) 1996, pp 153-178.
- Bresman, H. "External Learning Activities and Team Performance: A Multimethod Field Study," *Organization Science* (21:1) 2010, pp 81-96.
- Brown, J. S., and Duguid, P. "Organizational learning and communities of practice: Toward a unified view of working, learning, and innovation," *Organization Science* (2) 1991, pp 40-57.
- *Campion, M. A., Medsker, G. J., and Higgs, A. C. "Relations Between Work Group Characteristics and Effectiveness: Implications for Designing Effective Work Groups," *Personal Psychology* (46) 1993, pp 823-850.
- Chang, C. M. "New organizational designs for promoting creativity: A case study of virtual teams with anonymity and structured interactions," *Journal of Engineering and Technology Management* (28:4), Oct-Dec 2011, pp 268-282.
- Chen, M. "Understanding the benefits and detriments of conflict on team creativity process," *Creativity and Innovation Management* (15) 2006, pp 105-116.
- Chen, M. H., Chang, Y. C., and Hung, S. C. "Social capital and creativity in R&D project teams," *R & D Management* (38:1), Jan 2008, pp 21-34.
- *Cheng, J. "Interdependence and coordination in organizations: A role-system analysis," *Academy of Management Journal* (26) 1983, pp 156-162.
- *Cheng, J. L. C. "Organizational Coordination, Uncertainty, and Performance: An Integrative Study," *Human Relations* (37) 1984, p 829.
- Chirumbolo, A., Livi, S., Mannetti, L., Pierro, A., and Kruglanski, A. W. "Effects of need for closure on creativity in small group interactions," *European Journal of Personality* (18:4), Jun 2004, pp 265-278.
- Claxton, G. L. "Knowing without knowing why: Investigating human intuition," *The Psychologist* (11) 1998, pp 217-220.
- *Coppola, N. W., Hiltz, S. R., and Rotter, N. G. "Building Trust in Virtual Teams," *IEEE Transactions on professional communication* (47:2) 2004, p 95.
- Csikszentmihalyi, M. *Creativity: Flow and the psychology of discovery and invention* Harper, New York, 1996.
- Cummings, J. N. "Work Groups, Structural Diversity, and Knowledge Sharing in a Global Organization," *Management Science* (50:3) 2004, pp 352-364.
- Curseu, P. L. "Team Creativity in Web Site Design: An Empirical Test of a Systemic Model," *Creativity Research Journal* (22:1) 2010, pp 98-107.
- Curtis, B., Krasner, H., and Iscoe, N. "A field Study of the Software Design Process for large Systems," *Communications of the ACM* (31:11) 1988, pp 1268-1287.
- Dayan, M., and Di Benedetto, C. A. "Team intuition as a continuum construct and new product creativity: The role of environmental turbulence, team experience, and stress," *Research Policy* (40:2), Mar 2011, pp 276-286.

- De Dreu, C. K. W. "Team innovation and team effectiveness: The importance of minority dissent and reflexivity," *European Journal of Work and Organizational Psychology* (11:3) 2002, pp 285-298.
- Dobbelaere, A., and Goeppinger, K. "The right way and the wrong way to set up a self-directed work team," *Human Resources Professional* (5) 1993, pp 31-35.
- *Drucker, P. "The age of social transformation," *Atlantic Monthly* 1994, pp 53-80.
- Edmondson, A. C. "Psychological safety and learning behavior in work teams," *Administrative Science Quarterly* (44) 1999, pp 350-383.
- Espinosa, A., Kraut, R. E., Lerch, J., Slaughter, S., and Herbsleb, J. "Shared Mental Models and Coordination in Large-Scale, Distributed Software Development," International Conference on Information Systems, 2001.
- Estrada, C. A., Isen, A. M., and Young, M. J. "Positive affect improves creative problem-solving and influences reported source of practice satisfaction in physicians," *Motivation and Emotion* (18) 1994, p 285-299.
- *Faraj, S., and Sambamurthy, V. "Leadership of Information Systems Development Projects," *IEEE Transactions on Engineering Management* (53:2) 2006.
- *Faraj, S., and Sproull, L. "Coordinating Expertise in Software Development Teams," *Management Science* (46:12) 2000, pp 1554 -1568.
- Faraj, S., and Xiao, Y. "Coordination in fast-response organizations," *Management Science* (52) 2006, pp 1155-1189.
- *Faraj, S., and Yan, A. "Boundary Work in Knowledge Teams," *Journal of Applied Psychology* (94:3) 2009, pp 604-617.
- Farh, J. L., Lee, C., and Farh, C. I. C. "Task Conflict and Team Creativity: A Question of How Much and When," *Journal of Applied Psychology* (95:6), Nov 2010, pp 1173-1180.
- *Gersick, C. J. G. "Time and transition in work teams: Toward a new model of group development," *Academy of Management Journal* (31) 1988, pp 9-41.
- *Gibson, C. B., and Gibbs, J. L. "Unpacking the Concept of Virtuality: The Effects of Geographic Dispersion, Electronic Dependence, Dynamic Structure, and National Diversity on Team Innovation," *Administrative Science Quarterly* (51:3) 2006, pp 451-495.
- Gino, F., Argote, L., Miron-Spektor, E., and Todorova, G. "First, get your feet wet: The effects of learning from direct and indirect experience on team creativity," *Organizational Behavior and Human Decision Processes* (111:2), Mar 2010, pp 102-115.
- Gladstein, D. L. "Groups in Context: A Model of Task Group Effectiveness," *Administrative Science Quarterly* (29:4) 1984, pp 499-517.
- Goncalo, J. A., Flynn, F. J., and Kim, S. H. "Are Two Narcissists Better Than One? The Link Between Narcissism, Perceived Creativity, and Creative Performance," *Personality and Social Psychology Bulletin* (36:11), Nov 2010, pp 1484-1495.

- Goncalo, J. A., and Staw, B. M. "Individualism-collectivism and group creativity," *Organizational Behavior and Human Decision Processes* (100:1), May 2006, pp 96-109.
- *Goodman, R. A., and Goodman, L. P. "Some Management Issues in Temporary Systems: A Study of Professional Development and Manpower-The Theater Case," *Administrative Science Quarterly* (21:3) 1976, pp 494-501.
- *Grabher, G. "Temporary architectures of learning: knowledge governance in project ecologies," *Organization Studies* (25) 2004, pp 1491-1514.
- *Grawitch, M. J., Munz, D. C., Elliott, E. K., and Mathis, A. "Promoting Creativity in Temporary Problem-Solving Groups: The Effects of Positive Mood and Autonomy in Problem Definition on Idea-Generating Performance," *Group Dynamics: Theory, Research, and Practice* (7:3) 2003a, pp 200-213.
- Grawitch, M. J., Munz, D. C., and Kramer, T. J. "Effects of member mood states on creative performance in temporary workgroups," *Group Dynamics-Theory Research and Practice* (7:1), Mar 2003b, pp 41-54.
- Gray, P. H., and Meister, D. B. "Knowledge sourcing effectiveness," *Management Science* (50:6) 2004, pp 821-834.
- Gray, P. H., and Meister, D. B. "Knowledge sourcing methods," *Information & Management* (43) 2006, pp 142-156.
- Griffith, T. L., and Sawyer, J. E. "Supporting technologies and organizational practices for the transfer of knowledge in virtual environments," *Group Decision and Negotiation* (15:4), Jul 2006, pp 407-423.
- Guilford, J. P. "Creativity," *American Psychologist* (5) 1950, pp 444-454.
- *Guzzo, R. A., and Dickson, M. W. "Teams in Organizations: Recent Research on Performance and Effectiveness," *Annual Review of Psychology* (47) 1996, pp 307-338.
- Hackman, J. R. "The design of work teams," in: *Handbook of Organizational Behavior*, J. Lorsch (ed.), Prentice-Hall Englewood Cliffs, NJ, 1987, pp. 315-342.
- Hargadon, A. B., and Bechky, B. A. "When Collections of Creatives Become Creative Collectives: A Field Study of Problem Solving at Work," *Organization Science* (17:4) 2006, pp 484-500.
- *Heide, J., and Miner, A. "The shadow of the future: Effects of anticipated interaction and frequency of contact on buyer-seller cooperation," *Academy of management journal* (35:2) 1992, pp 265-291.
- Hemlin, S. "Creative knowledge environments for research groups in biotechnology. The influence of leadership and organizational support in universities and business companies," *Scientometrics* (67:1), Apr 2006, pp 121-142.
- Hemlin, S., and Olsson, L. "Creativity-Stimulating Leadership: A Critical Incident Study of Leaders' Influence on Creativity in Research Groups," *Creativity and Innovation Management* (20:1), Mar 2011, pp 49-58.
- *Hender, J. M., Dean, D. L., Rodgers, T. L., and Nunamaker, J. F. "An examination of the impact of stimuli type and GSS structure on creativity: Brainstorming versus non-brainstorming techniques in a GSS

- environment," *Journal of Management Information Systems* (18:4), Spr 2002, pp 59-85.
- Henderson, J. C., and Lee, S. "Managing I/S Design Teams: A Control Theories Perspective," *Management Science* (38:6) 1992, pp 757-777.
- Iacono, C. S., and Weisband, S. "Developing Trust in Virtual Teams," Proceedings of the Thirtieth Hawaii International Conference on System Sciences, 1997.
- Isen, A. M. "Positive affect and decision making," in: *Handbook of emotions* M. Lewis and J.M. Haviland-Jones (eds.), Guilford Press, New York, 2000, pp. 417-435.
- Janis, I. L. "Victims of Groupthink," in: *A Psychological Study of Foreign-Policy Decisions and Fiascoes*, Houghton Mifflin, Boston 1972.
- *Janowicz-Panjaitan, M., Bakker, R. M., and Kenis, P. "Research on temporary organizations: the state of the art and distinct approaches toward 'temporariness'," in: *Temporary Organizations: Prevalence, Logic and Effectiveness*, P. Kenis, M. Janowicz-panjaitan and B. Cambré (eds.), Edward Elgar Publishing Limited, Cheltenham, 2009.
- *Janz, B. D., Colquitt, J. A., and Noe, R. A. "Knowledge Worker Team Effectiveness: The Role of Autonomy, Interdependence, Team Development, and Contextual Support Variables," *Personnel Psychology* (50:4) 1997, pp 877 - 904.
- Jarvenpaa, S. L., and Leidner, D. E. "Communication and Trust in Global Virtual Teams," *Organization Science* (10:6) 1999, pp 791-815.
- Jehn, K. A. "A multimethod examination of the benefits and detriments of intragroup conflict," *Administrative Science Quarterly* (40) 1995, pp 256-282.
- Jessup, L. M., Connolly, T., and Galegher, J. "The Effects of Anonymity on GDSS Group Process with an Idea-Generating Task," *MIS Quarterly* (14:3) 1990, pp 313-321.
- Joshi, A., Pandey, N., and Han, G., Helen "Bracketing team boundary spanning: an examination of task-based, team-level, and contextual antecedents," *Journal of Organizational Behavior* (30) 2009, pp 731-759.
- Kanawattanachai, P., and Yoo, Y. "Dynamic nature of trust in virtual teams," *Journal of Strategic Information Systems* (11) 2002, pp 187-213.
- Katz-Navon, T., Naveh, E., and Stern, Z. "Active Learning: When Is More Better? The Case of Resident Physicians' Medical Errors," *Journal of Applied Psychology* (94:5) 2009, pp 1200-1209.
- Katz, R. "The effects of group longevity on project communication and performance," *Administrative Science Quarterly* (27) 1982, pp 81-104.
- Katz, R., and Allen, T. J. "Project Performance and the Locus of Influence in the R&D Matrix," *Academy of Management Journal* (28:1) 1985, pp 67-87.
- Keller, R. T. "Predictors of the performance of project groups in R & D organizations," *Academy of Management Journal* (29) 1986, pp 715-726.
- Kelly, J. R., and Barsade, S. G. "Mood and Emotions in Small Groups and Work Teams," *Organizational Behavior and Human Decision Processes* (86:1) 2001, pp 99-130.

- *Kirkman, B. L., and Rosen, B. "Beyond Self-Management: Antecedents and Consequences of Team Empowerment," *Academy of Management Journal* (42:1) 1999, pp 58-74.
- Kohn, N. W., Paulus, P. B., and Choi, Y. H. "Building on the ideas of others: An examination of the idea combination process," *Journal of Experimental Social Psychology* (47:3), May 2011, pp 554-561.
- *Kraut, R., and Streeter, L. "Coordination in large scale software development," *Communications of the ACM* (38:3) 1995, pp 69-81.
- Kudaravalli, S. "Practices and Strategies of Distributed Knowledge Collaboration," in: *Department of Decisions & Information Technologies*, University of Maryland, College Park, 2010, p. 150.
- Lankau, M. J., and Scandura, T. "An Investigation of Personal Learning in Mentoring Relationships: Content, Antecedents, and Consequences," *Academy of Management Journal* (45:4) 2002, pp 779-790.
- Lau, D. C., and Murnighan, J. K. "Demographic diversity and faultlines: The compositional dynamics of organizational groups," *Academy of Management Review* (23) 1998, pp 325-341.
- Lave, J., and Wenger, E. *Situated Learning: Legitimate Peripheral Participation* Cambridge University Press, Cambridge, UK, 1991.
- Lee, K. Y. and Basselliér, "Theoretical model of team effectiveness and creativity in knowledge teams", Working paper.
- Leenders, R., Engelen, J., and Kratzer, J. "Virtuality, communication, and new product team creativity: a social network perspective," *Journal of Engineering and Technology Management* (20) 2003, pp 69-92.
- Leenders, R., van Engelen, J. M. L., and Kratzer, J. "Systematic design methods and the creative performance of new product teams: Do they contradict or complement each other?," *Journal of Product Innovation Management* (24:2), Mar 2007, pp 166-179.
- Lubart, T. I., and Getz, I. "Emotion, Metaphor, and the Creative Process," *Creativity Research Journal* (10:4) 1997, pp 285-301.
- Lynn, G. S., Reilly, R. R., and Akgun, A. E. "Knowledge management in new product teams: Practices and outcomes," *IEEE Transactions on Engineering Management* (47:2), May 2000, pp 221-231.
- *Madhavan, R., and Grover, R. "From Embedded Knowledge to Embodied Knowledge: New Product Development as Knowledge Management," *Journal of Marketing* (62:4) 1998, pp 1-12.
- Majchrzak, A., Jarvenpaa, S. L., and Hollingshead, A. B. "Coordinating expertise among emergent groups responding to disasters," *Organization Science* (18:1), Jan-Feb 2007, pp 147-161.
- Malhotra, A., Majchrzak, A., Carman, R., and Lott, V. "Radical innovation without collocation: A case study at Boeing-Rocketdyne," *MIS Quarterly* (25) 2001, pp 229-249.
- Marks, M. A., Mathieu, J. E., and Zaccaro, S. J. "A Temporally Based Framework and Taxonomy of Team Processes," (26:3) 2001, pp 356-376.
- *Meyerson, D., Weick, K. E., and Kramer, R. M. "Swift trust and temporary groups," in: *Trust in Organizations: Frontiers of Theory and Research*,

- R.M. Kramer and T.R. Tyler (eds.), Sage Publications, Thousand Oaks, CA, 1996, pp. 166-195.
- Michinov, N., and Primois, C. "Improving productivity and creativity in online groups through social comparison process: New evidence for asynchronous electronic brainstorming," *Computers in Human Behavior* (21:1), Jan 2005, pp 11-28.
- *Miles, M. B. "On temporary systems," in: *Innovation in Education*, M.B. Miles (ed.), Teachers College Press, New York, 1964, pp. 437--490.
- Miura, A., and Hida, M. "Synergy between diversity and similarity in group-idea generation," *Small Group Research* (35:5), Oct 2004, pp 540-564.
- Moorman, C. "Organizational Market Information Processes: Cultural Antecedents and New Product Outcomes," *Journal of Marketing Research* (32:3) 1995, pp 318-335.
- Mulec, K., and Roth, J. "Action, reflection, and learning - coaching in order to enhance the performance of drug development project management teams," *R & D Management* (35:5), Nov 2005, pp 483-491.
- Narayanan, S., Balasubramanian, S., and Swaminathan, J. M. "A Matter of Balance: Specialization, Task Variety, and Individual Learning in a Software Maintenance Environment " *Management Science* (55:11) 2009, pp 1861-1876.
- Nemeth, C. J., Personnaz, B., Personnaz, M., and Goncalo, J. A. "The liberating role of conflict in group creativity: A study in two countries," *European Journal of Social Psychology* (34:4), Jul-Aug 2004, pp 365-374.
- Nigel, B.-J. "The Paradox of Diversity Management, Creativity and Innovation," *Creativity and Innovation Management* (14:2) 2005, pp 169-175.
- Nunamaker Jr., J. F., Applegate, L. M., and Konsynski, B. R. "Facilitating Group Creativity: Experience with a Group Decision Support System," *Journal of Management Information Systems* (3:4) 1987, pp 5-19.
- Orlikowski, W. J. "Knowing in Practice: Enacting a Collective Capability in Distributed Organizing," *Organization Science* (13:3) 2002, pp 249-273.
- *Packendorf, J. "Inquiring into the temporary organization: new directions for project management research," *Scandinavian Journal of Management Studies* (11:4) 1995, pp 319-333.
- Park, M. H. J., Lim, J. W., and Birnbaum-More, P. H. "The Effect of Multiknowledge Individuals on Performance in Cross-Functional New Product Development Teams," *Journal of Product Innovation Management* (26:1), Jan 2009, pp 86-96.
- Paulus, P. B. "Groups, Teams, and Creativity: The Creative Potential of Idea-generating Groups," *Applied Psychology: An International Review* (49:2) 2000, pp 237-262.
- Pearsall, M. J., Ellis, A. P. J., and Evans, J. M. "Unlocking the effects of gender faultlines on team creativity: Is activation the key?," *Journal of Applied Psychology* (93:1), Jan 2008, pp 225-234.
- Pintrich, P. R. "A Motivational Science Perspective on the Role of Student Motivation in Learning and Teaching Contexts," *Journal of Educational Psychology* (95:4) 2003, pp 667-686.

- Pirola-Merlo, A., and Mann, L. "The relationship between individual creativity and team creativity: aggregating across people and time," *Journal of Organizational Behavior* (25:2), Mar 2004, pp 235-257.
- Putnam, L. L. "Rethinking the nature of groups in organizations," in: *Small group communication: A reader* R.S. Cathcart and L.A. Samovar (eds.), William C Brown, Dubuque, IA, 1992, pp. 57-66.
- *Quinlan, E., and Robertson, S. "Modelling Dimensions of 'the Social' in Knowledge Teams: An Operationalisation of Habermas' Theory of Communicative Action," *Sociological Research Online* (15:3) 2010, p 11.
- Reagans, R., Argote, L., and Brooks, D. "Individual experience and experience working together: Predicting learning rates from knowing who knows what and knowing how to work together," *Management Science* (51:6) 2005, pp 869-881.
- Reilly, R. C. "Is expertise a necessary precondition for creativity? A case of four novice learning group facilitators," *Thinking Skills and Creativity* (3) 2008, pp 59-76.
- Rietzschel, E. F., Nijstad, B. A., and Stroebe, W. "Productivity is not enough: A comparison of interactive and nominal brainstorming groups on idea generation and selection," *Journal of Experimental Social Psychology* (42:2), Mar 2006, pp 244-251.
- *Saunders, C. S., and Ahuja, M. K. "Are All Distributed Teams the Same? Differentiating Between Temporary and Ongoing Distributed Teams," *Small Group Research* (37:6) 2006, pp 662-700.
- Schilpzand, M. C., Herold, D. M., and Shalley, C. E. "Members' Openness to Experience and Teams' Creative Performance," *Small Group Research* (42:1), Feb 2011, pp 55-76.
- Sense, A. J. "The project workplace for organizational learning development," *International Journal of Project Management* (29:8), Dec 2011, pp 986-993.
- *Shani, A. B., Sena, J. A., and Stebbins, M. W. "Knowledge work teams and groupware technology: learning from Seagate's experience," *Journal of Knowledge Management* (4:2) 2000, pp 111-124.
- Shumate, M., Ibrahim, R., and Levitt, R. "Dynamic information retrieval and allocation flows in project teams with discontinuous membership," *European J. International Management* (4:6) 2010.
- Sosik, J. J., Avolio, B. J., and Kahai, S. S. "Inspiring group creativity - Comparing anonymous and identified electronic brainstorming," *Small Group Research* (29:1), Feb 1998a, pp 3-31.
- Sosik, J. J., Kahai, S. S., and Avolio, B. J. "Transformational leadership and dimensions of creativity: Motivating idea generation in computer-mediated groups," *Creativity Research Journal* (11:2) 1998b, pp 111-121.
- Stahl, G. K., Maznevski, M. L., Voigt, A., and Jonsen, K. "Unraveling the effects of cultural diversity in teams: A meta-analysis of research on multicultural work groups," *Journal of International Business Studies* (41:4), May 2010, pp 690-709.
- Suh, T., Bae, M., Zhao, H. X., Kim, S. H., and Arnold, M. J. "A multi-level investigation of international marketing projects: The roles of experiential

- knowledge and creativity on performance," *Industrial Marketing Management* (39:2), Feb 2010, pp 211-220.
- Taggar, S. "Individual creativity and group ability to utilize individual creative resources: A multilevel model," *Academy of Management Journal* (45:2) 2002, pp 315-330.
- Teigland, R., and Wasko, M. M. "Integrating knowledge through information trading: Examining the relationship between boundary spanning communication and individual performance," *Decision Sciences* (34:2), Spr 2003, pp 261-286.
- Tempest, S., and Starkey, K. "The effects of liminality on individual and organizational learning," *Organization Studies* (25:4), May 2004, pp 507-527.
- Tiwana, A., and McLean, E. R. "Expertise integration and creativity in information systems development," *Journal of Management Information Systems* (22:1), Sum 2005, pp 13-43.
- Tu, C. Y. "A multilevel investigation of factors influencing creativity in NPD teams," *Industrial Marketing Management* (38:1), Jan 2009, pp 119-126.
- Tyre, M., and von Hippel, E. "The situated nature of adaptive learning in organizations," *Organization Science* (8:1) 1997, pp 71-83.
- Tyre, M. J., and Orlikowski, W. J. "Windows of Opportunity: Temporal Patterns of Technological Adaptation in Organizations," *Organization Science* (5:1) 1994, pp 98-118.
- Van der Vegt, G., and Emans, B. "Team members' affective responses to patterns of intragroup interdependence and job complexity," *Journal of Management* (26:4) 2000, pp 633-655.
- Webb, N. M. "Student Interaction and Learning in Small Groups," *Review of Educational Research* (52:3) 1982, pp 421-445.
- *Wellins, R. S., Wilson, R., Katz, A. J., Laughlin, P., Day, C. R., and Price, D. *Self-Directed Teams: A Study of Current Practice* DDI, Pittsburgh, PA, 1990.
- West, M. A. "Sparkling Fountains or Stagnant Ponds: An Integrative Model of Creativity and Innovation Implementation in Work Groups.," *SI* (3) 2002, pp 355-387.
- Wong, S.-S. "Distal and Local Group Learning: Performance Trade-Offs and Tensions," *Organization Science* (15:6) 2004, pp 645-656.
- Wood, R. E. "Task Complexity: Definition of the Construct" *Organizational Behavior and Human Decision Processes* (37:60-82) 1986.
- Woodman, R. W., Sawyer, J. E., and Griffin, R. W. "Toward a Theory of Organizational Creativity," *The Academy of Management Review* (18:2) 1993, pp 293-321.
- *Woolley, A. W. "Putting first things first: Outcome and process focus in knowledge work teams," *Journal of Organizational Behavior* (30) 2009, pp 427-452.
- Zaccaro, S. J., Blair, V., Peterson, C., and Zazanis, M. "Collective efficacy," in: *Self-efficacy, adaptation, and adjustment: Theory, research, and application*, J. Maddux (ed.), Plenum Press, New York, 1995, pp. 305-330.

- Zammuto, R. F., Griffith, T. L., Majchrzak, A., Dougherty, D. J., and Faraj, S. "Information Technology and the Changing Fabric of Organization," *Organization Science* (18:5) 2007, pp 749-762.
- Zellmer-Bruhn, M. E. "Interruptive Events and Team Knowledge Acquisition," *Management Science* (49:4) 2003, pp 514-528.
- Zhang, A. Y., Tsui, A. S., and Wang, D. X. "Leadership behaviors and group creativity in Chinese organizations: The role of group processes," *Leadership Quarterly* (22:5), Oct 2011, pp 851-862.

Appendix, Table 3 and Table 4 List of Literatures Reviewed

Table 3. Literature review on the antecedents of team creativity in knowledge teams								
Category 1	Category 2	Category 3	Inputs	Processes(Media-tors or moderators)	Environment	Outcome	Team setting	Author(s) (yr)
Inputs	Cognitive Inputs	Individual Creativity	Individual members' creativity		Team climate for creativity	Innovativeness of the work on the project	R&D Team	Pirola-Merlo and Mann (2004)
			Individual members' creativity	Creativity relevant team processes		Outcome Creativity	Project Team	Tagger (2002)
		Expertise	Shared expertise within a team			Instances of creativity	Learning task team	Reilly (2008)
			The existence of task-related knowledge	Team intelligence		Outcome Creativity	NPD Team	Akgun et al. (2008)
			The existence of experiential knowledge			Outcome Creativity	Project Team	Suh et al. (2010)
			The existence of team members with multi-functional knowledge	Internal knowledge sharing		Outcome Creativity	NPD Team	Park et al. (2009)
		Experience	Experience of working together	Transactive Memory System		Number and Originality of ideas	Idea generation (Brainstorming) team	Gino et al. (2010)
			Openness to experience			Outcome Creativity	Project Team	Schilpzand et al. (2011)
				Intuitive/cognitive decision-making	Team experience (moderating role)	Outcome Creativity	NPD Team	Dayan and Di Benedetto (2011)
		Collaboration capability	Absorptive capacity	Expertise integration		Creativity in team process	ISD team	Tiwana and McLean (2005)
				Transformational Leadership	Collective efficacy	Outcome Creativity	NPD Team	Zhang et al. (2011)
			Members' joint focus on related topics			Number and Originality of ideas	Idea generation (Brainstorming) team	Barruah et al. (2011)

Table 3. Literature review on the antecedents of team creativity in knowledge teams (Cont'd)								
Category 1	Category2	Category3	Inputs	Processes	Environment	Outcome	Team setting	Author (yr)
Inputs (Cont'd)	Psychological Inputs	Moods	Negative moods		Support and control	Outcome Creativity	NPD Team	Tu (2009)
			Positive moods		High autonomy	Number and Originality of ideas	Idea generation (Brainstorming) team	Grawitch et al. (2003)
		Relationships	Relational Capital	Expertise integration		Creativity in team process	ISD team	Tiwana and McLean (2005)
			Trust		Collaborative culture	Creativity in team process	Research teams	Barczak et al. (2010)
		Psych. Safety	Empirical effort not found, but theoretical argument on the positive relationship between psychological safety and team creativity					Paulus (2000), West (2002), Chen (2006)
		Stress & Autonomy		Intuitive/cognitive decision-making	Low level of team stress	Outcome Creativity	NPD Team	Dayan and Di Benedetto (2011)
			Positive moods	High autonomy		Number and Originality of ideas	Idea generation (Brainstorming) team	Grawitch et al. (2003)
		Cultural Aspects	Individualistic Culture		Objective (Creative vs. practical)	Number and Originality of ideas	Idea generation (Brainstorming) team	Goncalo and Staw (2006)
			Gender Fault line	Emotional conflict (-)		Number and Originality of ideas	Idea generation (Brainstorming) team	Pearsall et al. (2008)
	Structural Input	Diversity	Cultural Diversity			Outcome Creativity	Meta Analysis	Stahl et al. (2010)
			Expertise Heterogeneity	Expertise integration		Creativity in team process	ISD team	Tiwana and McLean (2005)
			Team members' external ties			Outcome Creativity	R&D Team	Chen et al. (2008)
			Team variety (knowledge differentiation)	Team planning		Originality of ideas	Idea generation (Brainstorming) team	Curseu (2010)
			Team disparity (Asymmetry in the distribution of resources) (-)			Originality of ideas	Idea generation (Brainstorming) team	Curseu (2010)
			Functional Diversity (n)			Outcome Creativity	NPD Team	Akgun et al. (2008)
			Narcissists in a team (n)			Outcome Creativity	Idea generation (Brainstorming) team	Goncalo et al. (2010)
			Diversity in one aspect and Similarity in another aspect			Number and Originality of ideas	Idea generation (Brainstorming) team	Miura and Hida (2004)
		Anonymity	Inspirational Leadership		Anonymity	Number and Originality of ideas	Idea generation (Brainstorming) team	Sosik et al. (1998)
		Longevity	Team longevity (-)			Creative performance	NPD Team	Leenders et al. (2003)
			Experience of working together	Transactive Memory System		Number and Originality of ideas	Idea generation team	Gino et al. (2010)

Table 3. Literature review on the antecedents of team creativity in knowledge teams (Cont'd)								
Category 1	Category 2	Category 3	Inputs	Processes	Environment	Outcome	Team setting	Author (yr)
Processes	Internal Interaction	Internal Communication		Degree of internal communication (n)		Creative performance	NPD Team	Leenders et al. (2003)
				No interaction (Nominal Group)		Number and Originality of ideas	Idea generation team	Rietzschel et al. (2006)
		Creativity-enhancing internal interaction		Within team social interaction		Outcome Creativity	R&D Team	Chen et al. (2008)
			Individual members' creativity	TCRP (Team Creativity Relevant Processes)		Outcome Creativity	Project Team	Tagger (2002)
				Help seeking and giving, reflective reframing, and reinforcing		Collectively Creative moment	Problem-solving team	Hargadon and Bechky (2006)
				Problem finding through social creativity processes		Instances of creativity	Learning task group	Reilly (2008)
	KM processes	Internal K- Sharing	Multi-functional Knowledge	Internal knowledge sharing		Outcome Creativity	NPD Team	Park et al. (2009)
			Transformational Leadership	Internal knowledge sharing		Outcome Creativity	NPD Team	Zhang et al. (2011)
			Absorptive capacity	Expertise integration		Creativity in team process	ISD team	Tiwana and McLean (2005)
				Building on others' ideas		Novelty and Feasibility of ideas	Idea generation team	Kohn et al. (2011)
		External K- Sourcing	Functional Diversity	Knowledge sourcing from external sources		Product innovation	NPD Team	Ancona and Caldwell (1992)
	Tactical Processes	Leadership		Leaders' role of evaluating, monitoring, encouraging, and guiding the processes		Number and Originality of ideas	Idea generation team	Chang (2011)
				Proper leadership		Outcome Creativity	Research Team	Hemlin (2006)
				Four distinct leader's behaviors (expertise provision, team coordination, support, and task assignment)		Creative incidents	Research Team	Hemlin and Olsson (2011)
				Transactional goal-setting and inspirational motivation		Outcome Creativity	Electronic Brainstorming teams	Sosik et al. (1998a)
				Transformational Leadership		Elaboration and originality of ideas	Electronic Brainstorming teams	Sosik et al. (1998b)

Table 3. Literature review on the antecedents of team creativity in knowledge teams(Cont'd)								
Category 1	Category2	Category3	Inputs	Processes	Environment	Outcome	Team setting	Author (yr)
Processes (Cont'd)	Tactical Processes (Cont'd)	Coaching		Coaching intervention		Outcome Creativity	R&D Team	Mulec and Roth (2005)
				Training on idea generation skill		Originality of ideas	Idea generation team	Baruah and Paulus (2008)
				Analogy and Assumption reversals		Number and Originality of ideas	Idea generation team	Hender et al. (2002)
		Decision-making		Intuitive/cognitive decision-making	Team stress (-)	Outcome Creativity	NPD Team	Dayan and Di Benedetto (2011)
	Conflict	Task conflict		Instruction of debate and critiques		Number and Originality of ideas	Idea generation (Brainstorming) team	Nemeth et al. (2004)
				Task conflict	Types of team (tech- vs. service-driven)	Outcome Creativity	Project Team	Chen (2006) and Curseu (2010)
				Task conflict (n)	Project stage (early stage of project)	Outcome Creativity	ISD team	Farh et al. (2010)
		Rel. conflict		Relational conflict (-)		Outcome Creativity	Project Team	Chen (2006)
		Other types of conflict		Minority Dissent	Team reflexivity	Innovative Team processes	Knowledge teams	De Dreu and Carsten (2002)
				Level of disagreement (U)		Creative performance	NPD Team	Leenders et al. (2007)
		Coordination		Absorptive capacity	Expertise Integration		Creativity in team process	ISD team
			Team variety	Team planning		Originality of ideas	Idea generation (Brainstorming) team	Curseu (2010)
			Social comparison process		Number and Originality of ideas	Electronic Brainstorming teams	Michinov and Primois (2005)	
External Factors		Organizational Pressure			Time pressure (n)	Outcome Creativity	Team of Scientists	Andrews and Farris (1972)
					Time pressure (-)	Creativity expressed in interaction	Idea generation (Brainstorming) team	Chirumbolo et al. (2004)
					Conformity pressure (-)	Creativity expressed in interaction	Idea generation (Brainstorming) team	Chirumbolo et al. (2004)
		Organizational Support	Negative moods		High support and low control	Outcome Creativity	NPD Team	Tu (2009)
					Organizational Support	Outcome Creativity	Research Team	Hemlin (2006)

Table 4. Literature review on the antecedents of individual learning outcomes in knowledge teams								
Category 1	Category2	Category3	Inputs	Behaviors	Environment	Outcome	Team setting	Author (yr)
Input	Cognitive input	Cognitive attitude	Intellectual demand	Knowledge-sourcing behaviors		Individual learning outcome	Teams in Manufacturing co.	Gray and Meister (2004)
			Learning orientation	Knowledge-sourcing behaviors		Individual learning outcome	Teams in Manufacturing co.	Gray and Meister (2004)
			Vision clarity		Information Acquisition	Information Implementation	NPD Teams	Lynn et al. (2000)
		Cognitive ability	Specialized Experience			Productivity (Shorter Resolution Time)	SW Maintenance Teams	Narayanan (2009)
			Experience			Procedure completion time.	Teams in teaching hospital	Reagans et al. (2005)
			Specialized Experience			Learning as productivity increase	System Develop. teams	Boh et al. (2007)
	Psychological Input		Psychological Safety (conceptual)			Individual learning outcome	NA	Edmondson (1999)
Behaviors	Internal-learning behavior		Group knowledge sourcing (with co-located members)		Individual learning outcome	Teams in Manufacturing co.	Gray and Meister (2006)	
			Dyadic knowledge sourcing (co-located)		Individual learning outcome	Teams in Manufacturing co.	Gray and Meister (2006)	
			Reviewing team tasks	Information Acquisition	Information Implementation	NPD Teams	Lynn et al. (2000)	
			Dialogic Practice		Individual learning outcome	Knowledge teams	Kudaravalli (2010)	
	External learning behavior		External 'communities of practice' meetings.		Individual learning outcome	Virtual Teams	Griffith and Sawyer (2006)	
			Published knowledge sourcing		Individual learning outcome	Teams in Manufacturing co.	Gray and Meister (2006)	
			Knowledge sourcing from archives and videos		Individual learning outcome	Knowledge teams	Kudaravalli (2010)	
External Influence	Team environm ent	Diversity		Expertise -> Collective team identification	Individual learning outcome	Multi-disciplinary teams	Van der vegt and Emans (2000)	
		Learning climate		Active learning climate	Reduced numbers of errors	Medical Teams	Katz-Navon et al. (2009)	
		Liminality		Liminality (+/-)	Individual learning outcome	Teams in UK TV Industry	Tempest and Starkey (2004)	
	Team support	Mentoring		Mentoring	Job-related learning and skill development	Knowledge teams	Lankau and Scandura (2002)	
		Tech. support		Groups Supporting Systems	Individual learning outcome	Distributed learning teams	Alavi et al. (2003)	

Chapter 3 – Essay II: The Role of Shared Team Passion, Expertise, and Shared Norms of ICT Use on Knowledge Team Creativity

Abstract

This study investigates how knowledge teams produce creative outcomes. More specifically, this study focuses on the role of shared team passion on team knowledge processes, which leads to team creativity. We identify three important inputs and two processes in knowledge teams: 1) *shared team passion*; 2) *the existence of team expertise*; and 3) *shared norms of Information Communication Technology (ICT) Use* as three important inputs, and 1) *external knowledge sourcing*; and 2) *internal knowledge sharing* as two processes that facilitate the *creativity of team outcomes (or team creativity)*, in the context of knowledge teams, where team members work together via ICT (Information Communication Technologies), and their active participation in team activities is not strictly mandated. We hypothesize that 1) *shared team passion about team activities* is positively associated with *external knowledge sourcing and internal knowledge sharing*; 2) *the existence of expertise* is positively associated with *internal knowledge sharing*; 3) *shared norms of ICT use* positively moderate the relationship between *shared team passion* and *team knowledge management (external knowledge sourcing and internal knowledge sharing) processes*; and 4) *external knowledge sourcing and internal knowledge sharing processes* positively influence *team creativity*. Further, we also argue that 5) if the *team task is*

explorative (i.e., the extent that a knowledge team explores something new for its team outcome), the impact of *external knowledge sourcing* on *team creativity* should be stronger. The research model is tested with team-level survey data from an educational service company that facilitates knowledge teams. We conclude with the possible implications of this study for the academy and practice.

Introduction

Knowledge teams are made up of knowledge workers who are engaged in creating new products, business ideas, and solutions (Faraj and Sproull 2000; Faraj and Yan 2009). In current business environments, a knowledge team often includes members from different organizational units, and typically needs to combine the distributed knowledge of members in order to create a novel outcome (Hargadon and Bechky 2006). Nowadays, it is common to see that employees are involved in several subunits of an organization (or even of multiple organizations). Thus, although an employee is involved in a knowledge team, it does not always mean that they are off from their day-to-day routine jobs. Involving in a knowledge team often requires the employees to take part in both their day-to-day jobs and the tasks of their knowledge team. In this case, knowledge team members may not meet daily. Instead, members continue to work on their day-to-day tasks, while coming together as needed to exchange and integrate knowledge. For example, a group of sales specialists from different regional offices who form a task-force team to develop several new products for a new market niche (while still working on their sales jobs) exemplifies a knowledge team in a contemporary

organizational environment.

A literature review on knowledge team (Essay I) shows that key performance measures of knowledge teams include effectiveness, efficiency, and creativity (Akgun, Byrne, Keskin, Lynn, and Imamoglu 2005; Faraj and Sproull 2000) and also suggests that more attention has been paid to investigate effectiveness and efficiency of knowledge teams rather than team creativity, although creativity of knowledge team outcome is another important aspect of team performance that organizations expect from knowledge teams (Paulus 2000). Although the research on team creativity has identified different *psychological facilitators* of team creativity, such as mood, motivation, and trust (Paulus 2000; Tiwana and McLean 2005; Tu 2009; Woodman, Sawyer, and Griffin 1993), the roles of *team passion* have not been empirically examined. However, passion has recently been identified as a key driver of knowledge collaboration in online communities (Faraj, Jarvenpaa, and Majchrzak 2011) and may play an important role in team processes that can enable creativity (Amabile 2000).

Woodman et al. (1993) suggested that team creativity is a function of *team inputs (individual members' inputs, team composition and team characteristics), team processes and contextual influences*. Based on this research framework, this study proposes and tests a research model on knowledge team creativity, while highlighting the role of *shared team passion* as an important team-level psychological input in knowledge team context. That is, this study aims to show that *shared passion about team activities*, defined as the extent to which a knowledge team has experienced love, enthusiasm, and attachment to the

activities (tasks) for the team (Baum and Locke 2004; Billow 2002; Cardon, Zietsma, Saporito, Matherne, and Davis 2005; Hirschhorn 2003), is indirectly related to team creativity, through team knowledge processes. Further, this study also investigates the role of *team expertise*, a well-known cognitive input for knowledge team creativity (Csikszentmihalyi 1996), *shared norms of ICT*, an important team input for knowledge team collaboration (Cannon-Bowers, Salas, and Converse 2001; Espinosa, Kraut, Lerch, Slaughter, and Herbsleb 2001), and *tasks characteristics in terms of exploration* (Jansen, Van Den Bosch, and Volberda 2006; March 1991) as a contextual factor in knowledge teams.

In detail, we first suggest that *shared passion about team activities* is an important team-level psychological input that influences team knowledge processes; *external knowledge sourcing and internal knowledge sharing*, and the *existence of team expertise related to team tasks* (i.e., team expertise) is an important team-level cognitive input that influences *internal knowledge sharing*. In turn, these two knowledge processes (*external knowledge sourcing and internal knowledge sharing*) will positively influence *team creativity*. Secondly, we suggest that in the environment of knowledge teams (where team members frequently rely on Information Communication Technology (ICT) for their collaboration), *shared norms of ICT use*, which is defined as team members' common understanding about the way ICT is used for team activities (Cannon-Bowers et al. 2001; Espinosa et al. 2001), moderates the impact of *shared team passion* on *two knowledge processes*. Finally, we argue that *explorative team tasks* positively moderate the relationship between *external knowledge sourcing*

and *team creativity*.

In this study, we report on a field survey study of knowledge teams with a diverse membership. These teams are supported by ICT for their collaboration and engagement in creative tasks. The study aims to answer the following research questions:

“What are the impacts of team passion and team expertise on team creativity through team knowledge processes? and,

“Do shared norms of ICT and explorative tasks moderate the relationship between team inputs (passion and expertise) and team knowledge processes, and the relationship between team processes and team creativity, respectively?”

To answer these research questions, this paper develops as follows. We first discuss theoretical perspective on *shared team passion, shared norms of ICT, knowledge team environment, team knowledge processes, and team creativity*. Then, we develop a research model that hypothesizes the relationship among *shared team passion, team expertise, shared norms of ICT use, team knowledge processes, exploration of team tasks, and team creativity*. We then describe the research design that will be used to test these hypotheses. Results of this data analysis will be discussed, followed by contributions and limitations of this study and suggestions for the future research.

Theoretical Background

Knowledge team environment

We focus on the knowledge team with three characteristics; 1) *knowledge*

creating tasks, 2) temporary and non-routine activities of team members, and 3) ICT-enabled communication.

First, knowledge teams are formed to combine the knowledge of team members from different areas of knowledge within an organization, in order to create something new (Katz and Allen 1985; Faraj and Yan 2009). Such teams are often *cross-functional* (Walczak 2005), facing *complex and non-routine tasks* (Wooley 2009), and with high *interdependence among team members* (Cheng 1983). Another important characteristic of knowledge teams is *its self-managed environment*, as this kind of teams work on the topics that are not well circumscribed and that do not have a single or correct method of completion (Wooley 2009). Although they are supposed to meet the requirements of the stakeholders from different parts of an organization (Faraj and Sambamurthy 2006), knowledge team members often choose their own goals to achieve by themselves (Kirkman and Rosen 1999). Thus, *the nature of team task varies* according to the goals that are self-decided by the team itself. Some knowledge teams may decide to work on improving current products or services without creating something outside their technical or managerial scopes (exploitative innovation), or others may decided to create completely new products and services (explorative innovation) (Jansen, Van den Bosch, and Volberda 2006). We will later argue that *task characteristics that originated from different topics of knowledge team* should influence the way team knowledge processes enhance team creativity.

Second, it is not always the case that knowledge team are formed

temporarily, but often, knowledge teams are formed for a certain period of time to achieve a specific goal of knowledge creation and are expected to be dismissed when they achieve the goal. In this case, the members of knowledge teams lack the history of working together, as the teams are formed temporary basis (Meyerson, Weick, and Kramer 1996; Faraj and Sproull 2000). Unlike ongoing teams, in the knowledge teams formed temporarily, members may have *social interaction anxiety* at least during the initial stage of team formation (Camacho and Paulus 1995). This anxiety often discourages members from freely sharing their ideas because of the reactions and the potential evaluation of ideas by other members (Camacho and Paulus 1995). If team members develop a shared psychological input over time that mitigates this interaction anxiety, the members will be able to share their ideas more actively. Also, as briefly mentioned in the introduction, anecdotal evidences (including the knowledge teams of the field of this study) indicate that involving in knowledge teams as temporary basis often requires that team members have to engage in both their day-to-day jobs in their functional teams and knowledge creating activities in knowledge teams. That is, knowledge team members participate in knowledge team activities as their non-routine activities, while they still keep working on their routine jobs. In the case of the teams in this study as well, members work on their knowledge team activities while they engage in their day-to-day tasks. In this case, it is possible that some team members may show “social loafing” (Paulus 2000) due to the fact that knowledge team activities may not be their first priority, and that their inputs and participation in team activities may not be accounted for in their team

outcomes (Latané, Williams, and Harkins 1979). Thus, in order to achieve successful team performance in the context where the tasks are non-routine activities for the members, it is also necessary for team members form a psychological shared input that ensures their active participation. In this study, we will argue that this psychological shared input should be *shared passion about team activities*.

Third, in contemporary knowledge teams the communication among members is supported by both face-to-face (f2f) and ICT, whether or not team members are geographically distributed. According to Kirkman and Mathieu (2005), any contemporary teams can have a certain level of virtuality with the help of ICT. Geographical distribution of team members is one of dimensions of team virtuality (Gibson and Gibbs 2006). Thus, if members are geographically distributed, the team's virtuality will be higher. In the teams with high virtuality in terms of location, they will rely more heavily on ICT for team collaboration, as ICT can support the lack of interaction among distributed members (Hinds and Bailey 2003). Like many other types of knowledge teams, members of our focal knowledge teams are geographically dispersed (for the majority of team period) and do not meet every day, but communicate virtually via ICT while they are working on their own sub-tasks for knowledge teams, except when they periodically meet f2f to work on team tasks. These dual communication modes should influence the way team members work together. In this collaboration environment of high level of dependence on ICT, members' shared understanding of how to use ICT for team collaboration should be very important for team

processes, as well as for team outcome. Thus, we later introduce that *shared norms of ICT use* are one of key variables in our research model.

Shared team passion

In this paper, we introduce “shared team passion” as an important team-level input for output creativity, as shared team passion address a number of detrimental factors such as social interaction anxiety and social loafing (Camacho and Paulus 1995; Diehl and Stroebe 1987) embedded in knowledge teams and will help members make an extra effort to participate in team activities.

Passion as a distinctive psychological input for knowledge team creativity

Before we define passion at the team level, let us review the literature on passion and discuss it as an important psychological construct that is conceptually different from other psychological constructs. Passion has been studied mostly at the individual level. It has been defined various ways, as *a strong inclination toward an activity* (Vallerand, Blanchard, Mageau, Koestner, Ratelle, Léonard, Gagné, and Marsolais 2003), *intense positive emotional arousal, an internal drive and full engagement* (Perttula 2003), and *an intense affective state accompanied by cognitive and behavioral manifestations* (Chen, Yao, and Kotha 2009).

Common to those definitions above is that passion is formed toward a specific object (also referred to as a “reference target”) and that passion about a certain reference target entails *love, strong likeness and full engagement* about the reference target.

Passion has been investigated in various contexts, such as sports, gambling, gaming and other recreational activities (Vallerand et al. 2003), but in the field of

management, most studies on passion investigated '*entrepreneurial passion*' (Cardon, Wincent, Singh, and Drnovsek 2009). Common to those contexts (sports, gambling, gaming, recreational activities, and entrepreneurial activities) is that passion plays an important role in success in the environment where *active engagement in the reference target* is not strictly mandated by a third party. In the context of entrepreneurial activities, where active engagement of entrepreneurial activities is not strictly mandated by anyone, it is found that passion is related to willingness to work long hours, courage, high level of initiative, and persistence in the target activities and that it is positively associated to entrepreneurial success (Cardon et al. 2009; Bierly, Kessler, and Christensen 2000).

Passion has been compared to similar psychological constructs. According to the literature review article by Cardon et al. (2009), passion seems to be similar to positive feeling, positive emotion, and is closely related to intrinsic motivation. However, here are some arguments on the similarities and differences of passion from other concepts: feeling (affect), emotion, and motivation.

Comparison with feeling and affect: Passion is a kind of feeling, but is more compatible with a highly intense and positive feeling, whereas feeling can be positive or negative. Second, affect is activated by external objects or activities that may or may not be related to one's identity, but passion is activated by a target that is meaningful to one's identity (Cardon et al. 2009).

Comparison with emotions: Passion and emotions have some commonality. Some scholars have argued that passion is a kind of emotion since emotion is a multi-faceted phenomenon (Morris and Keltner 2000), and passion was

sometimes defined as a strong positive emotion (Winnen 2005). Moreover, both constructs need a reference target. However, the main difference between passion and emotion is twofold. First, passion is always positive, but emotion can be positive or negative. Second, passion originates from long-term engagement or experience about the target activities (Cardon et al. 2009), while an emotion is more a short term response to that target (Morris and Keltner 2000; Rafaeli and Sutton 1991).

Comparison with motivation: Motivation can be intrinsic and extrinsic (Ryan and Deci 2000). Intrinsic motivation is similar to passion as both concepts relate to the “liking of a certain activity.” However, several studies have indicated that passion precedes (or positively influences) intrinsic motivation. For example, Wang et al. (2008) found that passion positively influences intrinsic motivation in the context of digital gaming and Cardon et al. (2009) argued that passion can affect motivational factors. Baum and Locke (2004) also distinct passion from motivational factors, such that passion is one of personal traits of an entrepreneur and is more dispositional than motivation, while motivational factors focus on tasks and situation on hand. Thus, having passion about a certain activity means that someone has a love about the activity, while having intrinsic motivation about it means that s/he has a specific inclination to engage in the tasks and situations in hand related to the activity. Extrinsic motivation does not have much to do with “liking toward an activity.” Rather, extrinsic motivation is related to the extrinsic rewards that come from engaging in the activity, whether people like the target or not.

In sum, while passion shares some meanings with other psychological constructs, it is 1) *an acquired personal trait about a certain activity (reference target)*, which is 2) *formed by rather longer engagement with the activity*, and 3) *entails strong positive love and likeness about the target*. While the impact of other psychological constructs (positive feeling, mood, emotion, and motivation) on creativity have been investigated quite often (Amabile 1979; Amabile 1985; Baas, De Dreu, and Nijstad 2008; Barron and Harrington 1981; Woodman et al. 1993), the role of passion on creativity is not much investigated empirically. However, in the next paragraph we will propose that in the knowledge team environment, where active participation in team activities is not strictly mandated, passion should be a key team-level input for team processes, which result in creative team outcomes.

Defining passion at the team level – shared team passion as a key driver for team knowledge processes

Passion is not clearly defined at the team level (Cardon et al. 2009). Additionally, to the best of our knowledge, there is no empirical research article on passion at the collective level. However, passion at the group (or even organizational) level has been considered important for success in group work (Hirschhorn 2003) (e.g., *Managers complain about passion in their groups for its absence*). In particular, Faraj, Jarvenpaa, and Marjzack (2011) argue that passion at the community level may influence knowledge collaboration in online communities. Group or team passion is often mentioned in situations where members' participation in target activities is not strongly mandated by third party

entities as it is the case for the knowledge teams in this study because they do not necessarily have mandated (or designated) tasks to finish. Rather, under a self-managed team environment, where members can freely decide what they will achieve by the end of their tenure on the knowledge teams and can participate in team activities as their non-routine task activities, passion should make a difference in the level of participation in team activities by team members.

We suggest that passion at the collective level is formed through experience with the target (Cardon et al. 2009). Thus, especially in the context of knowledge teams, where members have never met before or worked together, it is not likely that passion about team activities is made or shown at team formation. Instead, team-level passion forms and evolves over time as members engage in team activities. Thus, in general the fact that knowledge team members are passionate about their team activities means that they have experienced love, enthusiasm, and attachment to the activities they are doing while they are in the knowledge team (Baum and Locke 2004). With this in mind, we define *shared team passion about knowledge team activities* as the degree with which a team – through its members – has experienced love, enthusiasm, and attachment to the activities (tasks) of the team (Baum and Locke 2004).

Shared norms of ICT use

In virtual team environments, the concept of shared norms has often been emphasized as an important team cognitive input for successful performance in previous studies (Caya 2008; Malhotra and Majchrzak 2004; Malhotra, Majchrzak, Carman, and Lott 2001; Sarker and Sahay 2003). Actually, there are

many aspects of shared norms identified in previous studies, namely: 1) norms about overall team interaction or communication (the amount of communication, virtual presence, and the use of ICT); 2) norms about team members' activities and behavior (roles and responsibilities, responsiveness, participation, and attendance); and 3) norms about capturing and sharing information and knowledge (Caya 2008; Malhotra et al. 2001; Sarker and Sahay 2003).

Although all of these norms about team activities may be important for successful knowledge team outcomes (Sarker and Sahay 2003), this study focuses on *the shared norms about ICT use* (Caya 2008) as important team-level norms in the environment of knowledge teams. In many cases of teams that are formed for a specific purpose of creating new knowledge and that are highly virtual in terms of geographic distance, at the initial stages there are few shared norms of many aspects of team activities (e.g., team goals, tasks, members' behavior, and team communication), as the teams are formed with members who have never worked together before (Malhotra et al. 2001; Sarker and Sahay 2003; Saunders and Ahuja 2006). However, it is very important for team members to have a shared norm of how to communicate, how to exchange digitalized documents, and how to move the team's ongoing outputs forward to the final outcome via ICT so that although they are distributed, members can work on their own tasks and can communicate with one another through ICT (Malhotra et al. 2001).

Research suggested that shared norms in a team are not formed in a day. Norms can be formed over a period of time by interaction among members. According to Bettenhausen and Murnighan (1985), norms in organizational

groups can be formed not only by members' interaction over time, but norm can also be formed more quickly (or sometimes modified significantly from initially formed norms) when group members experience and resolve some challenges within their group. In the case of the norms of ICT as well, the extant studies on the shared norms of ICT suggested that norms are formed with certain events or conflicts. For instance, shared norms of ICT in teams are formed through technology adaptation when team members see the misalignment between team structure and the technology given (Majchrzak, Rice, Malhotra, King, and Ba 2000). Also, when individuals perceive Information Technology support for communicating contextual information, they form collaboration know-how with other members of teams (Majchrzak, Malhotra, and John 2005). Moreover, when there are errors in the team process or conflict among members of teams, the team members perceive the need for building a shared understanding of ICT for communication (Malhotra and Majchrzak 2004). As such, some critical events or team members' efforts are required for a knowledge team to reach a shared understanding about ICT use. Thus, the extent to which teams have developed a shared norm of how to use ICT should vary among different knowledge teams so that the extent to which ICT is used by team members for team knowledge management should also be different among knowledge teams. This paper argues that the extent in the *shared norms of ICT use* in knowledge teams should influence the way team inputs affect team knowledge management processes.

Based on previous studies involving shared norms at the team level, we define *shared norms of ICT use* as team members' common understanding about

the way Information Communication Technologies (ICT) are used for team activity (Cannon-Bowers et al. 2001; Espinosa et al. 2001). The dimensions of the shared norms of ICT are introduced in several studies on virtual teams, but it seems that the dimensions of the shared norms of ICT vary according to the contexts of different teams. However, the dimensions identified from those studies can be summarized into two broad categories: 1) shared norms of managing and sharing digital contents (e.g., digital repository) related to team activities; and 2) shared norms of members' use of different types of ICT for communication among one another, which also includes the dimensions of "which ICT they use" and "how (often) they communicate with different ICT (or make themselves available virtually)" (Malhotra and Majchrzak 2004; Sarker and Sahay 2003). These two dimensions of the shared norms of ICT use help members collaborate among one another, whether or not team members are geographically distributed (Caya, Pinsonneault, and Bassellier, 2011).

Creativity of knowledge team outcomes: the role of knowledge management processes

Creativity is one of the key success factors for current organizations by playing a central role in organizational innovation (Runco 2004; Taggar 2002). Creativity in organizational context refers to the creation of a valuable and useful new product, service, idea, procedure, or process by individuals working together in a complex social system (Woodman et al. 1993). As such, in the context of knowledge teams, *the creativity of team outcomes* is defined as the creation of valuable and useful outcomes (products, service, ideas, procedures, or processes)

by a knowledge team (Amabile 1983; Moorman 1995; Woodman et al. 1993).

A number of studies have suggested the roles of *team inputs* (*team composition, psychological and cognitive status of members, etc*) and *processes* (*members' activities related to team tasks*) on the creative outcomes of knowledge teams (Amabile, Conti, Coon, Lazenby, and Herron 1996; Paulus 2000). Some argue that team level inputs are direct enablers of creativity, while others argue that team-level processes (or team behaviors) are key enablers of creative outcomes.

The team inputs that are said to be related to team creativity include psychological—such as shared commitment for objective—(Amabile et al. 1996), compositional—such as member diversity—(Gibson and Gibbs 2006), or cognitive—such as expertise—(Csikszentmihalyi, 1996) factors. In this study, as introduced above, we propose '*shared team passion*' as an important *psychological* input and '*team expertise*' as an important *cognitive* input, since in the context of knowledge teams (diverse members, non-mandated active participation, and non-routine and knowledge-creating tasks), team members' expertise related to team knowledge outcomes and a psychological force (passion) that encourages team members' active participation in team activities are important.

In addition, team processes such as boundary spanning (Ancona and Caldwell 1992), external knowledge sourcing (Bresman 2010), help-giving, help-receiving and reflecting others' ideas (Hargadon and Bechky 2006), and group sessions followed by individual idea generation (Paulus 2000) are said to be the

processes that positively influence team creativity. Although extant studies have informed the impact of both team inputs and processes on team creativity, we take the perspective of the *input-process-output model* by Woodman et al. (1993) and argue that team inputs enable team processes, which improve the creativity of team outcomes in the context of knowledge teams. The reason for taking the perspective of the *input-process-output model for creativity* is that simply having a team's psychological or cognitive inputs may not necessarily ensure the best possible team creativity in the context of knowledge teams. As mentioned, knowledge teams often consist of members from different backgrounds lacking a history of working together. In this environment, merely having a strong psychological attitude (passion) and cognitive team resources (expertise) may not directly influence the creativity of team outcomes unless team members engage in the active sharing of knowledge and gathering of necessary information from external sources.

Therefore, this study focuses on two well-known team-level knowledge management processes: 1) *external knowledge sourcing*; and 2) *internal knowledge sharing*, which are suggested to improve the creativity of team outcomes. *Internal knowledge sharing* in this study is defined as the provision or receipt of task information, know-how, and feedback regarding team activities among team members, and *external knowledge sourcing* is defined as the receipt of task information, know-how, and feedback regarding team activities from external knowledge sources (Wong 2004; Cummings 2004; Hansen 1999). We argue that these two team-level processes mediate the link between team-level

cognitive and psychological inputs (team expertise and shared passion about team activity) and the creativity of team outcomes. The relationship among team inputs, these team knowledge processes, team task characteristic, and outcome creativity will be elaborated and hypothesized in the following section.

Summary of theoretical perspectives

To summarize the theoretical perspectives of this study, in order to investigate creativity in knowledge team environment, we take *input-process-output (with contextual factors)* research framework (Gladstein 1984; Woodman et al. 1993) and propose a role of *team's psychological and cognitive inputs (passion and expertise), shared norm on ICT use, team knowledge processes, and team tasks characteristics* on knowledge team creativity.

The key theoretical contributions of our research model are as follows. First, this paper introduces the role of *shared team passion* in knowledge teams, which has been said to be an important input for non-mandated work environment, as well as the role of *expertise* of knowledge teams, which is found to be one of key inputs for team knowledge processes and team creativity.

Second, this paper also investigates the mediating role of *knowledge processes* on the relationship between team inputs and team creativity.

Third, our research model also considers two important contextual characteristics of knowledge teams; 1) the reliance on ICT for team collaboration and 2) self-managed task environment and proposes that *shared norms of ICT use* (which is related to the dependence of ICT of IT-enabled knowledge teams) and *task characteristics in terms of exploration* (which is related to self-managed team

environment) be moderating factors for the input-process-output model of team creativity for knowledge teams.

Research Model and Hypothesis

The impact of shared team passion on team knowledge processes

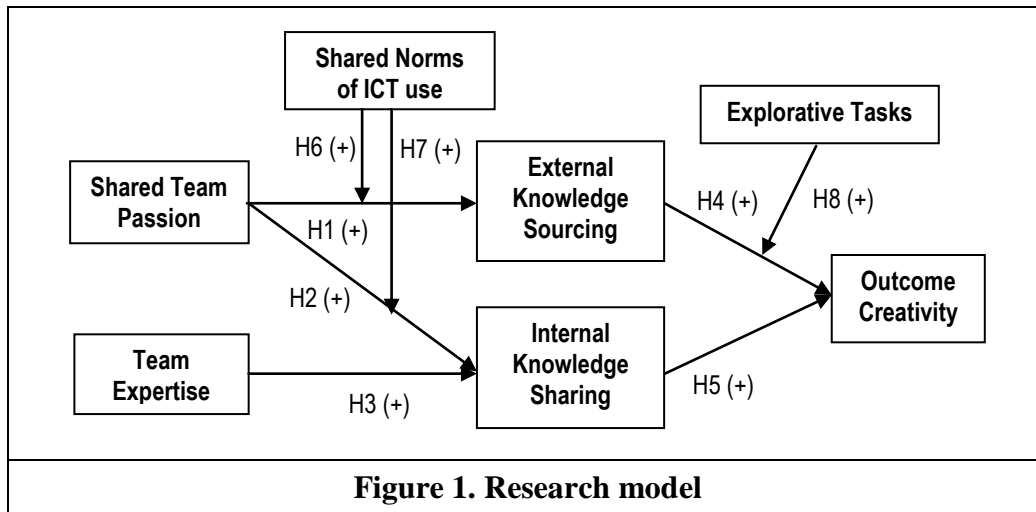


Figure 1 illustrates our research model. In the context of knowledge teams working at achieving creative outcomes, both cognitive (expertise) and psychological (passion) inputs are important, as passion is related to higher levels of performance (Hagel 2012), and the existence of expertise is said to be related to creativity (Csikszentmihalyi 1996; Herzburg 1987). However, simply having team expertise and shared passion about team activities may not be enough to generate creative team outcomes. In order for those team inputs to take effect on team creativity, team-level processes of *sourcing new knowledge from external sources* and *sharing knowledge of the members from different backgrounds* are required.

Therefore, we argue that these team inputs should influence team knowledge management processes first, and the increased team-level knowledge management processes, in turn, facilitate team creativity.

We argue that shared team passion about team activities can address some detrimental factors for members' active participation in team knowledge processes and will improve the team's knowledge management processes. Passion is an important factor for hard-working and deliberate practice for success in target outcomes (Vallerand, Salvy, Mageau, Elliot, Denis, Grouzet, and Blanchard 2007). More specifically, with passion about team activities, team members become committed to achieve more of their potential and drive to better performance (Hagel 2012).

In the context of our study, team members participate in team activities as non-routine activities and they do not meet every day. Members are mostly distributed, and active engagement in their team activities is not strictly mandated, as they are supposed to produce just one final team outcome at the end of the team period. Without prioritizing the activities of knowledge teams, some teams do not care about knowledge team activities while they are physically away from other members. Also, in the environment of knowledge teams where team outcomes are made up of a collective effort, the members of a team under a low level of passion will easily engage in social loafing because they know that their participation in virtual team processes may not be accountable in the end (Latané et al. 1979).

On the other hand, if members of a team have a shared passion for team activities, they will be more willing to actively participate in team activities, since

they are more psychologically attached to team activities (Baum and Locke 2004). Thus, shared team passion will reduce the overall tendency of social loafing in the knowledge team, and as a result it will lead to a higher level of participation in team activities. We argue that participation in team activities by members with shared passion should be done through two important team-level knowledge processes: external knowledge sourcing and internal knowledge sharing. .

First, in order to achieve the best possible performance with the given situation, such as diversified members, a distributed collaboration environment, and knowledge-creating tasks, passionate knowledge team members will try to search for knowledge from different backgrounds. Thus, the first step in achieving the best solutions for team goals from members with diverse backgrounds is to gather a variety of knowledge from the sources external to the boundary of a knowledge team. A knowledge team with a high level of virtuality is a good environment, where passion takes effect on team members' processes of external knowledge sourcing. While members are distributed from one another, they get to be surrounded by the knowledge sources external to a focal knowledge team. In this situation, when the members of the knowledge team are passionate about their knowledge team activities, they will be likely to seek useful knowledge for their knowledge team from external sources, for example, the members of their functional (ongoing) teams or their clients, from whom to ask advice. Also, even when the knowledge team members are together during f2f meetings, they have the opportunity to look for the best possible solutions for their team outcomes by searching for the best practices related to their team tasks (e.g., from a company

knowledge repository or by Internet searches), and even by inviting a person who is an expert on their subject, in order to achieve better outcomes for their knowledge team. With these perspectives, we hypothesize the following:

H1: Shared team passion about team activity is positively associated with external knowledge sourcing.

As stated, passion encourages teams to engage in activities for the best possible outcomes (Hagel 2012). Another important team process to achieve the best possible knowledge team outcomes is internal knowledge sharing. When knowledge teams bring together members who have not previously worked together, team members may experience some interaction anxiety (Camacho and Paulus 1995). Members may refrain from interacting with one another unless necessary. In knowledge teams of this study, for example, most of the time during the tenure of teams, the members are distributed, except when they periodically meet in f2f meetings. In this interaction environment, team members under a low level of shared passion will not spend extra time participating in sharing their own expertise, experience, and know-how about team tasks, since they might be afraid of possible criticism about others' opinions due to social interaction anxiety. Also, the team lacking passion about team activities (but about interpersonal relationship) may try to finish more quickly with minimum effort, so that the team will spend only a little bit of time to discuss about team tasks and to divide up team tasks into sub-tasks of individuals, but will refrain from actively sharing knowledge related to team tasks. Instead, their discussion could be focused on other peripheral issues (gossiping or topics unrelated to the key topics of their

team). For example, they might spend majority of time to build social relationship among one another.

On the other hand, shared team passion may help remove this psychological barrier for interaction among team members. Whether they meet in an f2f environment or virtually, the members of passionate teams are more excited to discuss issues related to their tasks, because passion about a certain object is related to love, attachment, excessive positive feelings, and enthusiasm toward a target, which may lead to hard work and the engagement of deliberate practices (Cardon et al. 2005; Jarvis, Mackenzie, and Podsakoff 2003; Smilor 1997). In this environment, team members are more comfortable speaking up and sharing their own opinions about team activities, which may result in more active participation in sharing one's knowledge within the knowledge team. In addition, in the teams with passion about team activities, team members' conversations will be more to the point of their target team activities, over the lifecycle of the knowledge team. As the team is passionate about team activities, they will waste no time to talk about something other than team activities. Thus, active conversation to the point of team task will also be reflected as active sharing of knowledge related to team activities.

Also, passion is all about connecting with and developing one's own capabilities and achieving more of one's potential (Hagel 2012). As previously mentioned, knowledge team members from different backgrounds should have different sets of expertise. Thus, a knowledge team with passion should work hard at connecting the set of diverse capabilities. In order to get the best out of the team

members' knowledge, members of a passionate knowledge team will engage in sharing one another's knowledge because in this way, they know that knowledge can be best leveraged and teams can achieve better outcomes. With these perspectives, we hypothesize the following:

H2: Shared team passion about team activity is positively associated with internal knowledge sharing.

The impact of the presence of expertise

If there is a good amount of knowledge related to the topic of team activities within a knowledge team, the members of the knowledge team will share it internally to see if the knowledge within the team (mostly the knowledge of the members of the team) can be applied to their team outcomes. Previous research has also found that the level of expertise should be related to sharing one's knowledge at the individual level (Constant, Sproull, and Kiesler 1996). That is, in order for each knowledge team member to share their knowledge within the team, it is important for them to have a certain level of expertise to do so (Wasko and Faraj 2005). At the team level as well, if the members of a knowledge team find that the knowledge embedded within the team is related to various aspects of team outcomes, they will spend more time to sharing it within the team. On the other hand, when team members in a knowledge team lack expertise related to the team tasks of the knowledge team, they will be less likely to contribute their knowledge to other team members, so that the overall degree of knowledge sharing within the team will be reduced. With these perspectives, we hypothesize the following:

H3: The existence of task-related expertise is positively associated with internal knowledge sharing.

The impact of team knowledge processes on team creativity

Research on team knowledge management and team learning has paid great attention to two team learning processes that happen either internally among team members or externally with external knowledge sources; *internal knowledge sharing* and *external knowledge sourcing* (or internal learning vs. external learning) (Bresman 2010; Cummings 2004; Wong 2004). A number of studies so far have found that these team knowledge processes enhance team creativity (e.g., Cummings 2004; Edmondson 1999; Hargadon 1999; Hargadon and Bechky 2006).

Research on external knowledge sourcing, external learning and boundary spanning have emphasized the importance of external knowledge sourcing (or external learning) on the various aspects of team outcomes (Bresman 2010; Cummings 2004; Edmondson 1999; Edmondson 2002; Hargadon 1999; Paulus 2000; Wong 2004). Since not all of the necessary knowledge and information are within focal knowledge teams due to the fact that knowledge teams are formed to create something new, it is important to learn from external knowledge sources in order to achieve the desired outcomes if such outcomes should be novel and creative.

One thing consistently suggested by knowledge management, team learning, and boundary spanning scholars is that knowledge sourcing from external sources (often used interchangeably with ‘external learning’ and ‘external

knowledge acquisition') should influence the creative performance of teams (Bresman 2010; Kessler, Bierly, and Gopalakrishnan 2000). Wong (2004) suggested that external learning (knowledge sourcing) activities (similar operationalization by Ancona and Caldwell's (1992) boundary spanning and Sutcliffe's (1994) organizational scanning measures) are related to team innovativeness, and Amabile et al. (1996) also argued that information sourcing from outside should improve creativity. In the context of knowledge teams, as well, members' efforts to bring external knowledge into the process of creating novel outcomes should influence team creativity because in the context of knowledge teams with a limited lifespan and diversified members' backgrounds, bringing in external information should stimulate members' creative thinking. Therefore, we argue the following:

H4: External knowledge sourcing positively influences the creativity of team outcomes.

A number of studies on team learning emphasize the role of knowledge sharing within teams on team performance. They suggest that sharing members' knowledge internally or learning from other members internally helps improve team efficiency (Edmonson, Dillon, and Roloff 2007; Wong 2004), creativity (Hargadon and Bechky 2006) overall performance (Bresman 2010; Edmondson 1999), and even members' satisfaction (Mesmer-Magnus and DeChurch 2009). In addition, studies on virtual teams or self-managed teams also suggest that sharing knowledge among members should influence team effectiveness (Gibson and Cohen 2003; Hinds and Bailey 2003). In the context of knowledge teams, as well,

sharing knowledge among members should lead to the efficient fulfillment of team outcomes with quality team outcomes, since it will help members quickly achieve shared norms of one another and team tasks (Mathieu, Heffner, Goodwin, Salas, and Cannon-Bowers 2000). As such, the internal knowledge sharing process is a key process that improves various aspects of knowledge team performance. In this paper, we propose that in the context of knowledge teams composed of diverse team members, internal knowledge sharing should also positively influence the creativity of team outcomes, for the following reasons.

Knowledge sharing within a team is an important team knowledge process that helps innovative ideas to disseminate within a team and is considered a critical factor for creativity (Ipe 2003). One benefit of knowledge sharing in knowledge teams composed of diverse members is that team members can have the opportunity to learn about categories of knowledge to which they might not have otherwise been exposed (Brown, Tumeo, Larey, and Paulus 1998). Those diversified categories of knowledge for team members help them learn various perspectives and ideas (quite different from their own) from different parts of an organization. These ideas and perspectives shared by team members may stimulate the team as a whole to think about additional ideas and may also remind each team member of some relevant domain of knowledge or experience that can be applied to the outcomes of the knowledge team (Paulus 2008). Argote and Kane (2003) also argued that sharing knowledge from indirect experience among the members from the diversified group is a critical factor for creativity. Also, when members share knowledge among one another and reflect upon others'

ideas and ongoing achievement, the members can reach a moment when individual members' creative ideas can be translated into several team-level creative solutions, which can be realized in creative team outcomes (Hargadon and Bechky 2006). With these perspectives, we hypothesize the following:

H5: Internal knowledge sharing positively influences the creativity of team outcomes.

The moderating impact of shared norms of ICT use

Most teams in contemporary business environments rely on ICT for various team activities, such as communicating among members, sharing and archiving digitalized documents, and structuring group tasks, whether or not the members are geographically distributed (Gibson and Gibbs 2006; Griffith Sawyer, and Neale 2003). As such, the use of ICT is becoming embedded in many aspects of team processes (Griffith et al. 2003). Knowledge teams also rely on ICT for team processes. For example, in the context of the focal knowledge teams of this study, as the members are not always co-located, but meet f2f periodically, they are supposed to use ICT for many aspects of team processes. However, as mentioned, shared norms of ICT use throughout the period of the team lifecycle should vary among different knowledge teams with a diverse membership (Majchrzak et al. 2005; Malhotra and Majchrzak 2004). We argue that the *shared norms about how to use ICT to support team activities* should moderate the impact of team members' psychological inputs (passion) on team knowledge processes for the following reasons.

First, in a context where members' active participation in team activities is

not mandated, the key drivers of team knowledge processes are team members' psychological engagement (passion) in team activities and cognitive resources (expertise). Thus, we previously hypothesized that *shared team passion about team activities* and *members' expertise related to team tasks* are the key driving forces for internal knowledge sharing and external knowledge sourcing. While these team-level psychological and cognitive inputs play key roles in the team's processes, shared norms of ICT use should positively moderate the impact of those inputs on team processes. Simply speaking, when members have a shared psychological attachment to their team activity, they may still engage in knowledge sharing and sourcing processes without a high level of shared norms about using ICT (e.g., through f2f interaction if ICT is not used much) to achieve the best possible outcomes from their knowledge team because they are passionate about team activity, and they have the expertise to share, anyways. On the other hand, if members do have a shared norms of how to use ICT for team collaboration, but lack a psychological attachment to team activities, we may not expect team members' active participation in team knowledge processes because members are not likely to spend extra time or effort to do better without a good level of passion.

Second, let us look at the relationship between *shared team passion and external knowledge sharing* activities. As discussed before, members in a passionate team are willing to spend their extra time and effort in sourcing knowledge from external sources in order to have better outcomes, even when they are not co-located to other team members. External knowledge sourcing

involves seeking new knowledge from external sources, such as the members from their functional teams, external experts, the Internet, and other materials (Zimmer, Henry, and Butler 2007). When team members talk about using ICT for their team tasks to achieve a shared norm about using ICT for collaboration, they not only discuss how to communicate among one another via which ICT, but they also discuss what information and knowledge is needed and how to find useful knowledge and information from external sources using ICT. For instance, in order to develop new sales plans, knowledge team members will discuss which websites to visit, what keywords to use in Internet search engines to find useful information, and which ICT to use to find that information (e.g., emails or discussion boards). As such, if team members have shared norms of the ways to find useful information from external sources, they will engage in external knowledge sourcing processes more often, as long as they have a strong psychological attachment to their team activities.

Also, a high level of shared norms of ICT during the tenure of a knowledge team implies that the team members have reached a certain level of habits in using ICT. Under the team members' habitual use of ICT, passionate team members will spend more effort in finding new solutions for their final outcomes via ICT, especially from the sources available online. Thus, the interaction of the shared norms of ICT use and shared team passion will have a significant impact on external knowledge sourcing. With these perspectives, we hypothesize the following:

H6: Shared norms of ICT use positively moderate the relationship between

shared team passion and external knowledge sourcing.

Second, under a highly virtual team environment, such as the focal knowledge teams of this study, research has found that shared norms of ICT use improve team efficiency (Caya 2008). Improved team efficiency in knowledge teams implies that team members can easily engage in team knowledge sharing processes using ICT, as long as they have a good psychological attachment to their tasks. That is, when team members have shared norms of how to communicate among one another via ICT, passionate team members will spend more time and effort in sharing knowledge and information among other members via ICT.

Also, if they have a common norms of which ICT should be used in team communication or in digitalized document management, the knowledge (or digitalized contents) contributed by each member of a passionate knowledge team should be better shared, and even applied to the final team outcomes. For instance, according to an open-ended interview with some knowledge team participants in a certain knowledge team, there is a shared norms of using a team-dedicated bulletin-board system instead of emails for team communication. In this way, the history of online activities can be better archived and retrieved. As another example, team members have built a shared norm of documenting “the discussions happening in f2f meetings that are converted into a digitalized format” and archiving the digitalized discussions into an online repository (e.g., a shared folder or team e-bulletin). In this case, knowledge teams with a high level of passion about team activities will actually do such documenting and archiving of

discussions all of the time; as a result, the ideas generated within f2f meetings will be better shared among the team members. Thus, under a high level of shared norms of ICT use, passion will be more strongly associated with internal knowledge sharing.

H7: Shared norms of ICT use positively moderate the relationship between shared team passion and internal knowledge sharing.

The moderating impact of explorative tasks

As knowledge teams are formed to create something novel, the tasks of knowledge teams are often complex and ill-defined. In the context of the knowledge teams of this study, at the initial meeting, the members decided “which team outcomes they would produce,” and “which set of tasks should be done” to achieve successful team outcomes. Thus, there should be variation in the topics of prospective team outcomes. We propose that the variety of topics among the different teams will result in different task characteristics in terms of *exploration for team tasks*.

This study focuses on a task characteristic 1) *that varies because of different topics for each knowledge team*; and 2) *that is related to the members’ knowledge management processes*. Thus, we build on the concept of exploration and exploitation (March 1991), but focus on the extent to which team tasks are explorative, as we investigate the research field where creating or proposing new solutions (exploration) is more desired and valued than improving current products and services (exploitation). Building on the extant studies involving “exploration,” we define task characteristics in terms of exploration. An

explorative task is defined as *a task* 1) for which people acquire rather new knowledge; 2) with which people improve their products in a new market or technological trajectory; and 3) that requires radical innovation (Gupta, Smith, and Shalley 2006; Jansen et al. 2006; March 1991).

In this study, we propose that the task characteristics in terms of exploration moderates the relationship between external knowledge sourcing and the creativity of team outcomes, while explorative tasks have no moderating impact on the relationship between internal knowledge sharing and creativity for the following reasons. As hypothesized, we argue that for creative team outcomes, both sharing knowledge internally among team members and sourcing knowledge from external sources are important team processes. However, explorative tasks in knowledge teams require finding new ideas and knowledge from outside the boundary of a focal knowledge team (Jansen et al. 2006). Thus, with explorative tasks, team-level activities of knowledge sourcing from external knowledge sources become more critical for the creativity of team outcomes, as the creativity of outcomes requires new perspectives and insight. Thus, the impact of external knowledge sourcing on outcome creativity becomes stronger if a knowledge team decides to create more explorative outcomes. With this perspective, we hypothesize the following:

H8: Explorative tasks positively moderate the relationship between external knowledge sourcing and the creativity of team outcomes.

In sum, shared team passion is positively associated with external knowledge sourcing and internal knowledge sharing processes, and team expertise

is positively associated with internal knowledge sharing processes. The impact of passion on team knowledge processes (external sourcing and internal sharing) is moderated by team members' shared norms of ICT use. These two team knowledge processes positively influence the creativity of knowledge team outcomes, and the impact of external knowledge sourcing on team creativity becomes stronger when team tasks are explorative.

Methodology

Description of the research site

Data on knowledge teams were collected at a large firm in South Korea operating in the educational service industry. The firm's customer base ranges from pre-school to high-school students, and this company mainly offers "home visiting tutoring services," with approximately 16,000 tutors. This company has facilitated a form of knowledge teams since mid 2008, to create various business ideas or codified knowledge contents (e.g., marketing ideas, new work process manuals, etc.). Members can either voluntarily join knowledge teams or be appointed by their team leaders (or division leaders). Joining a knowledge team means that an employee has to work on this project in addition to working on her/his own regular task. Teams usually have between 6 and 12 members.

To fulfill their tasks, team members meet regularly f2f (normally bi-weekly), as well as communicate virtually via information communication technologies (ICT) such as instant messenger programs (IM), short-message systems (SMS), and team e-bulletin systems. The topics of their final outcomes

are voluntarily decided by the team members, mostly during the first f2f meeting of each team. The main outcomes of these teams are codified knowledge contents submitted to the company headquarters for evaluation. The outcomes are rated and selectively awarded, but there is no monetary reward for participating in the teams.

Item development procedure

Initial development of items

Available measures were used and adapted to the context of this study. We developed, refined and adapted to fit the context of this study measures for individual learning outcome, shared team passion, expertise within a team, shared norms of ICT use, internal knowledge sharing, external knowledge sourcing, and the degree of exploration in team tasks. All of the measures were then presented to and reviewed by four academics (two professors and two Ph.D. students) who are experts in the topic of this study. Necessary changes were made, according to their comments. The items were initially generated in English, but the survey was conducted in Korean. Thus, the first author translated all of the items into Korean, and the items were back-translated into English by a person who did not know about this research. Necessary modification of the items, both in Korean and English, were made in order to ensure that no meanings had been lost in the translation.

Item refinement and verification with interviews and archival data

After the study was approved at the senior manager level, several calls and face-to-face meetings were conducted with a senior manager (a key informant)

who takes care of organization-wide knowledge management and knowledge teams. We were given access to all of the 163 teams that were held during the period between February and October 2011. An in-depth open-ended interview with four informants (current and previous knowledge team participants) was conducted. This in-depth interview helped us verify the key constructs and their items, such as passion, shared norms of ICT use, and two team knowledge processes. Further, several interviews with senior-level KM (Knowledge Management) managers and several archival data (e.g., PowerPoint slides on the overall outcomes from the previous rounds of knowledge teams) provided by one KM manager helped us confirm the relevance of creativity as the dependent variable of this study. With these procedures, the items were further adapted to the context of our focal knowledge teams.

A pre-test with pilot survey

A pre-test was then performed with pilot survey; the pilot survey questionnaire was distributed to 94 individual respondents, who are in the same target population as actual survey research and 77 individual respondents sent their responses back. The responses were analyzed to obtain reliability and validity measures (Moore and Benbasat 1991). Items that did not contribute to the reliability or validity of the scales were eliminated following this procedure. Finally, the field survey was carried out to test the measurement and structural model of this study.

Respondents

According to recommendations by a senior manager and key informants,

the actual survey was administered via a traditional paper-based survey. The authors sent the surveys to the division KM managers, who then sent to the team leaders a package of survey booklets customized for the number of members in their teams. The team leaders distributed the surveys to each team member at the end of one of their f2f meetings. The introduction of the survey provided a brief description of the study and its objectives, stated that participation in this study was voluntary, and provided a guarantee of confidentiality at both the individual and team levels. Once the surveys were completed, they were immediately stored into sealed envelopes, collected by the team leader and sent back to the first author.

We surveyed two groups of respondents. First, individual team members responded to the questions on independent, mediating, moderating, and control variables, which were aggregated into team-level measures. Second, once all of the teams had submitted their project outcomes, one senior manager (at the company headquarters' office) who supervises all participating knowledge teams rated the dependent variable –the creativity of each team outcome. Using a third party to evaluate the dependent variable substantially reduces the risk of common method bias. Previous studies suggest that subjective assessment of team performance provides a team-level measure of outcomes as good as or even better than an objective assessment of team performance (Bourgois 1980; Venkatraman and Ramanujan 1987). Further, subjective assessment of team creativity is the most often used measure of team creativity (Amabile, Barsade, Mueller, and Staw 2005).

A total of 402 individuals (number of individual participants) from 82 (number of teams) of the 163 targeted teams completed the survey (50% of teams). Among those completed surveys, 18 individual survey responses were dropped because of many unanswered questions (more than half survey questions were unanswered) or lack of variance in answers (e.g., marked all 7 in the responses). Three teams were dropped from the sample because less than 2 of the team members provided responses, and two teams were dropped from the sample after identifying two outliers using visual examination and the standardized residuals criteria ($|\text{residuals}| > 3.0$) (Chua, Weira, and Wolfinger 2002; Orr, Sackem, and Dubois 1999). Overall, 375 respondents spread across 77 teams provided usable survey data (team level sample size $n = 77$), for a response rate of 47.2 % at the team level. Within the final sample, 83.2% were female, and 85.0% were between 25 and 44 years old. On average, respondents had approximately 5 years (59 months) of experience in the functions they were performing in the field of the educational service industry. A total of 89.3% of individuals had a university degree or higher. A total of 66.4% of the respondents were tutors, while the rest performed other types of jobs, such as managing branches and book publishing. The number of members who completed the survey varied from 2 to 10 members per team, with an average of 4.87 members per team. Table 1 indicates the number of teams per each number of team members who provided usable responses.

Table 1. Frequencies of teams per each number of team members (2~10)										
Number of Members within a team	2	3	4	5	6	7	8	9	10	Total
Number of Teams	8	12	12	19	12	9	1	3	1	77

Measures

The measures included in the questionnaires were developed with seven-point Likert scales (with scale item responses running from 1 = “strongly disagree” to 7 = “strongly agree” or from 1 = “not at all” to 7 = “to a great extent”). Details of the items for each construct are in Appendix 1.

Creativity of team outcome: There are various aspects of team creativity (processes, products, team members, and situations) (Woodman et al. 1993) and also there are various ways to measure team creativity (Amabile 1983). For example, team creativity can be measured with the creativity of team processes (Tiwana and MacLean 2005) or of team outcomes (Akgun et al. 2005). In this study, we focus on the creativity embedded in the outcomes of knowledge teams. Although there are various ways of measuring team outcome creativity in extant studies, we modified the measure of new product creativity by Moorman (1995), as this measure is most appropriate for the context of the field of this study (knowledge teams) and is used in several studies on knowledge team creativity (e.g. Akgun et al. 2005). The creativity of knowledge team outcomes is operationalized as *the production of outcomes by a team that is reliably assessed as*: 1) challenging existing ideas; 2) encouraging (spawning) new ideas; 3) generating ideas for other products (or services); and 4) encouraging fresh thinking (Amabile 1983; Moorman 1995), since the context of this study requires

each team to produce new ideas for new products, services, work processes, and work policies. A senior manager at the corporate headquarters assessed four items of outcome creativity for all knowledge teams.

Shared team passion: We modified Baum and Locke's (2004) measure of passion. Five items were used, measuring aspects such as the extent to which each member agreed that their team loved their activities in the team, were looking forward to participating in their team activities, and derived life satisfaction from team activities.

Expertise within a knowledge team: Three items were used to measure the existence of the expertise related to team tasks. We asked each team member to evaluate the percentage of necessary expertise located inside her/his knowledge teams, in terms of three dimensions of expertise: 1) about what is required to achieve the goals of the team; 2) about how to achieve the goals of the team; and 3) about how to make the presentation of the team outcomes.

External knowledge sourcing and internal knowledge sharing: We adapted Wong's (2004) scales of learning behavior for two team knowledge processes. In order to capture the team members' participation in external knowledge sourcing, the items measure the extent to which each team member 1) "sought ideas/expertise related to their team activities; 2) reviewed their team activities; 3) obtained help or advice related to the team activities; and 4) sought feedback related to the team activities." For internal knowledge sharing, the items measured the extent to which each team member 1) "shared ideas/expertise related to the team activities; 2) reviewed the team activities; 3) shared advice related to the

team activities; and 4) shared feedback related to team activities.”

Shared norms of ICT use: We adapted Caya et al.(2011)’s “shared mental model of IT” measure and created six-item measures of shared norms of ICT use in the context of knowledge teams. Three items measure the dimension of shared norms of managing and sharing digital documents related to team activities, and the other three items measure the dimension of shared norms of communication among team members. Examples of each dimension are the following: 1) “People in our team have developed a shared understanding about the way to use ICT to communicate among one another”; and 2) “People in our team have developed a shared understanding about the way to use ICT to manage team documents.”

The degree of exploration in team tasks: We modified the measures of innovation in terms of exploration in Jansen et al. (2006) into the context of tasks. Examples of items are as follows: “Our team worked on activities that go beyond existing products, services, and policies”; and, “The activities of our team required the creation of new products, services, work processes, or work policies.” Three items were created to measure exploration.

Control variables: At the team level, we used three control variables that might be related to team creativity: 1) the average number of months served by team members (i.e., although most members had participated in the knowledge teams when the knowledge teams were started (February or March 2011), but some members joined several months after); 2) the average industry experiences (in months) of the team members; and 3) the average level of education (0: high school graduate; 1: 2-year college; 2: 4 year university; and 3: graduate school).

Result

Measurement model testing

Pre-test result with pilot samples

As we modified several measures from the extant studies, we conducted an exploratory factor analysis (EFA), using the 77 pilot samples (at the individual level) from the pre-test to identify any items that cross-loaded on other constructs in order to refine the items that were created in this study and modified from other studies (all independent, mediating, and moderating variables were included).

A principal component analysis was conducted with VARIMAX rotation. The results indicated that a six-factor solution was the most likely (eigenvalue >1), with 5 items for shared team passion, 3 items for team expertise, 4 items for external knowledge sourcing, 4 items for internal knowledge sharing, 6 items for shared norms of ICT use, and 3 items for exploration of team tasks. With 25 items, all items correlated most strongly with their intended constructs, and the Cronbach's alpha (Cronbach 1970) of all constructs exceeded the recommended threshold value of 0.7, which assesses adequate internal consistency of the items for each latent variable. Team creativity was not included in the pilot study, as team creativity was measured by one key informant after the pre-test.

Aggregation of data

The unit of analysis for this study is the team, but data was collected at the individual level. After the actual survey data was collected (375 individual respondents), individual team members' answers for each item within the same team are averaged to form team-level data (77 teams). We followed the steps

taken by Faraj and Yan (2009) to ensure agreement among each team member before we used aggregated individuals' responses for our analysis at the team level. These steps are described below.

First, all survey items were *worded to refer to the team (members)*, rather than individuals, in order to ensure that the level of measurement matches the level of theory (except for knowledge sharing and sourcing processes).

Second, to justify aggregation from individual responses to the team level, we computed an inter-rater agreement statistic using the R_{wg} procedure (LeBreton and Senter 2008) to assess the convergence of responses among the members of each team. The median R_{wg} values ranged from 0.904 to 0.950, above the generally accepted level of 0.7, thus indicating strong agreement among the team members for all the items.

Third, we calculated *intra-class correlations* (ICC_1 and ICC_2) to check the reliability of the measures, even after being aggregated at the team level (Bliese 1998). ICC_1 indicates the clustering (team) effect (team membership) against individual variance, while ICC_2 indicates whether teams can be reliability differentiated on the basis of average individual members' ratings (Faraj and Yan 2009). The ICC_1 for passion, expertise, external knowledge sourcing, internal knowledge sharing, shared norms of ICT use and task exploration were 0.444, 0.349, 0.207, 0.283, 0.232, and 0.282, respectively, while ICC_2 were 0.795, 0.723, 0.560, 0.658, 0.596, and 0.656, respectively, which ensures a moderate level of reliability of the measures, even after aggregation.

Finally, we performed *a one-way analysis of variance* on each variable to

assess whether between-team variance was larger than within-team variance. All of our variables were significant at the $\alpha = 0.01$ level. As the result of these analyses showed the agreement within teams, the data was aggregated by taking the average of all members' answers for each team of the 77 number of teams.

Table 2. Means, standard deviations, reliabilities, and correlations among variables (The bolded and underlined numbers are the square roots of Average Variance Extracted - AVE)												
Variables	# items	Mean (STD)	Cronbach-alpha team (indi)	STD loadings	Composite Rel.	Correlations and <u>Square Roots of AVE</u>						
						1	2	3	4	5	6	7
1. Creativity	4	4.786 (1.315)	.931 (.935)	.920 .931 .892 .898	.951	<u>.910</u>						
2. Passion	5	4.907 (.978)	.979 (.946)	.951 .949 .966 .967 .967	.983	.187	<u>.960</u>					
3. Expertise	3	0.598 (.131)	.856 (.832)	.892 .811 .936	.912	.013	.221	<u>.881</u>				
4. Ext K-Sourcing	4	4.580 (.731)	.911 (.888)	.899 .895 .889 .868	.937	.270	.318	.021	<u>.888</u>			
5. Int K-Sharing	4	5.700 (.698)	.961 (.951)	.935 .952 .959 .938	.972	.374	.617	.270	.306	<u>.946</u>		
6. SNIT	6	5.224 (.784)	.973 (.950)	.854 .961 .960 .951 .967 .934	.978	.201	.596	.344	.310	.522	<u>.939</u>	
7. Task Expl.	3	4.987 (.796)	.944 (.882)	.951 .948 .942	.963	.194	.537	.074	.459	.569	.610	<u>.947</u>

Reliability and validity

To ensure the internal consistency of measurement, we calculated *Cronbach's alpha* for all of the variables at the team and individual levels

(Cronbach 1970). Cronbach's alpha for all variables at the team and individual levels are above 0.7, which ensures internal consistency of measurement.

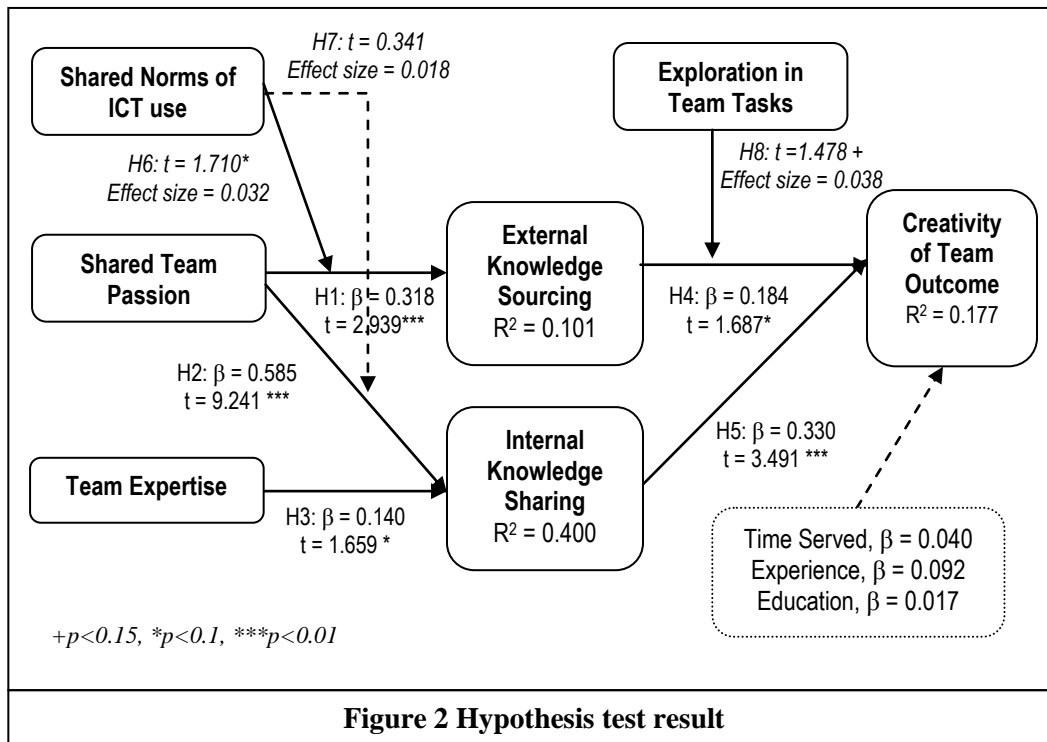
Then, to evaluate convergent validity, we first examined the standardized loadings from the PLS analysis. The standardized loadings should be above 0.707, as more than half of the variance is captured by the constructs. As shown in Table 2, all standardized item loadings are above 0.707, meaning that the reflective items are unidimensional in their representation of their associated constructs (latent variables). We then checked the composite reliability and average variance extracted (AVE). The acceptable levels for composite reliability and average variance extracted are 0.7 or higher (Chin 1998; Yi and Davis 2003) and 0.5 or higher (Fornell and Larcker 1981), respectively. Table 2 shows that these thresholds were exceeded for all constructs, which ensures that these constructs all had adequate convergent validity.

Discriminant validity can be first assessed by determining if the indicators load more strongly on their own constructs than on other constructs. We checked the cross loadings from a factor analysis that all indicators have higher loadings on their own construct than other constructs. Also, the square root of the AVE of each construct has to be larger than its correlation with other factors (latent variables) (Gefen, Straub, and Boudreau 2000). All constructs meet this requirement.

Hypothesis testing

We used Partial Least Squares (PLS) analysis with SmartPLS (Ringle, Wende, and Will, 2005) to test the paths hypothesized in the research model. PLS

analysis is appropriate for this study because we have a multi-paths research model, and the data for this study contain non-normal data. PLS analysis also allows us to test for moderation effects (Chin, Marcolin, and Newsted 2003). The structural model was assessed on the basis of the explained variance of dependent variables (R^2), path coefficients (β), and their level of significance. To obtain the level of significance, a bootstrapping re-sampling method (200 re-samples generated) was used, as recommended in Chin (1998). Figure 2 illustrates the structural path-coefficient estimates with t-statistics, the moderating effect sizes with t-statistics, and R^2 .



As shown, hypotheses 1, 2, and 5 were supported at the 0.01 level, and hypotheses 3 and 4 were supported at the 0.1 level. Shared team passion was

positively associated with external knowledge sourcing (H1, $\alpha = 0.01$ level, $\beta = 0.318$) and was positively associated with internal knowledge sharing (H2, $\alpha = 0.01$ level, $\beta = 0.585$). Team expertise is positively associated with internal knowledge sharing (H3, $\alpha = 0.1$ level, $\beta = 0.140$). Both external knowledge sourcing (H4, $\alpha = 0.10$ level, $\beta = 0.184$) and internal knowledge sharing (H5, $\alpha = 0.01$ level, $\beta = 0.330$) processes positively influence the creativity of team outcomes. None of three control variables (average number of months having participated in knowledge teams by members, industry experience and level of education) was a significant factor for the creativity in team outcomes.

In order to test Hypotheses 6, 7, and 8 (moderation effect), we followed the steps taken in Chin et al. (2003). Hypothesis 6 was supported at the $\alpha = 0.1$ level with an effect size of 3.2 %, which is a small, but not negligible moderation effect (Henseler and Fassott 2010). The effect size of this moderation impact is calculated with the R^2 's of the two models (Figure 3): 1) one with both a moderating variable (as an independent variable) and an interaction term (moderator x main effect variable) on the predicted variable; and 2) the other with a moderating variable as an independent variable on the predicted variable in the PLS model (Chin et al. 2003; Cohen 1988).

$$\text{Effect size (f}^2\text{)} = \frac{R^2_{\text{model with interaction}} - R^2_{\text{model without interaction}}}{1 - R^2_{\text{model with interaction}}} \text{ (Figure 3)}$$

We can interpret this result as the following: under a high level of shared team norms of ICT use, the impact of shared team passion on the external knowledge sourcing process will be stronger.

However, hypothesis 7 is not supported, with a very weak (almost negligible) effect size of 1.8%. We can interpret this result as follows: a high level of shared norms of ICT use does not increase the impact of passion on internal knowledge sharing. In other words, shared team passion influences internal knowledge sharing, regardless of having a high level of shared norms of ICT use. Or, the impact of passion on internal knowledge sharing happens without much help of ICT.

Finally, hypothesis 8 is supported at the $\alpha = 0.15$ level with an effect size of 3.8 %, which is also a small, but not negligible moderation effect. We can interpret this result as the following: when a knowledge team engages in explorative tasks, the impact of external knowledge sourcing on team creativity becomes stronger, as hypothesized. Overall, approximately 18% of the variance in the creativity of team outcomes measured by a senior manager was explained by our research model.

Post-hoc test

A post-hoc test was conducted to see if there are direct relationships between two input variables (shared team passion and team expertise) and team creativity. A PLS path model with shared team passion and team expertise as independent variables and team creativity as a dependent variable was constructed. Results from the PLS analysis and a bootstrapping re-sampling (200 samples generated) method indicate that neither shared team passion nor team expertise is a significant predictor of creativity of team outcomes ($\beta_{\text{passion}} = 0.162$ with $t_{\text{passion}} = 1.232$ and $\beta_{\text{expertise}} = 0.168$ with $t_{\text{expertise}} = 0.774$), and only 6.8% of the variance of

creativity was explained by these two inputs, which suggests that simply having team passion and expertise may not be enough. Nonetheless, the process of sharing knowledge internally and sourcing knowledge from external sources will be important processes that link team inputs and creative team outcomes.

Discussion

Contribution

The primary goal of this study is to explore the role that shared team passion can have in developing creative outcomes in knowledge team. To achieve this goal, this study worked on the development of the construct of passion at the team level and tested a model to assess its impact on team creativity in a context of where teams include members with a diversity of expertise and relying on Information Communication Technologies (ICT) for collaboration. More specifically, we propose and test that in knowledge team environments, shared team passion be an important psychological driving force for team knowledge processes, which in turn, facilitate creative team outcomes.

Another goal is to show how team expertise can take effect on team creativity in the context of knowledge teams. Third, this research also aims at examining the role of shared norms with respect to using ICT on the input-process-outcome model of creativity. Finally, this study also proposes “the concept of exploration” as a task characteristic for knowledge team contexts and shows how the degree of exploration in team tasks enhances the impact of external knowledge sourcing on team creativity. The empirical test results of this

study contribute to the literature in several ways.

First, we brought the concept of “passion” into the field of knowledge management and examined it at the team level. Passion has been frequently studied in the field of entrepreneurship, but most studies on passion have been conducted at the individual level (Cardon et al. 2009). However, in practice, passion has often been mentioned at the collective level in different ways, especially in the context where the collectives’ participation in the target activity is not strictly mandated (Faraj et al. 2011). By introducing and testing the role of team-level passion on team members’ knowledge sourcing and sharing processes in the context of knowledge teams, this study contributes not only to the field of knowledge management broadly, but also to the input-process-output model of team performance (Gladstein 1984). Empirical test results imply that overall passion shared by team members encourages members to actively bring new perspectives from external sources and share them within knowledge teams. These significant relationships between shared team passion and two important team knowledge processes (external knowledge sourcing and internal knowledge sharing) suggest that shared team passion should be another important team-level input for team knowledge management processes, on top of previously found team-level inputs for knowledge sharing and sourcing (e.g., trust and learning orientation) (Bakker, Leenders, Gabbay, Kratzer, and Engelen 2006; Politis 2003; Gray and Meister 2004). In addition, significant relationships between team knowledge processes and team creativity and the post-hoc test result (no direct relationship between passion and team creativity) also suggest that simply having

passion does not significantly facilitate creative team outcomes, but shared team passion can have an effect on team creativity through team knowledge management processes.

Second, this study highlights the mediating role of the internal knowledge sharing process for the relationship between expertise and creativity at the team level. Research has shown that at the individual level, expertise is one of the most important antecedents of creativity (Csikszentmihalyi 1996), but that at the collective level, members should share their expertise within teams in order to produce creative outcomes (Hargadon and Bechky 2006). The post-hoc test results – 1) no direct relationship between expertise and creativity, but 2) significant relationships between expertise and knowledge sharing; and between knowledge sharing and team creativity – highlight the importance of exchanging expertise among team members in the context of knowledge teams formed by diverse members. This study re-confirms the importance of integrating expertise for team creativity in the context of knowledge teams by internal knowledge sharing (Tiwana and MacLean 2005).

Third, this study suggests the importance of the role involving shared norms about ICT use in the context of knowledge teams. In contemporary work environments, ICT refers to the given resources for most types of teams, whether or not team members are distributed. In the environment of knowledge-creating tasks, a limited time period for creating team outcomes, diversified members, and a highly virtual communication environment such as focal knowledge teams, passionate teams will engage in team knowledge sharing and sourcing processes

more intensively when the members have a shared norms about how to use ICT for communication and managing digitalized documents.

Fourth, this study suggests the degree of exploration in tasks as an important task-characteristic to be considered in the context of knowledge teams. Although numerous studies on team tasks have investigated various task characteristics—complexity (Campbell 1988), inter-dependence (Campion et al. 1996), analyzability (Rice 1992), and equivocality (Dennis and Kinney 1998), to name a few—this study proposes task characteristics in terms of *the extent to which the team task requires exploration*. As previously mentioned, this characteristic of task fits the situation where the team goal is not set *a priori*, and the creativity of team outcomes is required. We developed the items of this construct and tested the reliability of it. Also, we used this construct as an important task environment, which moderates the way external knowledge sourcing influences team creativity. It can be further used in other types of teams where the degree of exploration in tasks varies among different teams.

Finally, we had the outcome of creativity measured by a senior manager, who is not one of the team members from any of the knowledge teams. This approach improves the robustness of our findings and contributes to studies on team creativity.

The results of this study may help practitioners who are engaged in knowledge team activities, as their non-routine tasks identify the conditions under which they can achieve more creative team outcomes.

First, to achieve more creative outcomes from knowledge team activities,

an overall passion within teams should be a proper initial step in improving knowledge team members' participation in team activities, in general. Thus, it might be a good idea for a company headquarters manager to advertise that *“passion about your team activity can make a difference in your team outcomes,”* when they facilitate the knowledge team activities of their employees.

Second, the finding on the role of knowledge sourcing and sharing processes suggests that although the members of a knowledge team are passionate about their team activities, and they have expertise on the topic of the team tasks, without the processes of external knowledge sourcing and internal knowledge sharing, it might not be possible to produce the best possible team-level outcomes. Thus, facilitators of knowledge teams should also encourage teams share knowledge and find useful information from external sources, so that team-level psychological and cognitive input can significantly improve team creativity, through these team knowledge processes.

Third, the finding on the moderating role of the shared norms of ICT use suggests that it is important for teams to build up shared norms of how to use ICT in order to improve the team process of knowledge sharing with passionate team members. The facilitators of knowledge teams should encourage each knowledge team to build norms of using ICT for their team tasks, which will improve overall team processes, as long as the team members are passionate about their team activities. Eventually a higher level of shared norms of ICT use will help the knowledge teams produce more creative outcomes, through knowledge processes.

Limitations and future research

There are several limitations of this study. First of all, this study took place in one company with a homogenous group of respondents with a high proportion of women who are engaged in very similar types of tasks. Thus, the results may not be generalizable beyond the context of the field of this study. Future research should be done with more heterogeneous groups (e.g., from different organizations) to test the impacts of passion, expertise, shared norms of ICT use, and knowledge processes on the creativity of team outcomes.

Second, there could be a bias in measuring the creativity of team outcomes due to the use of a single rater. However, this concern is mitigated by relying on the most knowledgeable stakeholder, i.e., the team manager, and therefore also addressing potential concerns of common bias. Future research could improve on this approach by relying on measures from different stakeholders.

Third, we can argue the causality between mediating variables and dependent variables because the dependent variable (creativity) is measured by a senior manager after all teams finished and submitted their team outcomes. However, we cannot argue the causality between shared team passion and team knowledge processes because the research design is cross-sectional, so that those variables are measured at the same time. We can only argue that there is a significant relationship (or association) between shared team passion and team knowledge process variables (external knowledge sharing and internal knowledge sourcing). Also, there is possible common-method bias among independent (shared team passion), moderating (shared norms of ICT and exploration of team

task), and mediating variables (external knowledge sourcing and internal knowledge sharing). However, testing for discriminant validity from the cross loadings in the confirmatory factor analysis mitigates this concern because it shows that the variables are distinct from one another.

Conclusion

Achieving creative solutions by participating in non-mandated knowledge teams is not easy. To achieve the best possible outcomes (most creative outcomes with the given resources), there should be good psychological team-level input, as well as properly coordinated team processes. This study shows that in such a non-mandated setting with diverse membership, for novel knowledge creation with a high level of virtuality, shared passion at the collective level and team expertise help improve team knowledge processes, which in turn, facilitate the creativity of team outcomes. On top of a team's psychological input and knowledge processes, this study suggests that it is also important to have shared norms of using information communication technologies, which are the key resources that most teams in contemporary organizational environments have.

Appendix 1: Survey Items

1. The creativity of team outcome (measured by a senior manager)

The outcome of this knowledge team is...		
Did not challenge existing ideas	1 ~ 7	Challenged existing ideas
Did not offer new ideas	1 ~ 7	Offered new ideas
Did not spawn ideas for other products, services, work processes, or work policies	1 ~ 7	Generated ideas for other products, services, work processes, or work policies
Did not encourage fresh thinking	1 ~ 7	Encouraged fresh thinking

2. Shared team passion

Please indicate the extent to which you agree or disagree with each statement below, on a scale of 1 (strongly disagree) to 7 (strongly agree). During the period of this team...
Our team members loved our activities in this team.
Our team members were looking forward to participating in team activities when they were away from each other (in our functional teams).
Our team members derived their life satisfaction from participating in the activities of this team.
Our team members accomplished a lot in this team because they loved the activities of the team.
There were the times where our team members wished that they could be at this team when they were not.

3. Existence of expertise within team

Please evaluate, for each of the following three dimensions of expertise, the percentage of necessary expertise that is located inside your team. (i.e., if you evaluate 60% for question 37), then 60% of expertise about what are required to achieve the goal of the team is located in your team, while 40% of the expertise is located outside your team.)	Percentage (0 ~ 100%)
Expertise about <i>what are required to achieve</i> the goal of the team	%
Expertise about <i>how to achieve</i> the goal of the team	%
Expertise about <i>how to make the</i> presentation of team outcomes	%

4. External knowledge sourcing

Please indicate the extent to which you did each of the knowledge sourcing activities listed below (with knowledge sources external to your team), on a scale of 1 (not at all) to 7 (to a great extent).
seeking ideas/expertise related to our team activities

reviewing our team activities
obtaining help or advice related to our team activities
seeking feedback related to our team activities

5. Internal knowledge sharing

Please indicate the extent to which you did each of knowledge <u>sharing</u> activities listed below (with knowledge sources <u>within</u> your team), on a scale of 1(not at all) to 7 (to a great extent).
sharing ideas/expertise related to the team activities
reviewing the team activities
sharing help or advice related to the team activities
sharing feedback related to team activities

6. Shared norms of ICT use

Please indicate the extent to which you agree or disagree with each statement below, on a scale of 1 (strongly disagree) to 7 (strongly agree). Our team members...
...relied on shared norms of information communication technology usage for <i>communication</i> .
...developed a shared understanding about the way to use information communication technologies <i>to communicate among one another</i> .
...knew how to adapt their usage of information communication technologies based on <i>whom they are interacting with</i> .
...relied on shared norms of information communication technologies usage for <i>managing team documents</i> .
...developed a shared understanding about the way to use information communication technologies <i>to manage team documents</i> .
...knew how to adapt their usage of information communication technologies based on <i>which types of documents they are dealing with</i> .

7. Degree of exploration in team tasks

Please indicate the extent to which you agree or disagree with each statement below, on a scale of 1(strongly disagree) to 7 (strongly agree).
Our team worked on the ideas about products, services, work processes, or work policies that go beyond existing products or services.
The activities of our team required creation of new products, services, work processes, or work policies.
Our team experimented with new products, services, work processes, or work policies.

References

- Akgun, A. E., Byrne, J., Keskin, H., Lynn, G. S., and Imamoglu, S. Z. "Knowledge networks in new product development projects: A transactive memory perspective," *Information & Management* (42:8), Dec 2005, pp 1105-1120.
- Amabile, T. M. "Effects of external evaluation on artistic creativity," *Journal of Personality and Social Psychology* (37) 1979, pp 221-233.
- Amabile, T. M. "The social psychology of creativity; A componential conceptualization," *Journal of Personality and Social Psychology* (45) 1983, pp 357-376.
- Amabile, T. M. "Motivation and creativity: Effects of motivational orientation on creative writers," *Journal of Personality and Social Psychology* (48:2) 1985, pp 393-399.
- Amabile, T. M. "Stimulate Creativity by Fueling Passion," in: *Handbook of Principles of Organizational Behavior*, E.A. Locke (ed.), Wiley, 2000.
- Amabile, T. M., Barsade, S. G., Mueller, J. S., and Staw, B. M. "Affect and creativity at work," *Administrative Science Quarterly* (50:3) 2005, pp 367-403.
- Amabile, T. M., Conti, R., Coon, H., Lazenby, J., and Herron, M. "Assessing the work environment for creativity," *Academy of Management Journal* (39:5) 1996, pp 1154-1184.
- Andrews, F. M., and Farris, G. F. "Time pressure and performance of scientists and engineers: A five-year panel study," *Organizational Behavior and Human Performance* (8) 1972, pp 185-200.
- Ancona, D. G., and Caldwell, D. F. "Bridging the boundary: External activity and performance in organizational teams," *Administrative Science Quarterly* (37) 1992, pp 634-665.
- Argote, L., and Kane, A. A. "Learning from Direct and Indirect Experience in Organizations: The Effects of Experience Content, Timing, and Distribution," in: *Group creativity: Innovation through collaboration*, P.B. Paulus and B.A. Nijstad (eds.), Oxford University Press, New York, 2003.
- Ashforth, B. E., and Mael, F. "Social Identity Theory and the organization," *Academy of Management Review* (14:1) 1989, pp 20-39.
- Baas, M., De Dreu, C. K. W., and Nijstad, B. A. "A meta-analysis of 25 years of mood-creativity research: Hedonic tone, activation, or regulatory focus?," *Psychological Bulletin* (134:6) 2008, pp 779-806.
- Bailyn, L. "Autonomy in the industrial R&D laboratory," *Human Resource Management* (24) 1985, pp 129-146.
- Bakker, M., Leenders, R. T. A. J., Gabbay, S. M., Kratzer, J., and Engelen, J. M. L. V. "Is trust really social capital? Knowledge sharing in product development projects," *Learning Organizations* (13:6) 2006, pp 594 - 605.
- Barron, F. "The disposition toward originality," *Journal of Abnormal and Social Psychology* (51) 1955, pp 478-485.

- Barron, F. B., and Harrington, D. M. "Creativity, intelligence, and personality," *Annual Review of Psychology* (32) 1981, pp 439-476.
- Baum, J. R., and Locke, E. A. "The Relationship of entrepreneurial traits, skill, and motivation to subsequent venture growth," *Journal of Applied Psychology* (89:4) 2004, pp 587-598.
- Bierly, P. E., Kessler, E. H., and Christensen, E. W. "Organizational learning, knowledge, and wisdom," *Journal of Organizational Change Management* (13) 2000, pp 595-618.
- Billow, R. M. "Passion in groups: Thinking about loving, hating, and knowing," *International Journal of Group Psychotherapy* (52:3) 2002.
- Bliese, P. D., and Halverson, R. R. "Group Size and Measures of Group-Level Properties: An Examination of Eta-Squared and ICC Values," *Journal of Management* (24:2) 1998, pp 157-172.
- Bourgois, L. J. "Performance and consensus," *Strategic Management Journal* (1) 1980, pp 227--248.
- Bresman, H. "External learning activities and team performance: A multimethod field study," *Organization Science* (21:1) 2010, pp 81-96.
- Brown, V., Tumeo, M., Larey, T. S., & Paulus, P. B. "Modeling cognitive interactions during group brainstorming," *Small Group Research*, (29) 1998, 495-526.
- Camacho, L. M., and Paulus, P. B. "The role of social anxiousness in group brainstorming," *Journal of Personality and Social Psychology* (68) 1995, pp 1071-1080.
- Campbell, D. J. "Task complexity: A review and analysis," *Academy of Management Review* (13) 1988, pp 40-52.
- Campion, M. A., Medsker, G. J., and Higgs, A. C. "Relations between work group characteristics and effectiveness: Implications for designing effective work groups," *Personnel Psychology* (46) 1996, pp 823-850.
- Cannon-Bowers, J. A., Salas, E., and Converse, S. "Shared mental models in expert team decision making," in: *Environmental effects on cognitive abilities*, R.J. Sternberg and E. Grigorenko (eds.), Lawrence Erlbaum Associates, Hillsdale, NJ, 2001.
- Cardon, M. S., Wincent, J., Singh, J., and Drnovsek, M. "The nature and experience of entrepreneurial passion," *Academy of Management Review* (34:3) 2009, pp 511-532.
- Cardon, M. S., Zietsma, C., Saporito, P., Matherne, B., and Davis, C. "A tale of passion: New insights into entrepreneurship from a parenthood metaphor," *Journal of Business Venturing* (20) 2005, pp 23-45.
- Caya, O. "Information technologies, knowledge integration, and performance in virtual teams," in: *Information Systems*, McGill University, Montreal, Quebec, 2008.
- Caya, O., Pinsonneault, A., and Bassellier, G. "Virtual Team Common Knowledge: Construct Specification and Effect on Knowledge Integration Effectiveness," *International Conference on Information Systems, Association of Information Systems*, Paris, France, 2008.

- Chen, X., Yao, X., and Kotha, S. "Entrepreneur passion and preparedness in business plan presentations: A Persuasion analysis of venture capitalists' funding decisions," *Academy of Management Journal* (199-214:52) 2009, p 1.
- Cheng, J. "Interdependence and coordination in organizations: A role-system analysis," *Academy of Management Journal* (26) 1983, pp 156-162.
- Chin, W. W. "The Partial Least Squares approach to structural equation modeling," in: *Modern methods for business research*, G.A. Marcoulides (ed.), Lawrence Erlbaum Associates, Mahwah, NJ, 1998.
- Chin, W. W., Marcolin, B. L., and Newsted, P. R. "A Partial Least Squares Latent Variable Modeling Approach for Measuring Interaction Effects: Results from a Monte Carlo Simulation Study and an Electronic-mail Emotion/Adoption Study," *Information Systems Research* (14:2), 2003, pp. 189-217.
- Chua, T.M., Weira, B., and Wolfinger, R. "A systematic statistical linear modeling approach to oligonucleotide array experiments," *Mathematical Biosciences* (176:1) 2002, pp 35-51.
- Cohen, J. *Statistical power analysis for the behavioral sciences* Lawrence Erlbaum, Hillsdale, NJ, 1988.
- Constant, D., Sproull, L., and Kiesler, S. "The Kindness of Strangers: The Usefulness of Electronic Weak Ties for Technical Advice," *Organization Science* (7:2) 1996, pp 119-135.
- Cronbach, L. *Essentials of psychological testing*, Harper and Row, New York, 1970.
- Cummings, J. N. "Work groups, structural diversity, and knowledge sharing in a global organization," *Management Science* (50:3) 2004, pp 352-364.
- Csikszentmihalyi, M. "Creativity: Flow and the psychology of discovery and invention," *Harper*, New York, 1996.
- Dennis, A. R., and Kinney, S. T. "Testing media richness theory in the new media: The effects of cues, feedback, and task equivocality," *Information Systems Research* (9:3) 1998, p 256.
- Diehl, M., and Stroebe, W. "Productivity loss in brainstorming groups: Toward the solution of a riddle," *Journal of Personality and Social Psychology* (53) 1987, pp 497-509.
- Edmondson, A. C. "Psychological safety and learning behavior in work teams," *Administrative Science Quarterly* (44) 1999, pp 350-383.
- Edmondson, A. C. "The local and variegated nature of learning in organizations: A group-level perspective," *Organization Science* (13) 2002, pp 128-146.
- Edmonson, A. C., Dillon, J. R., and Roloff, K. S. "Three perspectives on team learning outcome improvement, task mastery, and group process," *The Academy of Management Annals* (1:1) 2007, pp 269-314.
- Espinosa, A., Kraut, R. E., Lerch, J., Slaughter, S., and Herbsleb, J. "Shared mental models and coordination in large-scale, distributed software development," International Conference on Information Systems, 2001.
- Faraj, S., and Sproull, L. "Coordinating expertise in software development teams," *Management Science* (46:12) 2000, pp 1554 -1568.

- Faraj, S. and Sambamurthy, V. "Leadership of Information Systems Development Projects," *IEEE Transactions on Engineering Management* (53:2) 2006.
- Faraj, S., and Yan, A. "Boundary work in knowledge teams," *Journal of Applied Psychology* (94:3) 2009, pp 604-617.
- Faraj, S., Jarvenpaa, S. L., and Majchrzak, A. "Knowledge Collaboration in Online Communities," *Organization Science* (22:5) 2011, p 10.
- Fornell, C., and Larcker, D. F. "Evaluating structural equation models with unobservable variables and measurement error," *Journal of Marketing Research* (18:1) 1981, pp 39-50.
- Gefen, D., Straub, D. W., and Boudreau, M. C. "Structural equation modeling and regression: Guidelines for research practice," *Communications of the Association for Information Systems* (4:7) 2000.
- Gibson, C. B., and Gibbs, J. L. "Unpacking the concept of virtuality: The effects of geographic dispersion, electronic dependence, dynamic structure, and national diversity on team innovation," *Administrative Science Quarterly* (51:3) 2006, pp 451-495.
- Gibson, C. B., and Cohen, S. G. *Virtual teams that work: Creating conditions for virtual team effectiveness* Jossey-Bass, San Francisco, 2003.
- Gladstein, D. L. "Groups in context: A model of task group effectiveness," *Administrative Science Quarterly* (29:4) 1984, pp 499-517.
- Gray, P. H., and Meister, D. B. "Knowledge sourcing effectiveness," *Management Science* (50:6) 2004, p 821-834.
- Griffith, T. L., Sawyer, J. E., and Neale, M. A. "Virtualness and knowledge in teams: Managing the love triangle of organizations, individuals, and information technology," *Mis Quarterly* (27:2) 2003, pp 265-287.
- Gupta, A. K., Smith, K. G., and Shalley, C. E. "The interplay between exploration and exploitation," *Academy of Management Journal* (49:4) 2006, pp 693-706.
- Hansen, M. T. "The search-transfer problem: The role of weak ties in sharing knowledge across organizational subunits," *Administrative Science Quarterly* (44) 1999, pp 82-111.
- Hargadon, A. B. "Group cognition and creativity in organizations," *Research on Managing Groups and Teams* (2) 1999, pp 137-155c
- Hargadon, A. B., and Bechky, B. A. "When collections of creatives become Creative collectives: A field study of problem solving at work," *Organization Science* (17:4) 2006, pp 484-500.
- Hagel, J. "Exploring passion – what kind of passion do you have?," in: *Edge Perspectives with John Hagel*, Permalink, 2012.
- Hender, J. M., Dean, D. L., Rodgers, T. L., and Nunamaker, J. F. "An examination of the impact of stimuli type and GSS structure on creativity: Brainstorming versus non-brainstorming techniques in a GSS environment," *Journal of Management Information Systems* (18:4), Spr 2002, pp 59-85.
- Henseler, J., and Fassott, G. "Testing Moderating Effects in PLS Path Models: An Illustration of Available Procedures," in: *Handbook of Partial Least Squares*, Springer, Verlag Berlin Heidelberg, 2010, pp. 713-735.

- Herzberg, F. (1987). "Innovation: Where is the relish?" *Journal of Creative Behavior*, 21, 179–192.
- Hinds, P. J., and Bailey, D. E. "Out of sight, out of sync: Understanding conflict in distributed teams," *Organization Science* (14:6) 2003, pp 615-632.
- Hirschhorn, L. "Passion and group life," *Center for Applied Research* (Philadelphia, PA) 2003.
- Ipe, M. "Knowledge Sharing in Organizations: A Conceptual Framework," *Human Resource Development Review* (2:4) 2003, pp 337-359.
- Jansen, J. J. P., Van Den Bosch, F. A. J., and Volberda, H. W. "Exploratory Innovation, Exploitative Innovation, and Performance: Effects of Organizational Antecedents and Environmental Moderators " *Management Science* (52:11) 2006, pp 1661-1674.
- Janz, B. D., Colquitt, J. A., and Noe, R. A. "Knowledge Worker Team Effectiveness: The Role of Autonomy, Interdependence, Team Development, and Contextual Support Variables," *Personnel Psychology* (50:4) 1997, pp 877 - 904.
- Jarvenpaa, S. L., Shaw, T. R., & Staples, D. S. "Toward contextualized theories of trust: The role of trust in global virtual teams," *Information Systems Research*, (15) 2004, pp250-267.
- Jarvis, C. B., Mackenzie, S. B., and Podsakoff, P. M. "A critical review of construct indicators and measurement model misspecification in marketing and consumer research " *Journal of Consumer Research* (30) 2003, pp 199-218.
- Katz, R., and Allen, T. J. "Project Performance and the Locus of Influence in the R&D Matrix," *Academy of Management Journal* (28:1) 1985, pp 67-87.
- Kessler, E. H., Bierly, P. E., and Gopalakrishnan, S. "Internal vs. external learning in new product development: effects on speed, costs and competitive advantage," *R&D Management* (30:3) 2000, pp 213-224.
- Kirkman, B. L., and Mathieu, J. E. "The dimensions and antecedents of team virtuality," *Journal of Management* (31) 2005, pp 700-718.
- Kirkman, B. L., and Rosen, B. "Beyond Self-Management: Antecedents and Consequences of Team Empowerment," *Academy of Management Journal* (42:1) 1999, pp 58-74.
- Latané, B., Williams, K., and Harkins, S. "Many hands make light the work: The causes and consequences of social loafing," *Journal of Personality and Social Psychology* (37:6) 1979, pp 822-832.
- LeBreton, J. M., and Senter, J. L. "Answers to 20 Questions About Inter-rater Reliability and Inter-rater Agreement," *Organizational Research Methods* (11:4) 2008, pp 815-852.
- Lubart, T. I., and Getz, I. "Emotion, Metaphor, and the Creative Process," *Creativity Research Journal* (10:4) 1997, pp 285-301.
- Madhavan, R., and Grover, R. "From Embedded Knowledge to Embodied Knowledge: New Product Development as Knowledge Management," *Journal of Marketing* (62:4) 1998, pp 1-12.

- Majchrzak, A., Rice, E. R., Malhotra, A., King, N., and Ba, S. "Technology adaptation: The case of a computer-supported inter-organizational virtual team," *MIS Quarterly* (24) 2000, pp 569-600.
- Majchrzak, A., Malhotra, A., and John, R. "Perceived individual collaboration know-how development through information technology-enabled contextualization: Evidence from distributed teams," *Information Systems Research*, (16) 2005, pp 9-27.
- Malhotra, A., and Majchrzak, A. "Enabling knowledge creation in far-flung teams: best practices for IT support and knowledge sharing," *Journal of Knowledge Management* (8:4) 2004, pp 75-88.
- Malhotra, A., Majchrzak, A., Carman, R., and Lott, V. "Radical innovation without collocation: A case study at Boeing-Rocketdyne," *MIS Quarterly* (25) 2001, pp 229-249.
- March, J. G. "Exploration and exploitation in organizational learning," *Organization Science* (2:71) 1991, p 17.
- Mathieu, J. E., Heffner, T. S., Goodwin, G. F., Salas, E., and Cannon-Bowers, J. A. "The influence of shared mental models on team process and performance," *Journal of Applied Psychology* (85:2) 2000, pp 273-283.
- Mesmer-Magnus, J. R., and DeChurch, L. A. "Information sharing and team performance: A meta-analysis," *Journal of Applied Psychology* (94:2) 2009, pp 535-546.
- Meyerson, D., Weick, K. E., and Kramer, R. M. "Swift trust and temporary groups," in: *Trust in organizations: Frontiers of theory and research*, R.M. Kramer and T.R. Tyler (eds.), Sage Publications, Thousand Oaks, CA, 1996, pp. 166-195.
- Moore, G. C., and Benbasat, I. "Development of an instrument to measure the perceptions of adopting an information technology innovation," *Information Systems Research* (2:3) 1991, pp 192-222.
- Moorman, C. "Organizational market information processes: Cultural antecedents and new product outcomes," *Journal of Marketing Research* (32:3) 1995, pp 318-335.
- Orr, J. M., Sackem, P. R., and Dubois, C. L. Z. "Outlier Detection and Treatment in I/O Psychology: A Survey of Researcher Beliefs and an Empirical Illustration," *Personal Psychology* (44) 1999, pp 473-486.
- Paulus, P. B. "Groups, teams, and creativity: The creative potential of idea-generating groups," *Applied Psychology: An International Review* (49:2) 2000, pp 237-262.
- Paulus, P. B. "Chapter 7. Fostering Creativity in Groups and Teams," in: *Handbook of organizational creativity*, J. Zhou and C. Shalley (eds.), Lawrence Erlbaum Associates, New York, 2008.
- Perttula, K. M. "The POW factor: Understanding passion for one's work," in: *The Annual Meeting of the Academy of Management*, Seattle, 2003.
- Politis, J. D. "The connection between trust and knowledge management: what are its implications for team performance," *Journal of Knowledge Management* (7:5) 2003, pp 55 - 66.

- Rice, R. E. "Task Analyzability, Use of New Media, and Effectiveness: A Multi-Site Exploration of Media Richness," *Organization Science* (3:4) 1992, pp 475-500.
- Ringle, C. M., Wende, S., and Will, A. SmartPLS SmartPLS, Hamburg, Germany, 2005.
- Runco, M. A. "Creativity," *Annual Review of Psychology* (55) 2004, pp 657-687.
- Sarker, S., and Sahay, S. "Understanding virtual team development: An interpretive study," *Journal of the Association for Information Systems* (4) 2003, pp 1-38.
- Saunders, C. S., and Ahuja, M. K. "Are all distributed teams the same? Differentiating between temporary and ongoing distributed teams," *Small Group Research* (37:6) 2006, pp 662-700.
- Smilor, R. W. "Entrepreneurship: Reflections on a subversive activity," *Journal of Business Venturing* (12) 1997, pp 341-346.
- Sutcliffe, K. M. "What executives notice: Accurate perceptions in top management teams," *Academy of Management Journal* (37) 1994, pp 1360-1378.
- Taggar, S. "Individual creativity and group ability to utilize individual creative resources: A multilevel model," *Academy of Management Journal* (45:2) 2002, pp 315-330.
- Tiwana, A., and Mclean, E. R. "Expertise Integration and Creativity in Information Systems Development," *Journal of Management Information Systems* (22:1) 2005, pp 13-43.
- Tu, C. Y. "A multilevel investigation of factors influencing creativity in NPD teams," *Industrial Marketing Management* (38:1), Jan 2009, pp 119-126.
- Vallerand, R. J., Blanchard, C., Mageau, G. A., Koestner, R., Ratelle, C., Léonard, M., Gagné, M., and Marsolais, J. "Les passions de l'âme: On obsessive and harmonious passion," *Journal of Personality and Social Psychology* (85) 2003, pp 756-767.
- Vallerand, R. J., Salvy, S.-J., Mageau, G. A., Elliot, A. J., Denis, P. L., Grouzet, F. M. E., and Blanchard, C. "On the role of passion in performance," *Journal of Personality* (75:3) 2007, pp 505-534.
- Venkatraman, N., and Ramanujan, V. "Planning system success: A conceptualization and an operational model," *Management Science* (33) 1987, pp 687-705.
- Walczak, S. "Organizational knowledge management structure," *Learning Organizations* (12:4) 2005, pp 330-339.
- Wang, J. C. K., Khoo, A., Liu, W. C., and Divaharan, S. "Passion and intrinsic motivation in digital gaming," *CyberPsychology & Behavior* (11:1) 2008, pp 39-45.
- Wasko, M. M., and Faraj, S. "Why should I share? Examining knowledge contribution in electronic networks of practice," *MIS Quarterly* (29:1) 2005, pp 1-22.
- Winnen, C. J. "To be or not to be: The role of passion and obsession in the entrepreneurial process," in: *Unpublished doctoral dissertation*, University of St. Thomas, St. Paul, 2005.

- Wong, S.-S. "Distal and local group learning: Performance trade-offs and tensions," *Organization Science* (15:6) 2004, pp 645-656.
- Woodman, R. W., Sawyer, J. E., and Griffin, R. W. "Toward a Theory of Organizational Creativity," *The Academy of Management Review* (18:2) 1993, pp 293-321.
- Woolley, A. W. "Putting first things first: Outcome and process focus in knowledge work teams," *Journal of Organizational Behavior* (30) 2009, pp 427-452.
- Yi, M. Y., and Davis, F. D. "Developing and validating an observational learning model of computer software training and skill acquisition," *Information Systems Research* (14:2) 2003, pp 146-169.
- Zimmer, J. C., Henry, R. M., and Butler, B. S. "Determinants of the use of relational and nonrelational information sources," *Journal of Management Information Systems* (24:3) 2007, pp 297-331.

Chapter 4 – Essay III: The Impact of Individual Passion on Learning Outcomes in Knowledge Teams

Abstract

This study investigates the antecedents of individual learning under knowledge team environments, where team members work together for a limited time period, share knowledge informally and eventually create a knowledge outcome that is beneficial for an organization (e.g., project teams or short-term new product development teams composed of cross-functional members). Participating in a knowledge team provides individual members with a good opportunity to learn during a short period of time, since they work on novel and creative tasks, which are different from their routine ones. However, because knowledge team activities are often non-routine for each member, their attitudes toward and psychological involvement with their knowledge team activities vary among different individuals. In this study, we suggest that *individual passion about knowledge team activities* is an important psychological input for *individual members' external knowledge sourcing, internal knowledge sharing, and helping behaviors*, which eventually lead to improving an individual's learning outcomes through knowledge team activities. We hypothesize that *individual passion about the activities in a knowledge team* positively influences both 1) *knowledge management (sourcing and sharing) behavior*; and 2) *the organizational citizenship behavior – helping (OCB-helping)* of individuals, and these behaviors, in turn, result in their learning outcomes. Also, members' *perceived psychological safety within knowledge teams* positively moderates *the impact of members'*

passion on internal knowledge sharing and helping behavior on learning outcomes. The research model is tested with survey data from the knowledge team participants of a large Korean-based educational service company. We conclude with the implications of this study for the academy and practice, along with future research directions.

Introduction

This study aims to investigate the impact of *individual passion about team activities* on *individual learning outcomes* in the context of knowledge teams. A *knowledge team* in this study refers to an IT (Information Technologies)-enabled team of knowledge workers from functional areas who participate in the activities of creating novel outcomes (Goodman and Goodman 1976; Saunders and Ahuja 2006; Woolley 2009).

This form of team is now prevalent in the current business environment, since it is an efficient and less-costly solution in confronting the fast-changing business environment. It helps companies create something new without hiring additional human resources, and it combines and creates new knowledge from different geographical or functional areas within or across organizations (Bakker 2010; Grawitch, Munz, Elliott, and Mathis 2003). For example, employees from different functional teams (e.g., R&D, Production, and Marketing) get together for a limited period of time to develop new products while working on their routine jobs in their functional teams (Putnam 1992; Saunders and Ahuja 2006). Or, employees from different regional offices in an organization get together from

time to time as a form of informal gathering to make work-process manuals for their tasks by combining the best practices from different regional areas. Members work on producing novel outcomes as their non-routine activity, and their active participation is not strictly mandated (Saunders and Ahuja 2006; Woolley 2009); as a result, the extent to which individuals participate in team learning and helping activities should vary among different individuals, according to how much they are ready to make an effort and spend extra time on team activities. In order to explain the role of individuals' psychological attachment to non-mandated knowledge team activities, this study aims to identify and test *the impact of individual passion about team activities* on individuals' learning and helping behaviors, as well as learning outcomes.

In a team environment, individuals can learn from interaction with others (Alavi, Marakas, and Yoo 2002). We take the perspective that an individual's psychological input influences individual learning outcomes through participating in learning behavior (Webb 1982), while this link (individual input – behavior – learning outcome) is moderated by environmental factors in teams (Katz-Navon, Naveh, and Stern 2009), such as the psychological environment in a team (Figure 1). Based on this research framework, we propose the following two arguments with our research model.

First, we introduce the concept of “passion” in the knowledge team context and suggest that “*passion about the activities of a knowledge team,*” which refers to “the degree with which an individual has love, enthusiasm, and attachment to the activities (tasks) of the knowledge team (Baum and Locke

2004), is an important individual “input” factor that influences an individual’s external knowledge sourcing, internal knowledge sharing (i.e., two learning behaviors) and helping behavior in a knowledge team. We argue that in a knowledge team environment, where members participate in a team as a non-routine activity, individual learning can start from individuals’ psychological attachment to their team activities. We also argue that the relationship between passion and members’ internal behaviors (internal knowledge sharing and helping) is moderated by psychological safety within a team (Edmondson 1999).

Second, we propose that three individual-level behaviors in knowledge teams - 1) *knowledge sourcing from external knowledge sources*; 2) *knowledge sharing with other team members*; and 3) *organizational citizenship behavior of helping other team members (OCB-helping)* - are important behaviors that link individual passion to learning outcomes (Bresman 2010; Van Dyne and LePine 1998; Wong 2004). In a knowledge team environment, the extent to which individuals spend their time and effort engaging in these behaviors is likely to vary among different members. We argue that the variation of these three behaviors is explained significantly by how passionate individuals are about their activities within a team. We also argue that individuals who are engaged in these behaviors (knowledge sourcing, knowledge sharing, and helping other members) will learn more from their knowledge team activities.

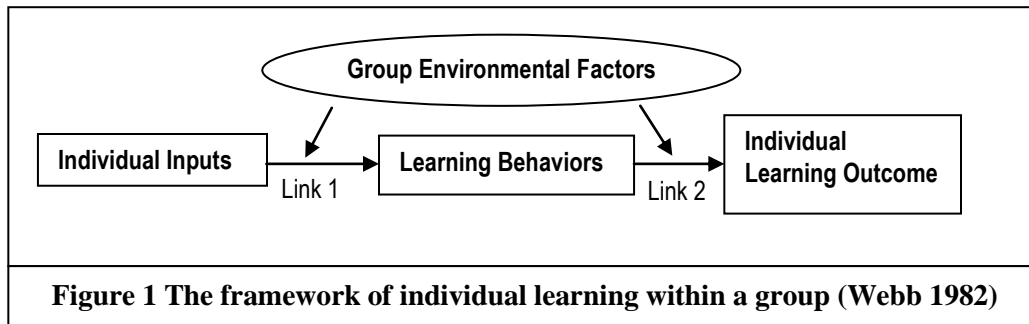
In sum, this research aims to answer the following two questions:

“Is an individual’s passion about the activities in her/his knowledge team associated with her/his learning outcomes through learning and helping

behavior?” and,

“Does an individual’s perceived psychological safety in a knowledge team improve the relationships between passion and knowledge sharing (and helping) behaviors?”

To answer these research questions, this paper is developed as follows. We first review the previous studies on knowledge teams, learning, passion, and individual learning and helping behaviors. Then, we develop a research model that hypothesizes the relationship among passion, individuals’ learning and helping behaviors, psychological safety and individual learning outcomes in the context of knowledge teams. Next we describe the research design and the results of the data analysis, followed by contributions, limitations of this study and suggestions for future research.



Theoretical Background

Passion as an important antecedent for learning behavior in knowledge teams

Passion as a psychological attachment to a reference target

The term “passion” has been used not only for organizational work, but

also in different contexts, such as sports and recreational activities (Vallerand, Blanchard, Mageau, Koestner, Ratelle, Léonard, Gagné, and Marsolais 2003). Thus, it has been defined in many different ways, according to different contexts of studies. For example, it is defined as the “persistent desire to succeed” (Smilor 1997), “intense positive feelings by engaging in a certain activity” (Cardon, Wincent, Singh, and Drnovsek 2009), an “intense affective state” (Chen, Yao, and Kotha 2009), and “attachment to a certain object” (Cardon, Zietsma, Saporito, Matherne, and Davis 2005). In the organizational context, passion has been defined as *strong likeness, enthusiasm, and attachment to the activities individuals are doing* (Baum and Locke 2004; Hagel 2012). As such, the definition of “passion” includes strong likeness, a desire to succeed, and psychological attachment to a certain object, which is also referred to as a “reference target” (Cardon et al. 2009).

Extant studies distinguish passion from other similar psychological statuses, although it shares some commonality with other psychological constructs, namely *feeling (affect), emotion, and motivation*. First, compared to “feeling” (which can be both positive and negative), passion is a kind of individual feeling; however, it is more compatible with a highly intense and positive feeling. Passion is different from affect, as passion is activated by a target that is meaningful to one’s identity (Cardon et al. 2009), while affect is activated by something that may not be related to one’s identity. Second, passion is similar to emotion, as both constructs entail a reference target and passion is interpreted as a strong positive emotion (Winnen 2005; Cardon et al. 2009). However, whereas passion is formed

by rather long-term engagement with reference target, an emotion is a short-term response to the reference target (Morris and Keltner 2000; Rafaeli and Sutton 1991). Third, passion is also related to intrinsic motivation. However, Baum and Locke (2004) argued that passion is a kind of dispositional feeling about a reference target (although it is formed by experience with the target), while motivation is an inclination to do something that is related to the reference target. Also, several studies found that passion and intrinsic motivation are different concepts and that passion antecedes intrinsic motivation (Cardon et al. 2009). In sum, passion entails strong and positive feelings or emotion about a target, but it is formed by an individual's experience with activities related to the target.

The literature review on passion shows that it could be multi-faceted in two ways. First, it can be a psychological status, or it can be shown as a behavioral manifestation. Thus, it has been measured as both a *psychological* (e.g., intense positive feelings, Cardon et al. 2009) and *behavioral construct* (e.g., voice tones, Chen et al. 2009), but most studies treat passion as an individual's psychological status (Cardon et al. 2009). Thus, we consider only the *psychological aspect* of passion, which will influence individuals' learning behavior and helping behavior in their teams.

Second, Vallerand et al. (2003) argued that there are two distinct types of passion: *obsessive* and *harmonious*. Briefly, obsessive passion is one in which an individual has no control over, and the individual is obsessively involved in the target of passion; moreover, it is not easy for the individual to forget about the target object. Individuals with obsessive passion normally have a negative result,

such as a passion for gambling and entertainment. However, harmonious passion results from an autonomous internalization of an activity into the person's identity. Individuals have control over the object of passion, and it normally results in a positive outcome. We will focus only on the *harmonious* side of passion, since in the context of knowledge teams participants can freely accept the activities in knowledge teams as important for them, without any attached contingencies (Vallerand et al. 2003). In sum, in this study, we are looking at *"harmonious passion as individuals' psychological status."*

Formation of an individual's passion about knowledge team activities

Since passion entails psychological attachment and strong likeness to a reference target, and this feeling of attachment is supposed to come from a certain degree of experience with the reference target (Ashforth and Mael 1989), passion originates from experience rather than inherently disposed feelings (Cardon et al. 2009). For example, an individual could have good feelings (or even intentions) about playing tennis before s/he can actually play it, but it may not be possible to identify her/himself as a passionate tennis player without actually having the experience of playing this sport.

In knowledge teams, by engaging in goal-setting, brainstorming, fulfilling team tasks, and interacting with other members, passion about some aspects of knowledge teams (e.g., on team activities in general, the excellence in outcomes, or the team as a whole) can be formed by some participants of knowledge teams during the tenure of their teams. As active participation in the knowledge teams of this study is not strictly mandated, individuals will have different degrees of

experience from knowledge teams, so that passion will vary among the different individuals in the knowledge teams. We argue that this variation in individual passion about their team activities will eventually lead to how much they engage in team interaction behavior.

With this in mind, we define an *individual's passion about her/his activities* as the degree with which an individual has experienced love, enthusiasm, and attachment to the activities (tasks) of the team (Baum and Locke 2004). In the context of knowledge teams, where members participate in team activities as their non-routine activities, and where they are not always co-located, we argue that individual passion about knowledge team activity is an important psychological antecedent for individual *learning and helping behavior*, which is reflected as external knowledge sourcing, internal knowledge sharing and OCB-helping.

Individuals' learning behaviors and OCB-helping behavior for team tasks

In the context of knowledge teams, we argue that there are three important individual behaviors that make a difference in individual learning outcomes: 1) external knowledge sourcing; 2) internal knowledge sharing; and 3) OCB-helping.

First, *external knowledge sourcing*, which refers to the activity of obtaining knowledge from external knowledge sources of a team (whether they are people or other types of knowledge sources) (Bresman 2010; Gray and Meister 2004; Wong 2004) is important because knowledge teams are formed to create something new, whether the team goal is to produce a completely new business idea or to improve current work processes. For this, members should

look for appropriate knowledge and skills outside of their teams. At the individual level in the team context, external knowledge sourcing can be done from outside of their team boundaries (Ancona and Caldwell 1992; Williams and Anderson 1991). Research also suggests that external knowledge sourcing (or external learning behavior) is important for learning outcomes (Bresman 2010; Espinosa, Slaughter, Kraut, and Hersbsleb 2007). As members of a knowledge team are from different functional areas of an (or multiple) organization(s), they can leverage their diversified backgrounds by sourcing knowledge from their functional (ongoing) teams, which are outside the boundaries of focal knowledge teams. Other than individual team members' functional teams, team members should also look for knowledge from other external sources (e.g., external experts, Internet searches, etc.) to develop something new, as knowledge from internal sources may not be enough to create novel outputs from their teams. Therefore, it is necessary to look outside and find information and expertise using non-relational sources (such as Internet search engines) and relational sources (such as personal information networks: friends, former colleagues, and in our case, the members of their functional teams) (Rulke, Zaheer, and Anderson 2000; Zimmer, Henry, and Butler 2007).

Second, in order to create a common outcome for their knowledge teams by combining the knowledge and experience of each member, team members' knowledge should be shared within the team. *Internal knowledge sharing in this study* is defined as the activity of exchanging knowledge with the other members of a knowledge team (Wong 2004). Previous studies also argue that *knowledge*

sharing within a work group is beneficial to group performance, and it can also help an individual obtain broader insights and skills related to her/his team tasks (Allen 1977; Bock, Zmud, Kim, and Lee 2005; Tushman 1979; Wong 2004). As a member of a knowledge team, sharing knowledge with other members means that s/he shares ideas, expertise, advice, and feedback related to team activities and reviews the ongoing activities of the team together. That is, “sharing” knowledge within the team is bi-directional for a focal individual. It involves not only the outflow of knowledge from the focal individual to other members, but also the inflow of knowledge from other members to the focal individual by interacting among one another as a group.

Third, *organizational citizenship behavior – helping* occurs when an individual uses discretion and decides to assist co-workers in their work or when they volunteer to do things that benefit the teams (LePine, Erez, & Johnson, 2002). It is defined as voluntarily assisting other group members in work-related areas (Ng and Van Dyne 2005; Van Dyne and LePine, 1998). Within organizational teams, such behavior builds and preserves relationships among team members and improves the collective harmony of the members (Van Dyne and LePine 1998). This helping behavior can be another important factor for accomplishing goals in knowledge teams, where members have never worked together before. In this study, we define *OCB-helping* as an individual team member’s behavior that not only helps the other members fulfill their tasks in her/his team, but also helps the knowledge team accomplish its goal (Van Dyne and LePine 1998). This form of behavior is distinct from knowledge sharing with other members because helping

behavior can go beyond merely sharing knowledge and skills. It helps members work together by improving collective harmony.

Individual learning outcomes as an accumulation of knowledge

Definition of individual learning outcomes

Before we propose a research model on individual learning in knowledge team context, we should review how the literature has looked at “individual learning in organizations.” First, there is a distinction between *learning processes* and *learning outcomes*. Individuals’ learning can be conceptualized as the outcome of the acquisition of knowledge or skills, while it can also be conceptualized as the process of acquiring knowledge. For example, learning outcomes are defined as the outcomes of some learning activities “encoding inferences from history into routines that guide behavior” (Levitt and March 1988). On the other hand, some studies have looked at an individual’s learning behaviors (or processes) as their main focus of learning. Studies on learning outcomes have often used “learning” as a dependent variable that is influenced by learning behaviors or learning environments (Alavi et al. 2002), while other studies on learning processes (or behaviors) have used learning as independent or process variables (Tucker, Nembhard, and Edmondson 2007). In this study, we look at individuals’ *learning outcomes* after their participation in knowledge teams as our dependent variable.

Second, another distinction is that a learning “outcome” can be interpreted in two distinct ways: 1) *a learning outcome as the accumulation of new knowledge and skills*; and 2) *a learning outcome as enhanced productivity*. The

former emphasizes the acquisition of “new knowledge content” (Alavi et al. 2002), while the latter focuses on the enhancement of productivity (reducing completion time) on group members’ tasks, implying that a “learning curve” is involved due to the antecedents (e.g., exercise or previous experience on similar tasks) of this type of learning (Narayanan, Balasubramanian, and Swaminathan 2009; Schilling, Ployhart, Vidal, and Marangoni 2003). From these two distinctions of the definitions of learning, this study looks at individuals’ “learning outcomes” as the “accumulation of new knowledge and skills,” which results from individuals’ participation in knowledge teams. Therefore, based on the definition of a learning outcome by Alavi et al. (2002), we define an *individual learning outcome in a knowledge team* as an individual’s change in knowledge representation as a result of the activities of her/his knowledge teams.

Informal learning by engaging in team activities

In organizations, individual learning outcome (as the accumulation of knowledge) occurs with the various activities of individuals. They can learn from formal educational sessions or from learning materials, such as manuals, books, and trade journals. Further, they can learn by working on their tasks. In team environments, learning by doing one’s tasks happens not only from an individual’s interaction with the tasks themselves, but also through formal and informal communication among the team members (Reagans, Argote, and Brooks 2005; Ryu, Kim, Chaudhury, and Rao 2006). In more detail, Alavi et al. (2002) argue that in order for an individual to achieve learning, two processes should occur: 1) reception; and 2) structuring. *Reception* is defined as the perception of

information in the learner's short-term memory, while *structuring* is defined as the mental activity of processing the information and connecting it to appropriate prerequisite concepts retrieved from the long-term memory to form new (or modified) knowledge (Alavi et al. 2002, p. 406). In other words, individual learning involves the acquisition of knowledge (reception) and the change in the knowledge structures of an individual (structuring) (Greeno 1974). As such, in the environment of work teams, an individual's learning starts with reception (knowledge acquisition) by communicating with other members and is achieved through structuring by challenging her/his initial understanding with others' points-of-view, clarifying her/his understanding of new perspectives and enhancing the comprehension of new information (Alavi et al. 2002). According to the perspective of communities of practice (Lave and Wenger 1991), individual learning is situated in one practice and results from participation in communities of practitioners.

In knowledge teams, where members work together to create their team outcomes by sharing knowledge and experience from diverse backgrounds, a significant amount of individual learning will occur. While working together, team members can monitor one another's thinking, opinions and experiences and can provide feedback to and receive feedback from one another on the tasks they are working on (Alavi et al. 2002). Getting involved in what other members are doing will also motivate one's learning by challenging an individual's initial understanding of things related to others' work (Glaser and Bassok 1989). As such, when people are working together to accomplish a common goal, individual

learning will occur mainly through collaborative interaction (Alavi et al. 2002).

Antecedents of individual learning outcomes from extant studies

What makes individuals learn by interacting with other members of their teams? The literature on learning activity suggests that team members' interaction behavior is affected by individuals' characteristics, such as *their attitudes* toward team tasks or *their abilities* related to their tasks and learning environment, such as the team culture of learning (Ausubel 1968; Davenport and Prusak 1998b; Webb 1982). As such, the theoretical link of "input characteristics affecting individuals' learning (interaction) behaviors, and these learning behaviors affecting individuals' learning outcomes" (Figure 1) should be the main framework in developing our research model.

The extant research suggests the antecedents of individual learning behaviors and outcomes. Some studies suggest the antecedents (input factors) of learning behaviors (Link 1 in Figure 1). Some antecedents of learning behaviors are an individual's internal factors, such as learning-related attitudes (e.g., perseverance, flexibility, improvisation, problem sensitivity, and tactical astuteness) (Ausubel 1968), and others are related to an individual's ability (Webb 1982). Moreover, group composition (homogeneity/heterogeneity) in terms of ability, skills, and race and reward structure should influence individual learning behavior (Webb 1982).

In addition to the antecedents for individuals' "*behavior*" of learning, other studies have also suggested a variety of factors for learning "*outcomes*" (Link 2 in Figure 1). As previously mentioned, the perspective of learning as the

acquisition of knowledge and skill (Alavi et al. 2002) sees that the degree of learning is enhanced when an individual has a chance to accumulate new knowledge (Schilling et al. 2003). In order to have a chance to accumulate new knowledge, individuals make an effort to learn. Making an effort in knowledge team context involves participating in team interaction. That is, an individual's interaction behaviors with the other members of a team are the key behavioral factors for individual learning (Gray and Meister 2006).

Finally, the culture of an active learning environment (Group environmental factor in Figure 1), such as *psychological safety*, is said to be an important factor for learning in knowledge team context, where members have not worked together before and have possible social interaction anxiety (Camacho and Paulus 1995; Davenport and Prusak 1998; Edmondson 1999; Katz-Navon et al. 2009).

Summary of theoretical perspectives

To summarize our theoretical perspectives, individuals' learning in knowledge team is achieved by their interaction behaviors with internal members and external knowledge sources. This study introduces *individual's passion about team activities* as a key input factor that facilitates *individual's interaction behaviors* within knowledge teams and identifies three interaction behaviors that are important for learning outcomes from participating in knowledge teams. In addition, this study also investigates the role of *psychologically safe team environment* on the relationship between passion and individuals' interaction behaviors within a team. The research model is elaborated in the following section.

Research Model and Hypothesis

The impact of passion on individuals' knowledge sourcing and sharing and helping behavior

Individual passion toward a certain object entails a high-level of liking (Cardon et al. 2009), a desire to succeed (Smilor 1997), and deep psychological involvement (Vallerand et al. 2003). When an individual within a team becomes excited about the goals and tasks of a knowledge team, they will not only try to engage in the activities to accomplish their sub-tasks as much as possible, but they will also put forth their extra time and effort to improve the outcomes generated by the knowledge team by sourcing new knowledge externally, by sharing them with other team members, and by helping other members fulfill their tasks.

First of all, passionate individuals will broaden their social networks toward their target activity (Baron 2008). That is, they will try to use or expand their social networks to those who may help their team tasks, which in turn, will assist them in gathering knowledge from external sources. In the context of knowledge teams, an individual member who is passionate about his/her tasks and goals will take an extra step to reach external knowledge sources. For example, if a member is passionate about her/his team activities or outcomes to produce, he/she will reach out to people who have successfully done knowledge team activities previously to obtain their know-how from their experiences. Also, because individuals want their outcomes to come out perfectly, they may reach out to industry experts for their group tasks, or they may consult an online community that contains useful information for their group tasks. They will also

spend time looking for the best examples related to their self-selected goals. As such, individual passion encourages an individual to engage in various external knowledge sourcing activities. With these perspectives, we hypothesize the following:

H1: Individual passion about knowledge team activities is positively associated with external knowledge sourcing behavior.

Second, research suggests that passionate people like to share their seeds of ideas in order for others to add and reincorporate them (Kane, Majchrzak, Johnson, and Chen 2009). In addition, they are willing to transfer and share their expertise (Sie and Yakhlef 2009). Since members of a knowledge team have different background knowledge and interest in their topic, sharing knowledge within the knowledge team requires significant effort by its members. Thus, sharing knowledge in this environment may require one's deliberate effort to transfer, translate, and transform ideas that are from different sources of knowledge (Carlile 2004). An individual with passion about her/his team activities will go through long and sometimes frustrating activities to engage in knowledge sharing (Vallerand et al. 2003). Thus, in order to make their team outcomes successful, passionate members of a knowledge team will not only share the documents or data they have found from external sources (although these materials are not directly related to their immediate sub-tasks), but they will also spend time sharing their know-how with other members who need that know-how so as to fulfill their tasks for the team. They will do so because they know that sharing their knowledge with the other members of the team will eventually

help improve the overall outcomes of the team, about which they have a passion.

With these perspectives in mind, we hypothesize the following:

H2: Individual passion about knowledge team activities is positively associated with internal knowledge sharing behavior in one's knowledge team.

Third, when individuals within a knowledge team become excited about and love the activities and goals of the knowledge team, they will not only try to engage in the activities to accomplish their own tasks in the team, but they will also put forth extra time and effort to improve the outcomes generated by the team as a whole. That is, passionate participants may regard team outcomes as an important part of their lives; in fact, they like to label the outcomes as their own product (e.g., this is “Sandra’s work process manual”). Thus, passionate individuals will put in a great deal of effort to perform her/his sub-tasks, as well as to do her/his teamwork, nurture team members’ relationships, and maintain collective harmony, whichever aspects of the team that help it move forward. Thus, while fulfilling their sub-tasks for the knowledge team, they will voluntarily help others’ work, which will be combined into one team outcome. OCB-helping behaviors include both the activity of literally helping others’ work and the activity of facilitating team members’ collaboration (Ng and Van Dyne 2005). The helping behavior within a team is manifested by “Organizational Citizenship Behavior-Helping,” which includes “volunteering to do things in the team,” “orienting others within the team,” and “assisting others’ work that could benefit the outcomes of the team.” With these perspectives in mind, we hypothesize the following:

H3: Individual passion about knowledge team activities is positively associated with OCB-helping in one's knowledge team.

The impact of learning and helping behaviors on individual learning outcomes

Individual learning outcomes involve acquisition of knowledge (reception) and a change in the knowledge structures of an individual (structuring) (Alavi et al. 2002; Greeno 1974). We argue that in the case of knowledge teams, merely participating in team meetings regularly or working on sub-tasks for team outcomes is not enough for individuals to be able to learn enough (by reception and structuring) on a particular topic. Rather, in the context of knowledge teams, individual learning is improved as members actually engage in knowledge sourcing activities in teams. By participating in external knowledge sourcing, team members improve the reception of new perspectives and information from external knowledge sources, whether they are human (e.g., an individual's functional team members) or non-human knowledge sources (e.g., online communities, Internet searches, etc.). This reception of new perspectives can be restructured when an individual actually applies the knowledge to team activities, which leads to learning outcomes (Alavi et al. 2002; Gray and Meister 2004; Greeno 1974). Research has also found that external knowledge sourcing behaviors help individuals learn new perspectives from various views and from external sources (Bresman 2010; Cummings 2004). With these perspectives in mind, we hypothesize the following:

H4: External knowledge sourcing behavior positively influences individual learning outcomes in knowledge teams.

As previously mentioned, when an individual team member shares knowledge with the other knowledge team members as a group, s/he can become engaged in an inflow of knowledge from other members to her/him, as well as an outflow of her/his knowledge to other members. While engaging in internal knowledge sharing in a knowledge team, an individual member not only receives new information from other members (reception) by having an inflow of knowledge from other members, but he/she also processes the shared knowledge and connects it to his/her prerequisite concepts to modify his/her long-term memory (structuring) (Alavi et al. 2002). On the other hand, while sharing one's knowledge with others, an individual participant in a knowledge team may often spend time with those who receive knowledge from her/him. By engaging in conversation to share one's knowledge with the others in their team, individuals get to know what the other members are working on, what kind of information and knowledge they need, and what concerns they have to improve their work performance. Thus, this activity of internal knowledge sharing makes individuals become involved with (either directly or indirectly) many different aspects of the activities related to the team. This activity can actually motivate one's learning by challenging her/his initial understanding of things related to others' work (Glaser and Bassok 1989). This experience will help individuals receive diversified knowledge about the way knowledge team tasks are fulfilled. Thus, internal knowledge sharing activities will improve individual learning outcomes.

Therefore, we hypothesize the following:

H5: Internal knowledge sharing behavior positively influences individual

learning outcomes in knowledge teams.

Helping is important to teams in organizations, especially when roles are interdependent and employee cooperation facilitates overall performance (Van Dyne and LePine 1998). This is the reason why OCB-helping is an important process that links passion with learning in the context of knowledge teams. A knowledge team is a team that is composed with individuals from different backgrounds and is formed to produce a new aggregated outcome. Thus, the tasks of teams are interdependent, and helping one another within the team will create great synergy for the members' final outcome, but it is not likely that team members will always be willing to help one another since they have never worked together before. In other words, in knowledge teams, helping is quite desired for optimal performance, but it is not naturally facilitated due to the temporary nature of knowledge teams.

Previously, extant studies have suggested that individual helping behaviors are related to job satisfaction and commitment (Van Dyne and LePine 1998; Williams and Anderson 1991). In our study, we suggest that individual OCB-helping not only improves team outcomes but also enhances help-givers' individual learning outcomes for the following reasons. As previously mentioned, OCB-helping consists of volunteering to do things, helping to orient other members, assisting others, and even helping others' to learn and fulfill their responsibilities (Van Dyne and LePine 1998). Since individual members' sub-tasks are interdependent among one another, helping to orient other members requires reviewing the overall goals of one's team, as well as the interdependence

among other members in terms of their roles and sub-tasks. By engaging in the orientation of other members, an individual member gets to learn many aspects of her/his team tasks. Also, when individuals help others to learn and fulfill their responsibilities, they get to work on something that could help their own work, and they get to reflect on their own experiences. Moreover, an individual showing helping behavior for her/his team as a whole tends to become more involved in the task of finalizing team output. These activities, in sum, eventually make an individual member learn more about the tasks in her/his knowledge team.

Therefore, we argue the following:

H6: Individuals' OCB-helping behavior positively influences individual learning outcomes in knowledge teams.

The moderation impact of psychological safety

Based on Webb (1982)'s framework (Figure 1) of individuals' informal learning in team environments, we argue that environmental factors within a team moderate the relationship between an individual's psychological input and his/her interaction behaviors or the link between an individual's learning behaviors and the his/her learning outcomes. As this study contributes to the literature on learning by introducing "passion" as an important antecedent of learning in team environments, it focuses on a moderating factor that enhances *the impact of passion on individuals' interaction behaviors* within a team.

In knowledge team environments, where members are gathered from different parts of an organization, an *individual's perceived psychological safety* (the extent that an individual participant feels comfortable (safe) for interpersonal

interaction and risk-taking within the team) should vary among different individuals (Edmondson 1999). It is found that psychological safety within a team encourages team members' learning behavior. For instance, Edmondson (1999) argued that psychological safety directly influences team learning behaviors. Further, Nembhard and Edmondson (2006) found that psychological safety helps individuals in teams engage in quality improvement work. We also believe that psychological safety may have a direct effect on an individual's interaction behaviors in the context of knowledge teams. However, instead of its direct impact on learning and helping behaviors, we focus on its moderating effect on the relationship between individuals' passion about their team activities and their internal interaction behaviors (internal knowledge sharing and OCB helping) in the context of knowledge teams, since we are interested in how an individual participant's perceived team environment affects the role of passion (input) on his/her interaction behavior (Figure 1).

First, if individuals feel safe about interpersonal risk-taking, their passion about team activity will more strongly encourage them to share knowledge with their team members. That is, if an individual team member with a high level of passion about his/her team work feels that s/he is comfortable with making a mistake in interpersonal interaction and asking other members questions, knowing that s/he will not be rejected by the other members for being different in opinion, then s/he will contribute more time to looking for solutions to others' work and sharing their experiences, opinions, and knowledge about others' jobs. On the other hand, if s/he has passion about team activities, but perceives that the team

environment is not safe enough to freely express her/his opinion or to share her/his knowledge about the team work, s/he may work hard to achieve good team outcomes by her/himself (because s/he has passion about team activities), but will not actively share her/his knowledge due to psychological fear about expressing her/his knowledge. With these perspectives, we hypothesize the following:

H7: An individual's perceived psychological safety within a knowledge team positively moderates the relationship between her/his passion about team activities and internal knowledge sharing behavior.

Second, in the same vein, we argue that psychological safety should enhance the relationship between passion and an individual's OCB-helping behavior within the team. In knowledge team environments, helping others entails not only an individual assisting others in doing their work, but also in taking the role of moving team work forward, persuading others' participation, and even finalizing team outcomes. If s/he feels that the psychological safety of her/his team is low, s/he may be passionate enough to do things in the team, but s/he will be reluctant to take on the role of making an extra effort to help others, persuade others' participation, and finalize team outcomes, because of her/his fear of being rejected by other members. However, if an individual participant of a knowledge team perceives that his/her team is a safe place to express opinions and make mistakes in trying different things, s/he will make more of an effort in helping others and taking the role of facilitating team work, as well as finalizing team outcomes, as long as s/he is willing to make an extra effort for the knowledge team (in other words, as long as s/he is passionate about the team's activities).

With this perspective, we hypothesize the following:

H8: An individual's perceived psychological safety within a knowledge team positively moderates the relationship between her/his passion about team activities and OCB-helping behavior.

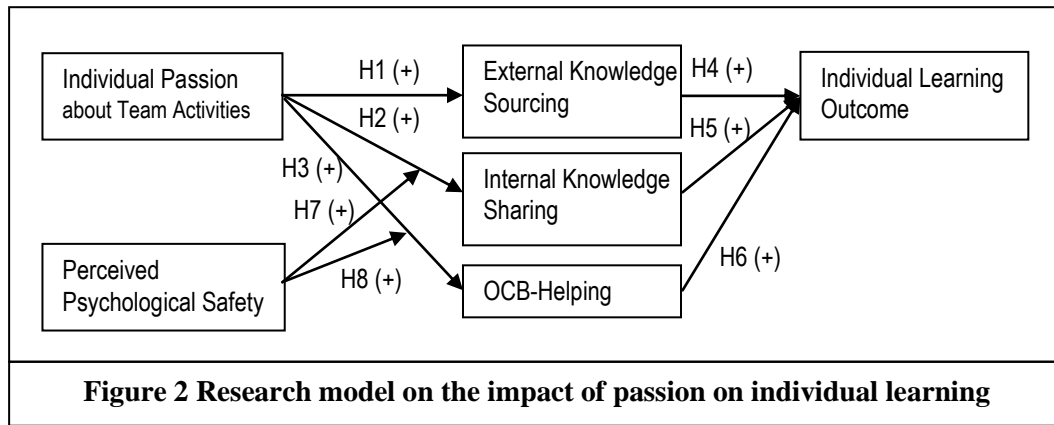


Figure 2 illustrates our research model. Briefly, an individual's passion about her/his team activities is positively associated with his/her interaction behaviors (external knowledge sourcing, internal knowledge sharing, and OCB-helping), and these behaviors positively influence her/his learning outcomes on knowledge team activities. An individual's psychological safety within a team positively moderates the relationship between passion and two internal behaviors (knowledge sharing with the members of the knowledge team and helping other members in the team).

Methodology

An overview of the research site

Survey data by the individuals who participate in knowledge teams were collected at a large South Korean firm operating in the educational service industry. This firm offers “home visiting private-tutoring services” and “book publishing”. The knowledge teams in this company have been facilitated once every year since 2008. This company facilitates knowledge teams in order to create various business ideas or codified knowledge contents (e.g., marketing ideas, new work process manuals, etc.) by combining the expertise and experience of its workers. Knowledge team participants can either voluntarily join knowledge teams or be appointed by their managers. Although individual workers participate in these teams, they are expected to do their routine jobs at the same time. Thus, joining a knowledge team in this company means that an individual has to work on the tasks of knowledge teams as well as working on her/his own regular tasks. The main outcomes of these teams are codified knowledge contents submitted to the company headquarters, and those submitted outcomes are evaluated and selectively awarded, but there is no monetary reward for individuals. Knowledge team members in this company meet regularly face-to-face (normally bi-weekly), as well as they communicate virtually via information communication technologies (ICT).

This research site is chosen because the participation in this knowledge team is not strictly mandated; thus, the individual’s psychological attachment to the team activities varies among different individuals. The members in most

knowledge teams in this research site have never worked together before; as a result, we can see the variation in their psychological safety. Also, the slogan of this company is “teach, learn, and grow together,” and it has facilitated a form of knowledge teams, not only for them to create various business ideas or codified knowledge contents, but also to let their employees learn together, which realizes the company slogan.

Item development procedure and pilot test

We developed and refined our items with the following processes.

First, we first developed items based on the existing conceptualization in the literature and our definition for each construct. Then, these items were reviewed by four academics (two professors and two Ph.D. students) who are experts in the topic of this study, and some changes were made after this review process.

Second, since the survey was conducted in Korean, all of the items were translated into Korean and then back-translated into English by a person who did not know the research question of this study. We made necessary modifications of items in Korean and English and made sure that no meanings had been lost in the translation.

Third, after the study was approved, the first author made several calls and face-to-face meetings with a senior manager (a key informant) who is responsible for facilitating the knowledge teams in this company. We were given access to all of the knowledge team participants (approx 1,300 participants) who belong to one of 163 knowledge teams during the period between February and October 2011.

An in-depth open-ended interview with four informants (current and previous knowledge team participants) was conducted to confirm the key constructs and their dimensions of this study. A necessary change was made after this interview.

Fourth, before it was released to all respondents, the pre-test to refine items with measurement model test. The pilot-survey questionnaire was distributed to 94 respondents who are in the same target population as actual survey research, and we received 75 usable responses. These pilot samples were analyzed for reliability and validity measures (Moore and Benbasat 1991). Some items that did not contribute to the measurement properties were eliminated in this procedure. Finally, the field survey was carried out to test the structural model of this study.

Survey administration and descriptive statistics

The survey was administered with a traditional paper-and-pen based survey. The authors sent the surveys to the division KM managers, who then sent to the team leaders a package of survey booklets for the members in their teams. The team leaders encouraged each team member to answer the survey booklet at the end of one of their regular meetings. In the introduction of the survey, we provided a brief description and its objectives, stated that participation in this study was voluntary, and provided a guarantee of individual confidentiality. The completed survey booklets were immediately stored into sealed envelopes, collected by the team leader and sent back to the author.

A total of 402 individuals (number of individual participants) of the approximately 1,300 targeted individuals completed the survey (31% of

individuals). Among those completed surveys, five were dropped because of many unanswered questions (more than half of unanswered questions) or lack of variance in the answers (e.g., marked all 7's in the responses); additionally, four samples were dropped after an outlier test ($|\text{standardized residuals}| > 3$) (Chua, Weira, and Wolfinger 2002; Orr, Sackem, and Dubois 1999). Overall, 393 respondents provided usable survey data, for a response rate of 30.2%. Within the final sample, 81.7% were female, and 84.7% were between 25 and 44 years old. On average, respondents had approximately 64 months of experience in the function they were performing within the field of the educational service industry. A total of 86.5% of individuals had a university degree or higher. A total of 66.2% of respondents were tutors, while the rest performed other types of jobs, such as managers and book-publishing. Approximately 87.0% of individuals participated in one of the knowledge teams when the teams first began, while the rest joined afterward.

Measures

Most measures included in the questionnaires were developed with seven-point Likert scales (with scale item responses running from 1 = “strongly disagree” to 7 = “strongly agree” or from 1 = “not at all” to 7 = “to a great extent”). Details of items for each construct are in Appendix 1.

Individual learning outcomes: Individual learning outcomes in this study refer to changes in the team participants' perceptions of knowledge levels after their knowledge team activities (Alavi et al. 2002). This construct measures the change in individuals' knowledge for fulfilling tasks related to team activities in

this company. To measure this construct, we modified the learning outcome measure from Kudaravalli (2010), since his study also measured learning as an outcome, which is a result of specific team activities. His research is similar to the context of this study, where individual learning comes from engaging in the activity of knowledge work in knowledge teams. We asked team members five questions in order to obtain their perceptions of their learning outcomes after they finished working in their knowledge teams.

Individual Passion: We defined an *individual's passion about her/his activities* as the degree with which an individual has experienced love, enthusiasm, and attachment to the activities (tasks) of her/his knowledge team (Baum and Locke 2004). We modified Baum and Locke's (2004) measure of passion. We asked individual participants five questions to obtain the degree of their passion about the activities they did in the teams in which they participated.

External Knowledge Sourcing and Internal Knowledge Sharing behavior: To measure *external knowledge sourcing behavior* and *internal knowledge sharing behavior*, we adapted Wong's (2004) scales of learning behavior at the individual level. In order to capture individuals' participation in external knowledge sourcing, the question item is written as follows: "Please indicate the extent to which you did each of the knowledge sourcing activities listed below (with knowledge sources external to your knowledge team): 1) seeking ideas/expertise related to your team activities; 2) reviewing your team activities; 3) obtaining help or advice related to your team activities; and 4) seeking feedback related to your team activities." For internal knowledge sharing behavior, the

question item is written as follows: “Please indicate the extent to which you did each of the knowledge sharing activities listed below (with knowledge sources within your knowledge team): 1) sharing ideas/expertise related to your team activities; 2) reviewing your team activities; 3) sharing advice related to your team activities; and 4) sharing feedback related to your team activities.”

Organizational Citizenship Behavior-Helping: The measure for OCB-helping was modified from Ang, Van Dyne, and Begley’s (2003) measure of OCB-Helping. For example, respondents will be asked to answer the extent to which they have volunteered to do things, helped orient other members, and assisted other members with their responsibilities for the period of the knowledge team. Four items were created to measure OCB-helping.

Perceived Psychological safety: To measure an individual’s perceived psychological safety in the context of this study, we adapted Edmondson’s (1999) scales of psychological safety. Initially, we created seven items. After pilot test, four items (non-reversed items) were dropped because they did not contribute the measurement property of this construct. Thus, three reversed items were selected to measure an individual’s perceived psychological safety within her/his knowledge team.

Control variables: Gender, Age, Education level (0: high school; 1: 2 year college; 2: 4 year university; and 3: graduate school), industry experience in months, and the time served in months are used as control variables to see if these variables are significantly associated with their learning outcomes.

Result

Pretest for measurement model with pilot samples (n=75)

Exploratory factor analysis and internal consistency

To test the properties of our measurement and refine the items that are modified from other studies, we first conducted an exploratory factor analysis (EFA) through a pretest with 75 respondents. A principal component analysis was conducted with VARIMAX rotation. Several rounds of EFA resulted in a six-factor solution, after removing four items from psychological safety (the remaining three reversed items). Twenty-five items reflectively measure six constructs: individual learning outcomes, individual passion, external knowledge sourcing, internal knowledge sharing, OCB-helping, and psychological safety. For internal consistency, we checked the Cronbach's alphas (Cronbach 1970) for all constructs and found that all values exceeded the threshold value of 0.7 (Table 1).

Confirmatory factor analysis: testing convergent and discriminant validity

To assess the convergent validity, first, standardized cross-loadings were examined. As shown in Table 3, although all standardized item loadings of six constructs are above 0.707, there are several problems found in the measurement model. Two items of internal knowledge sharing (0.701, 0.707) and one item of individual passion (0.734) loaded strongly with the construct of the learning outcome, which implies that not all reflected items are unidimensional and representing their associated latent variables. Also, in Table 2, the correlation between internal knowledge sharing and individual learning (dependent variable) is higher than 0.7 (0.705), which indicates a problem in discriminant validity.

Table 1 Latent variable correlation and measurement model test with pilot 75 samples (The bolded and underlined numbers are the square roots of Average Variance Extracted)											
	Initial Items	Final Items	Cronbach's Alpha	Composite Rel.	AVE	Latent variable correlation and square root of AVE					
						1	2	3	4	5	6
1.Learn	5	5	.955	.965	.847	<u>.921</u>					
2.Passion	5	5	.909	.932	.731	.633	<u>.855</u>				
3.Ext-KS	4	4	.957	.969	.885	.320	.486	<u>.941</u>			
4.Int-KS	4	4	.960	.971	.893	<u>.705</u>	.423	.406	<u>.945</u>		
5.Help	4	4	.954	.967	.879	.476	.429	.442	.434	<u>.937</u>	
6.PsychS	7	3	.753	.858	.669	.425	.108	.017	.401	.013	<u>.818</u>

Table 2 Cross loadings from the confirmatory factor analysis with pilot 75 samples						
	Learn	Passion	EKSource	IKShare	OCB- Help	PsychS
Learn01	0.915	0.576	0.247	0.628	0.410	0.422
Learn02	0.939	0.589	0.253	0.680	0.465	0.433
Learn03	0.919	0.526	0.328	0.658	0.455	0.378
Learn04	0.939	0.643	0.282	0.673	0.429	0.369
Learn05	0.889	0.582	0.369	0.605	0.429	0.351
Passion01	0.734	0.845	0.334	0.554	0.426	0.280
Passion02	0.467	0.867	0.459	0.261	0.246	-0.024
Passion03	0.483	0.846	0.310	0.306	0.303	0.029
Passion04	0.565	0.849	0.424	0.360	0.397	0.150
Passion05	0.422	0.869	0.537	0.282	0.417	-0.019
ExKSourcing01	0.271	0.392	0.909	0.356	0.407	0.095
ExKSourcing02	0.316	0.468	0.961	0.368	0.466	0.016
ExKSourcing03	0.286	0.429	0.957	0.355	0.370	-0.003
ExKSourcing04	0.325	0.524	0.935	0.439	0.416	-0.030
InKSharing01	0.552	0.231	0.289	0.902	0.346	0.343
InKSharing02	0.683	0.447	0.450	0.948	0.395	0.353
InKSharing03	0.701	0.445	0.374	0.975	0.414	0.407
InKSharing04	0.707	0.436	0.405	0.953	0.473	0.404
Helping01	0.480	0.396	0.365	0.428	0.945	0.026
Helping02	0.445	0.413	0.406	0.386	0.969	-0.002
Helping03	0.468	0.466	0.451	0.379	0.955	0.047
Helping04	0.381	0.314	0.442	0.451	0.878	-0.032
PsyS01R	0.213	-0.101	-0.056	0.312	-0.046	0.810
PsyS03R	0.371	0.041	-0.006	0.348	0.011	0.841
PsyS05R	0.452	0.323	0.102	0.322	0.065	0.803

We re-investigated the operationalization of items to see if their operational definitions are similar to each other, but the items of these three variables clearly measure different constructs. However, we found that these three variables (individual learning outcomes, passion, and internal knowledge sharing) are located closely in the pilot survey questionnaire sheets, which may cause an unnecessary correlation among the items of these three constructs. Therefore, on the actual questionnaire sheet that is distributed for data gathering, we placed the items of the dependent variable far from the items of passion and individual learning (by measuring the individual learning outcome first and measuring the other variables on different pages, which prevented these latent variables from having too much correlation with each other.

Test for measurement model with actual samples (n=393)

Following the pretest, the changes made to the questionnaire (re-locating items for several latent variables), we ran measurement model test with actual larger samples (n=393). In order to see if the problem of convergent and discriminant validity found in the pre-test has been resolved by re-locating survey items for individual learning on the first page (far from internal knowledge sharing and passion), we conducted a confirmatory factor analysis with actual samples (n=393). Table 3 and Table 4 demonstrate that the problem of validity issues has been resolved.

Table 3 Latent variable correlation and measurement model test with actual 393 samples (The bolded and underlined numbers are the square roots of Average Variance Extracted)									
	Cron-bach's Alpha	Comp-osite Rel.	AVE	1	2	3	4	5	6
1.Learn	.952	.963	.838	<u>.915</u>					
2.Passion	.947	.960	.826	.697	<u>.909</u>				
3.Ext-KS	.894	.926	.758	.172	.259	<u>.871</u>			
4.Int-KS	.956	.968	.882	.574	.560	.215	<u>.939</u>		
5.Help	.947	.962	.863	.515	.576	.253	.644	<u>.929</u>	
6.PsychS	.883	.925	.804	.216	.091	-.088	.304	.205	<u>.897</u>

Table 4 Cross loadings from the confirmatory factor analysis with actual 393 samples						
	Learn	Passion	EKSource	IKShare	OCB- Help	PsychS
Learn01	0.929	0.610	0.158	0.511	0.448	0.211
Learn02	0.938	0.638	0.167	0.528	0.471	0.223
Learn03	0.882	0.600	0.195	0.494	0.450	0.181
Learn04	0.926	0.645	0.138	0.535	0.481	0.155
Learn05	0.901	0.689	0.132	0.554	0.504	0.215
Passion01	0.698	0.882	0.210	0.537	0.530	0.198
Passion02	0.591	0.918	0.212	0.447	0.479	0.042
Passion03	0.623	0.918	0.247	0.524	0.512	0.079
Passion04	0.667	0.927	0.261	0.566	0.574	0.071
Passion05	0.575	0.899	0.244	0.454	0.513	0.013
ExKSourcing01	0.165	0.212	0.857	0.189	0.209	-0.010
ExKSourcing02	0.193	0.261	0.905	0.213	0.222	-0.094
ExKSourcing03	0.124	0.199	0.864	0.177	0.231	-0.082
ExKSourcing04	0.099	0.221	0.855	0.163	0.223	-0.121
InKSharing01	0.576	0.532	0.230	0.935	0.578	0.273
InKSharing02	0.545	0.544	0.188	0.936	0.601	0.268
InKSharing03	0.498	0.507	0.188	0.950	0.615	0.287
InKSharing04	0.533	0.519	0.200	0.937	0.629	0.317
Helping01	0.485	0.519	0.226	0.622	0.919	0.210
Helping02	0.465	0.511	0.221	0.576	0.929	0.187
Helping03	0.479	0.543	0.253	0.599	0.934	0.183
Helping04	0.484	0.565	0.241	0.596	0.934	0.183
PsyS01R	0.155	0.020	-0.087	0.230	0.140	0.869
PsyS03R	0.164	0.031	-0.099	0.257	0.151	0.903
PsyS05R	0.237	0.152	-0.061	0.312	0.233	0.917

In Table 4, all standardized item loadings of six constructs are above 0.707, meaning that more than half of the variance is captured by the constructs,

and the reflective items are unidimensional, representing their associated latent variables. Then, in Table 3, the composite reliability and average variance extracted (AVE) exceed the acceptable levels of 0.7 or higher (Chin 1998; Yi and Davis 2003) and 0.5 or higher (Fornell and Larcker 1981), respectively, which ensures adequate convergent validity for all constructs.

Discriminant validity can be first assessed by investigating the cross loadings in Table 4. The cross loadings show that all indicators have higher loadings on their own construct than any other construct and there is no cross-loading between an item and other (i.e. not its own) latent variable that exceed the value of 0.7. Also, the square root values of the AVE of each construct are larger than its correlation with other factors (latent variables) (Gefen, Straub, and Boudreau 2000), which also ensures discriminant validity.

Test for common method bias

As all survey data were self-reported in a cross-sectional setting, there is a potential threat of common method biases (e.g. due to consistency motif) (Podsakoff, MacKenzie, Lee, and Podsakoff 2003). We performed two statistical analyses to address this issue; 1) Harman's single-factor test and 2) the inclusion of common method factor in the structural model (Liang, Saraf, Hu, and Xue 2007; Podsakoff and Organ 1986; Podsakoff et al. 2003).

First, we conducted Harman's one-factor test by including all items in a principal components analysis (without rotation). The threat of common method bias is high if only a single factor emerges and the single factor accounts for more than the majority of the covariance (Podsakoff et al. 2003). The result of this test

showed that six factors (eigenvalues > 1) are emerged (the same number of factors in our research model) and the most covariance explained by one factor is 44.38 percent, indicating that common method bias is not likely to be a major problem to our structural model.

Table 5 Common Method Bias Analysis					
Construct	Indicator	Substantive Factor Loading (R1)	R1 ²	Common Method Factor Loading (R2)	R2 ²
Learning	Learn01	0.882	0.778	0.816	0.665
	Learn02	0.917	0.842	0.740	0.547
	Learn03	0.918	0.843	0.780	0.608
	Learn04	0.927	0.859	0.823	0.677
	Learn05	0.899	0.807	0.734	0.538
Indi Passion	IPSN01	0.857	0.734	0.265	0.070
	IPSN02	0.905	0.819	0.297	0.088
	IPSN03	0.864	0.747	0.238	0.056
	IPSN04	0.855	0.731	0.226	0.051
	IPSN05	0.934	0.873	0.753	0.568
Ext K-Sourcing	EXTKS01	0.935	0.875	0.744	0.554
	EXTKS02	0.950	0.903	0.719	0.516
	EXTKS03	0.937	0.878	0.740	0.548
	EXTKS04	0.918	0.844	0.702	0.492
Int K-Sharing	INTKS01	0.929	0.863	0.681	0.464
	INTKS02	0.934	0.873	0.704	0.496
	INTKS03	0.933	0.871	0.712	0.506
	INTKS04	0.878	0.771	0.193	0.037
OCB-Helping	HELP01	0.912	0.832	0.210	0.044
	HELP02	0.905	0.819	0.308	0.095
	HELP03	0.931	0.866	0.813	0.662
	HELP04	0.939	0.882	0.834	0.696
Psych Safety	PSYS01R	0.882	0.778	0.785	0.616
	PSYS03R	0.926	0.857	0.828	0.686
	PSYS05R	0.898	0.806	0.839	0.705
Mean		0.911	0.830	0.619	0.439

Second, we included a ‘common method factor’, which is reflectively measured by all 25 items in our structural model and calculated each indicator’s variance explained substantively by its own factor and also by the common

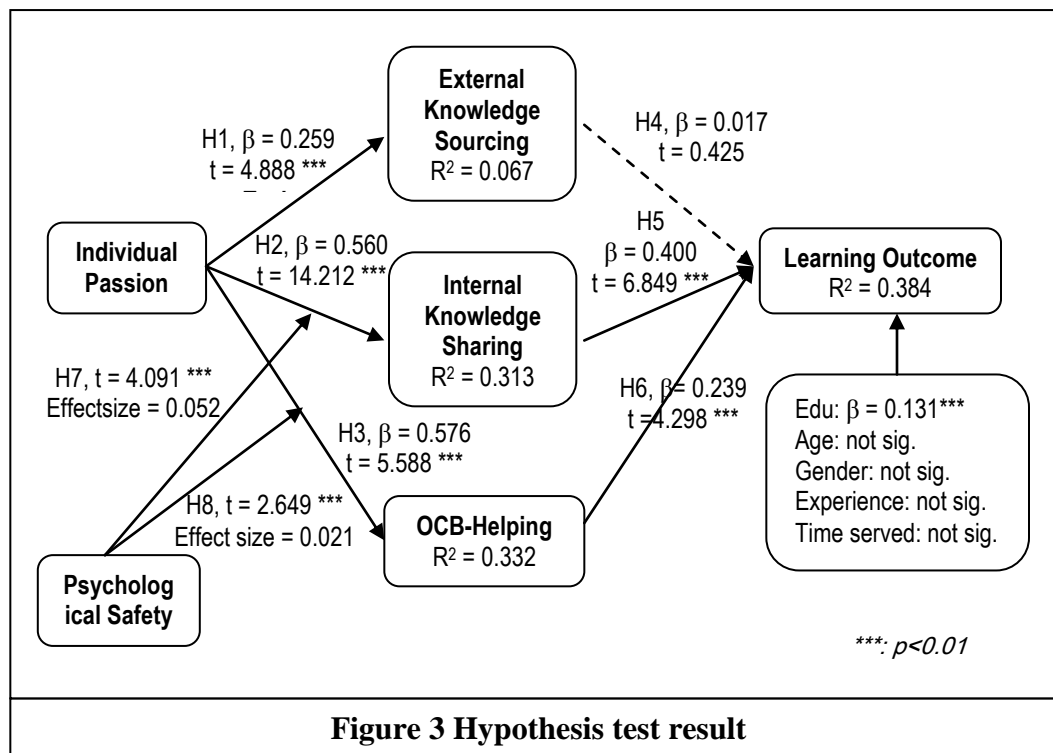
method factor. Table 5 shows that the magnitude of variance explained by common method factor (R^2) is relatively smaller than that of substantively explained variance (by each indicator's own factors) (R^2). The average substantive variance of each indicator by its own factor (83%) is much greater than the average variance explained by the common method factor (43.9%). As a result, these two tests combined indicate that common method is not likely to be a serious problem for this study.

Structural model testing result

To test our hypothesized model, we used Partial Least Squares (PLS) analysis with SmartPLS (Ringle, Wende, and Will 2005). PLS analysis is chosen because we have a multi-path research model. In addition, the data for this study contain non-normal data, and PLS analysis also supports testing moderation effects (Chin, 1998; Chin, Marcolin, and Newsted 2003). Analyzing the explained variance of endogenous variables (R^2), path-coefficients (β), and their level of significance allows us to test hypotheses 1 to 6. A bootstrapping with re-sampling method (600 re-samples > sample size) was used to obtain t-values for the level of significance (Chin 1998). Figure 3 illustrates the structural path coefficient estimates with t-statistics and R^2 for the structural model.

In figure 3, hypotheses 1, 2, 3, 5, and 6 were supported at the $\alpha=.01$ level, while hypothesis 4 was not supported. In the context of the knowledge team as a learning environment, an individual's passion about his/her team activity was positively associated with *his/her external knowledge sourcing behavior* (H1, $\alpha=.01$ level, $\beta = 0.257$), *internal knowledge sharing behavior* (H2, $\alpha=.01$ level, β

= 0.559), and *OCB-helping behavior* (H3, $\alpha=.01$ level, $\beta = 0.577$). While the degree of individuals' *internal knowledge sharing behavior* (H5, $\alpha=.01$ level, $\beta = 0.395$) and the degree of *helping other members within knowledge teams* (H6, $\alpha=.01$ level, $\beta = 0.223$) significantly influenced individual learning outcomes, the degree of *external knowledge sourcing* (H4) did not influence individual learning from knowledge teams. This means that in the context of our focal knowledge teams, the participants of knowledge teams learn better by sharing knowledge and helping others within knowledge teams. External knowledge sourcing can be done because they should fulfill their tasks for knowledge teams, but this might not be significantly related to their learning in the context of the focal knowledge teams of this study.



Among the control variables, only *the level of education* was significantly associated with learning outcomes, while the other four control variables were not significant. Overall, approximately 38.4% of the variance in the individual learning outcome was explained by our research model.

Hypotheses 7 and 8 on the moderation effect of an individual's perceived psychological safety on the relationship between passion about team activities and internal knowledge sharing (H7) or OCB-helping (H8) were tested following the steps taken in Chin et al. (2003).

First, hypothesis 7 was tested by calculating the effect size of the moderation of perceived psychological safety. The effect size of H7 is calculated with the R^2 's of the two models: 1) one with both the moderating variable (as an independent variable) and the interaction term (moderator x main effect variable) on the predicted variable ($R^2_{\text{with interaction}} = 0.409$); and 2) the other with the moderating variable as an independent variable on the predicted variable ($R^2_{\text{without interaction}} = 0.378$) in the PLS model (Chin et al. 2003). The effect size was 0.052, which is considered as medium moderating effect (Henseler and Fassott 2010). Further, the impact of the interaction term on internal knowledge sharing in the PLS model was significant at the $\alpha = .01$ level ($t = 4.091$), which also implies that there is a significant moderation impact of perceived psychological safety on the relationship between passion and internal knowledge sharing behavior. Hypothesis 7 was supported.

Second, the effect size of the moderation effect of perceived psychological safety on the relationship between passion and OCB-helping was calculated as

0.021 in the same manner ($R^2_{\text{with interaction}} = 0.368$ and $R^2_{\text{without interaction}} = 0.355$), which is a small, but not negligible effect size (Henseler and Fassott 2010), and the impact of the interaction term on OCB-helping in the PLS model was also significant at the $\alpha=.01$ level ($t = 2.649$), which implies that there is a significant moderation impact of psychological safety on the relationship between passion and OCB-helping behavior. Hypothesis 8 was supported. We may interpret these results as follows: in knowledge team environments, if a participant who is passionate about team activities feels psychologically safe to express her/his own opinions and make mistakes, s/he will tend to spend more time and effort in sharing her/his knowledge with other members and helping others.

Discussion

Contributions

This study aims to develop and test a model of the role of individuals' passion about knowledge team activities on their learning. With the perspective of informal learning in a team environment (Alavi et al. 2002) and the theoretical framework of learning under group environment (Webb 1982), this study proposes that in knowledge teams, individual participants' passion about their team activities positively influences their behavior of sourcing knowledge from external knowledge sources, sharing knowledge within teams, and helping other members within teams, which lead to their learning outcomes, while individuals' psychological safety improves the impact of passion on internal behaviors within teams (internal knowledge sharing and helping).

The results of this empirical study contribute to the literature in several ways. First, broadly, we investigate the role of passion in the area of the knowledge management field. Passion has been studied frequently in the field of entrepreneurship and has explained the variance of the success of entrepreneurs (Cardon et al. 2009; Chen et al. 2009). However, passion has not been studied much in the field of knowledge management, although it is often mentioned that passion is important in knowledge collaboration (Faraj, Jarvenpaa, and Majchrzak 2011). Since this study found that passion is an important input for individuals' knowledge management behaviors, it contributes to the field of knowledge management. More specifically, we introduced passion in the context of organizational teams and argued that it is an important psychological input for individual learning behaviors. The literature on individual learning behaviors has focused on various antecedents of knowledge sharing and knowledge sourcing under team or community environments, such as reciprocity (Bock et al. 2005), trust (Chowdhury 2005), cooperativeness (Lin 2007) and commitment (van den Hooff and van Weenen 2004) for knowledge sharing, and learning orientation (Gray and Meister 2004) and technical competency (Tushman and Scanlan 1981) for external knowledge sharing. We found and tested *the role of an individual's passion about his/her team activities* as an important psychological antecedent for knowledge sharing within teams and knowledge sourcing from external sources (or one of boundary spanning activities); as a result, we contribute to the field of knowledge management in team contexts. Especially for external knowledge sourcing, the result of this study suggests that there is a psychological factor for

knowledge sourcing other than the cognitive requirement of individuals (Gray and Meister 2004; Tushman and Scanlan 1981).

Second, OCB-helping behavior is one of the most important individual behaviors required in team environments for successful team outcomes (Van Dyne and LePine 1998). We believe that such helping should be more important under team contexts where an individual's active participation is not strictly mandated, because when members of a team help each other doing their team tasks, the outcome of a team should be improved in a more voluntary setting (Ng and van Dyne 2005). In this paper, we suggest that in knowledge team environments, passion should make a difference in an individual's active interaction with other team members for success, including an individual's voluntary behavior in helping others. Our empirical test result (an individual's passion about team activities explains 33% of the variance in OCB helping) suggests that passion should be an important antecedent for OCB-helping, in addition to the previously suggested psychological antecedents for OCB-helping behavior (e.g., job satisfaction, organizational commitment, trust in leaders, etc.) (Podsakoff, MacKenzie, Paine, Bachrach 2000).

Third, we also found that sharing (exchanging) knowledge and helping others under knowledge team contexts should improve individual learning. Because knowledge sharing is a kind of learning behavior, it is not surprising that it is positively associated with an individual's learning outcomes. However, the significant relationship between OCB-helping and an individual's learning outcomes suggests that in the context of knowledge teams, where members are

from diverse backgrounds, individuals' behaviors of helping others (help-giving) expose them to other members' tasks, experiences, and various perspectives so that it improves their informal learning from interaction with others. Also, the significant impact of knowledge sharing and helping within a knowledge team on learning outcomes re-confirms the notion of learning from a community of practice, which posits that individual learning is situated in one practice and results from participating in communities of practitioners (Lave and Wenger 1991).

Finally, psychological safety has been said to be a key factor for an individual's learning. As previously mentioned, we admit that psychological safety should have a direct impact on learning behavior (Edmondson 1999). However, the significant impact of the interaction terms (psychological safety x passion) on internal knowledge sharing and helping behaviors implies that in the knowledge team context, an individual who is passionate about her/his team activity will make more of an effort to share knowledge with and help other members if s/he feels that s/he is safe enough to make mistakes or take interpersonal risks while participating in team activities. This finding, on top of the direct relationship between psychological safety and learning, will make an extra contribution to the topic of the relationship between psychological safety and learning.

The results of this study may help general managers who facilitate knowledge team activities (as their employees' non-routine tasks) understand how to facilitate this type of team in order to improve employees' learning in a number of ways.

First, this study implies that an individual's passionate participation in the types of knowledge teams should be encouraged not only for the firm to achieve the best possible outcomes from facilitating these types of teams, but also for the individual participants to learn something that cannot be achieved from their routine tasks. The value of interaction with other members and the role of an individual's passion about his/her team activity on learning outcomes from team environments are found from the results of this study. Depending on how much an individual loves his/her work and has enthusiasm about his/her tasks in knowledge teams, his/her takeaways from participating in knowledge teams should be different.

Second, for the leaders of knowledge teams, they should keep in mind that providing a psychologically safe environment for members' interaction among one another should actually help passionate members engage in sharing knowledge with and helping others, which eventually helps their team members learn more from participating in knowledge team activities.

Limitations

There are several limitations of this study. First of all, this study is tested in one company with a homogenous group of respondents in terms of their job functions and even gender (a high proportion of female participants). Thus, the results might not be generalizable over the context of the field of this study. Future research should be conducted in other research fields with more heterogeneous groups to see if individuals' passion positively influences learning behaviors and outcomes.

Second, the insignificant relationship between external knowledge sourcing and learning could be due to the fact that the focal team members in the knowledge teams of this research field (a large-sized educational company) learn much more from interaction with others than from external sources. Or, there could be some contingent variable (or moderating factor) for the relationship between external knowledge sourcing and an individual's learning, such as task characteristics or an individual's role in knowledge teams. Thus, it would be worthwhile for future research to investigate the role of task characteristics or the role of knowledge teams on the relationship between external knowledge sourcing and an individual's learning outcomes.

Third, the self-reported data may have the risk of common method bias. In order to prevent this type of bias, when we administered the survey, we asked about the dependent variable first. Then we asked some survey questions that were not included in this study, and then asked about the independent and mediating variables, so that there was a time gap between the answers concerning the dependent variables and the independent/mediating/moderating variables. Also, the discriminant validity test in the confirmatory factor analysis implies that the constructs were distinct from one another.

Finally, the cross-sectional survey design may prohibit the conclusion of causality. That is, although this study hypothesizes that individuals' passion influences knowledge sourcing and sharing and helping behaviors, it is likely that knowledge sourcing and sharing and helping behaviors may affect individuals' passion regarding team activity. Although learning was measured near the end of

the team tenure, and the other variables were measured retrospectively in the absence of longitudinal data, we can only conclude that the significant relationships could be associative, and not causal. Therefore, future research should take a longitudinal research approach on how individuals' passion can increase their learning and helping behaviors, and eventually, how those interaction behaviors may improve their level of knowledge (learning outcomes).

Conclusion

Employees' learning has been one of the most important issues in organizations, and actually many companies spend a great deal of resource improving the learning of employees with various educational tools, such as formal educational sessions, e-learning tools, etc. However, organizational members actually obtain much knowledge by working on their own tasks and by interacting with the members from their organization (e.g., team members). This study presents the role of passion on team-level knowledge management and helping behaviors and individuals' informal learning from participating in knowledge teams, which is formed by diversified members from different parts of an organization. The findings of this study now only provide empirical support for the notion that individuals' internal knowledge sharing and helping behaviors with other team members facilitate individual learning, but also advance the theory of individual learning by highlighting the role of passion as an important antecedent for an individual's learning and helping behaviors.

Appendix 1 Survey items

1. Dependent variable: individual learning outcome

Please indicate the extent to which you agree or disagree with each statement below, on a scale of 1(strongly disagree) to 7 (strongly agree).My experience from participating in this team
made me more comfortable in doing similar activities.
made me more competent with similar activities.
made me spend less effort on participating in similar activities.
increased my confidence in my ability to deal with similar activities.
made me a better member of this company.

2. Individual passion about team activity

Please indicate the extent to which you agree or disagree with each statement below, on a scale of 1(strongly disagree) to 7 (strongly agree). During the period of this team...
I loved my activities in this team.
I was looking forward to doing my team activities when I was away from them.
I derived my life satisfaction from doing my team activities.
I accomplished a lot in this team because I loved the activities of the team.
There were the times where I wished that I could be at my team when I was not.

3. External knowledge seeking

Please indicate the extent to which you did each of knowledge <u>seeking</u> activities listed below (with knowledge sources <u>external to</u> your team), on a scale of 1(not at all) to 7 (to a great extent).
seeking ideas/expertise related to our team activities
reviewing our team activities
obtaining help or advice related to our team activities
seeking feedback related to our team activities

4. Internal knowledge sharing

Please indicate the extent to which you did each of knowledge <u>sharing</u> activities listed below (with knowledge sources <u>within</u> your team), on a scale of 1(not at all) to 7 (to a great extent).
sharing ideas/expertise related to the team activities
reviewing the team activities
sharing advice related to the team activities
sharing feedback related to team activities

5. Organizational citizenship behavior (Helping)

Please indicate the extent to which you did each of the activities listed below, on a scale of 1(not at all) to 7 (to a great extent).
--

helping orient other members in this team
assisting other members in this team with their activities for the benefit of the team
helping other members in this team learn from their activities
helping other members in this team with their responsibilities related to their team activities

6. Psychological safety (reversed)

Please indicate the extent to which you agree or disagree with each statement below, on a scale of 1(strongly disagree) to 7 (strongly agree).
If I made a mistake in this team, our team members would often hold it against me. (R)
Our team members sometimes rejected others for being different. (R)
It was difficult to ask other members of this team for help. (R)

References

- Alavi, M., Marakas, G. M., and Yoo, Y. "A comparative study of distributed learning environments on learning outcomes," *Information Systems Journal* (13:4) 2002, pp 404-415.
- Allen, T. J. *Managing the flow of technology: Technology transfer and the dissemination of technological information within the R&D organization*, MIT Press, Cambridge, MA, 1977.
- Ancona, D. "Outward bound: Strategies for team survival in an organization," *Academy of Management Journal* (33) 1990, pp 334-365.
- Ancona, D. G., and Caldwell, D. F. "Bridging the boundary: External activity and performance in organizational teams," *Administrative Science Quarterly* (37) 1992, pp 634-665.
- Ang, S., Van Dyne, L., and Begley, T. M. "The employment relationships of foreign workers versus local employees: A field study of organizational justice, job satisfaction, performance, and OCB," *Journal of Organizational Behavior* (24:5) 2003, pp 561-583.
- Ashforth, B. E., and Mael, F. "Social Identity Theory and the organization," *Academy of Management Review* (14:1) 1989, pp 20-39.
- Ausubel, D. P. *Educational Psychology: A cognitive view*, New York, 1968.
- Bakker, R. M. "Taking stock of temporary organizational forms: A systematic review and research agenda " *International Journal of Management Reviews* (12) 2010, pp 466-486.
- Baron, R. A. "The role of affect in the entrepreneurial process," *Academy of Management Review* (33) 2008, pp 328-340.
- Baum, J. R., and Locke, E. A. "The relationship of entrepreneurial traits, skill, and motivation to subsequent venture growth," *Journal of Applied Psychology* (89:4) 2004, pp 587-598.
- Beise, C., Carte, T., Vician, C., and Chidambaram, L. "A case study of project management practices in virtual settings: Lessons from working in and managing virtual teams," *The Data Base for Advances in Information Systems* (41:4) 2010, pp 75-97.
- Bock, G. W., Zmud, R. W., Kim, Y. G., and Lee, J. N. "Behavioral intention formation in knowledge sharing: Examining the roles of extrinsic motivators, social-psychological forces, and organizational climate," *Mis Quarterly* (29:1) 2005, pp 87-111.
- Bresman, H. "External learning activities and team performance: A multimethod field study," *Organization Science* (21:1) 2010, pp 81-96.
- Camacho, L. M., and Paulus, P. B. "The role of social anxiousness in group brainstorming," *Journal of Personality and Social Psychology* (68) 1995, pp 1071-1080.
- Campion, M. A., Medsker, G. J., and Higgs, A. C. "Relations between work group characteristics and effectiveness: Implications for designing effective work groups," *Personnel Psychology* (46) 1996, pp 823-850.

- Cardon, M. S., Wincent, J., Singh, J., and Drnovsek, M. "The nature and experience of entrepreneurial passion," *Academy of Management Review* (34:3) 2009, pp 511-532.
- Cardon, M. S., Zietsma, C., Saporito, P., Matherne, B., and Davis, C. "A tale of passion: New insights into entrepreneurship from a parenthood metaphor," *Journal of Business Venturing* (20) 2005, pp 23-45.
- Carlile, P. R. "Transferring, translating, and transforming: An integrative framework for managing knowledge across boundaries," *Organization Science* (15:5) 2004, pp 555-568.
- Chen, X., Yao, X., and Kotha, S. "Entrepreneur passion and preparedness in business plan presentations: A persuasion analysis of venture capitalists' funding decisions," *Academy of Management Journal* (199-214:52) 2009, p 1.
- Cheng, J. L. C. "Organizational Coordination, Uncertainty, and Performance: An Integrative Study," *Human Relations* (37) 1984, p 829.
- Chin, W. W. "The Partial Least Squares approach to structural equation modeling," in: *Modern methods for business research*, G.A. Marcoulides (ed.), Lawrence Erlbaum Associates, Mahwah, NJ, 1998.
- Chin, W. W., Marcolin, B. L., and Newsted, P. R. "A Partial Least Squares Latent Variable Modeling Approach for Measuring Interaction Effects: Results from a Monte Carlo Simulation Study and an Electronic-mail Emotion/Adoption Study," *Information Systems Research* (14:2), 2003, pp. 189-217.
- Chowdhury, S. "The Role of Affect- and Cognition-based Trust in Complex Knowledge Sharing," *Journal of Managerial Issues* (17:3) 2005, pp 310-326.
- Chua, T.M., Weira, B., and Wolfinger, R. "A systematic statistical linear modeling approach to oligonucleotide array experiments," *Mathematical Biosciences* (176:1) 2002, pp 35-51.
- Cronbach, L. *Essentials of psychological testing*, Harper and Row, New York, 1970.
- Cummings, J. N. "Work groups, structural diversity, and knowledge sharing in a global organization," *Management Science* (50:3) 2004, pp 352-364.
- Curtis, B., Krasner, H., and Iscoe, N. "A field Study of the Software Design Process for large Systems," *Communications of the ACM* (31:11) 1988, pp 1268-1287.
- Davenport, T. H., and Prusak, L. "Working knowledge," Harvard Business School Press, Boston, MA, 1998a.
- Diehl, M., and Stroebe, W. "Productivity loss in brainstorming groups: Toward the solution of a riddle," *Journal of Personality and Social Psychology* (53) 1987, pp 497-509.
- Edmondson, A. C. "Psychological safety and learning behavior in work teams," *Administrative Science Quarterly* (44) 1999, pp 350-383.
- Espinosa, J. A., Slaughter, S. A., Kraut, R. E., and Hersbsleb, J. D. "Familiarity, complexity, and team performance in geographically distributed software development," *Organization Science* (18:613-630) 2007.

- Faraj, S., Jarvenpaa, S. L., and Majchrzak, A. "Knowledge Collaboration in Online Communities," *Organization Science* (22:5) 2011, p 10
- Faraj, S., and Sproull, L. "Coordinating expertise in software development teams," *Management Science* (46:12) 2000, pp 1554 -1568.
- Faraj, S. and Sambamurthy, V. "Leadership of Information Systems Development Projects," *IEEE Transactions on Engineering Management* (53:2) 2006.
- Fornell, C., and Larcker, D. F. "Evaluating structural equation models with unobservable variables and measurement error," *Journal of Marketing Research* (18:1) 1981, pp 39-50.
- Gefen, D., Straub, D. W., and Boudreau, M. C. "Structural equation modeling and regression: guidelines for research practice," *Communications of the Association for Information Systems* (4:7) 2000.
- Glaser, R., and Bassok, M. "Learning theory and the study of instruction," *Annual Review of Psychology* (40:631-666) 1989.
- Goodman, R. A., and Goodman, L. P. "Some management issues in temporary systems: A study of professional development and manpower-the theater case," *Administrative Science Quarterly* (21:3) 1976, pp 494-501.
- Grawitch, M. J., Munz, D. C., Elliott, E. K., and Mathis, A. "Promoting creativity in temporary problem-solving groups: The effects of positive mood and autonomy in problem definition on idea-generating performance," *Group Dynamics: Theory, Research, and Practice* (7:3) 2003, pp 200-213.
- Gray, P. H., and Meister, D. B. "Knowledge sourcing effectiveness," *Management Science* (821-834:50) 2004, p 6.
- Gray, P. H., and Meister, D. B. "Knowledge sourcing methods," *Information & Management* (43) 2006, pp 142–156.
- Greeno, J. G. "Processes of learning and comprehension," in: *Knowledge and cognition*, L.W. Greg (ed.), Lawrence Erlbaum Associates, Hillsdale, NJ., 1974.
- Hagel, J. "Exploring passion – what kind of passion do you have?," in: *Edge Perspectives with John Hagel*, Permalink, 2012.
- Henseler, J., and Fassott, G. "Testing Moderating Effects in PLS Path Models: An Illustration of Available Procedures," in: *Handbook of Partial Least Squares*, Springer, Verlag Berlin Heidelberg, 2010, pp. 713-735.
- Janz, B. D., Colquitt, J. A., and Noe, R. A. "Knowledge worker team effectiveness: The role of autonomy, interdependence, team development, and contextual support variables," *Personnel Psychology* (50:4) 1997, pp 877 - 904.
- Kane, G. C., Majchrzak, A., Johnson, J., and Chen, G. "Theorizing perspective development in fluid online collectives," in: *Web 2.0 research workshop*, Boston: Boston College, 2009.
- Katz, R. "The effects of group longevity on project communication and performance," *Administrative Science Quarterly* (27) 1982, pp 81-104.
- Katz, R., and Allen, T. J. "Project Performance and the Locus of Influence in the R&D Matrix," *Academy of Management Journal* (28:1) 1985, pp 67-87.

- Katz-Navon, T., Naveh, E., and Stern, Z. "Active learning: When is more better? The case of resident physicians' medical errors," *Journal of Applied Psychology* (94:5) 2009, pp 1200-1209.
- Keller, R. "Predictors of the performance of project groups in R & D organizations," *Academy of Management Journal* (29) 1986, pp 715-726.
- Kirkman, B. L., and Rosen, B. "Beyond self-management: Antecedents and consequences of team empowerment," *Academy of Management Journal* (42:1) 1999, pp 58-74.
- Kraut, R., and Streeter, L. "Coordination in large scale software development," *Communications of the ACM* (38:3) 1995, pp 69-81.
- Kudaravalli, S. "Practices and strategies of distributed knowledge collaboration," in: *Department of decisions & information technologies*, University of Maryland, College Park, 2010, p. 150.
- LePine, J. A., Erez, A., & Johnson, D. E. "The nature and dimensionality of organizational citizenship behavior: a critical review and meta-analysis," *Journal of Applied Psychology* (87) 2002, pp 52-65.
- Lave, J., and Wenger, E. *Situated learning: Legitimate peripheral participation*, Cambridge University Press, Cambridge, UK, 1991.
- Levitt, B., and March, J. G. "Organizational learning," *Annual Review of Sociology* (14) 1988, pp 319-340.
- Liang, H., Saraf, N., Hu, Q., and Xue, Y. "Assimilation of enterprise systems: The effect of institutional pressures and the mediating role of top management," *MIS Quarterly* (31:1), 2007, pp 59-87.
- Lin, C.-P. "To Share or Not to Share: Modeling Tacit Knowledge Sharing, Its Mediators and Antecedents," *Journal of Business Ethics* (70:4) 2007, pp 411-428.
- Lindkvist, L. "Knowledge communities and knowledge collectivities: A typology of knowledge work in groups," *Journal of Management Studies* (42:6) 2005, pp 1189 - 1210.
- Madhavan, R., and Grover, R. "From Embedded Knowledge to Embodied Knowledge: New Product Development as Knowledge Management," *Journal of Marketing* (62:4) 1998, pp 1-12.
- Meyerson, D., Weick, K. E., and Kramer, R. M. "Swift trust and temporary groups," in: *Trust in organizations: Frontiers of theory and research*, R.M. Kramer and T.R. Tyler (eds.), Sage Publications, Thousand Oaks, CA, 1996, pp. 166-195.
- Morris, M. W., and Keltner, D. "How emotions work: The social functions of emotional expression in negotiations," *Research in Organizational Behavior* (22) 2000, pp 1-50.
- Narayanan, S., Balasubramanian, S., and Swaminathan, J. M. "A matter of balance: specialization, task variety, and individual learning in a software maintenance environment," *Management Science* (55:11) 2009, pp 1861-1876.
- Nembhard, I. M., and Edmondson, A. C. "Making it safe: the effects of leader inclusiveness and professional status on psychological safety and

- improvement efforts in health care teams," *Journal of Organizational Behavior* (27:7) 2006, pp 941-966.
- Ng, K. Y., and Van Dyne, L. "Antecedents and Performance Consequences of Helping Behavior in Work Groups : A Multilevel Analysis," *Group Organization Management* (30:5) 2005, pp 514-540.
- Orr, J. M., Sackem, P. R., and Dubois, C. L. Z. "Outlier Detection and Treatment in I/O Psychology: A Survey of Researcher Beliefs and an Empirical Illustration," *Personal Psychology* (44) 1999, pp 473-486.
- Podsakoff, P.M., MacKenzie, S.B., Lee, J.Y., and Podsakoff, N.P. "Common method biases in behavioral research: A critical review of the literature and recommended remedies," *Journal of Applied Psychology* (88:5) 2003, pp 879-903.
- Podsakoff, P.M., MacKenzie, S.B., Paine, J.B. and Bachrach, D.G. (2000), "Organization citizenship behaviors: a critical review of the theoretical and empirical literature and suggestions for future research", *Journal of Management*, Vol. 26, pp. 513-63.
- Podsakoff, P.M., and Organ, D.W. "Self-reports in organizational research: Problems and prospects," *Journal of Management*, (12:4) 1986, pp 531-544.
- Putnam, L. L. "Rethinking the nature of groups in organizations," in: *Small group communication: A reader* R.S. Cathcart and L.A. Samovar (eds.), William C Brown, Dubuque, IA, 1992, pp. 57-66.
- Rafaeli, A., and Sutton, R. I. "Emotional contrast strategies as means of social influence: Lessons from criminal interrogators and bill collectors.," *Academy of Management Journal* (34) 1991, pp 749-775.
- Reagans, R., Argote, L., and Brooks, D. "Individual experience and experience working together: Predicting learning rates from knowing who knows what and knowing how to work together," *Management Science* (51:6) 2005, pp 869-881.
- Ringle, C. M., Wende, S., and Will, A. SmartPLS SmartPLS, Hamburg, Germany, 2005.
- Rulke, D. L., Zaheer, S., and Anderson, M. H. "Sources of managers' knowledge of organizational capabilities," *Organizational Behavior and Human Decision Processes* (82) 2000, pp 134-149.
- Ryu, C., Kim, Y. J., Chaudhury, A., and Rao, H. R. "Knowledge acquisition via three learning processes in enterprise information portals: Learning-by-investment, learning-by-doing, and learning-from-others," *MIS Quarterly* (29:2) 2006, pp 245-278.
- Saunders, C. S., and Ahuja, M. K. "Are all distributed teams the same? Differentiating between temporary and ongoing distributed teams," *Small Group Research* (37:6) 2006, pp 662-700.
- Schilling, M. A., Ployhart, R. E., Vidal, P., and Marangoni, A. "Learning by doing something else: Variation, relatedness, and organizational learning," *Management Science* (49:1) 2003, pp 39-56.

- Shumate, M., Ibrahim, R., and Levitt, R. "Dynamic information retrieval and allocation flows in project teams with discontinuous membership," *European J. International Management* (4:6) 2010.
- Sie, L., and Yakhlef, A. "Passion and expertise knowledge transfer," *Journal of Knowledge Management* (13:4) 2009, pp 175-186.
- Smilor, R. W. "Entrepreneurship: Reflections on a subversive activity," *Journal of Business Venturing* (12) 1997, pp 341-346.
- Thompson, J. D. *Organizations in action* McGraw-Hill, New York, 1967.
- Tucker, A. L., Nembhard, I. M., and Edmondson, A. C. "Implementing new practices: An empirical study of organizational learning in hospital intensive care units," *Management Science* (53:6) 2007, pp 894-907.
- Tushman, M. L. "Work characteristics and subunit communication structure: A contingency analysis," *Administrative Science Quarterly* (24:1) 1979, pp 82-98.
- Tushman, M. L. and Scanlan, T. J. "Boundary Spanning Individuals: Their Role in Information Transfer and Their Antecedents," *Academy of Management Journal* (24:2) 1981, pp 289-305.
- Vallerand, R. J., Blanchard, C., Mageau, G. A., Koestner, R., Ratelle, C., Léonard, M., Gagné, M., and Marsolais, J. "Les passions de l'âme: On obsessive and harmonious passion," *Journal of Personality and Social Psychology* (85) 2003, pp 756-767.
- Van den Hooff, B., and Van Weenen, F. d. L. "Committed to share: commitment and CMC use as antecedents of knowledge sharing," *Knowledge and Process Management* (11:1) 2004, pp 13-24.
- Van Dyne, L., and LePine, J. A. "Helping and voice extra-role behaviors: Evidence of construct and predictive validity," *Academy of Management Journal* (41:1) 1998, pp 108-119.
- Webb, N. M. "Student interaction and learning in small groups," *Review of Educational Research* (52:3) 1982, pp 421-445.
- Wellins, R. S., Wilson, R., Katz, A. J., Laughlin, P., Day, C. R., and Price, D. *Self-directed teams: A study of current practice*, DDI, Pittsburgh, PA, 1990.
- Williams, L. J., and Anderson, S. E. "Job satisfaction and organizational commitment as predictors of organizational citizenship and in-role behaviors," *Journal of Management* (17) 1991, p 601.
- Winnen, C. J. "To be or not to be: The role of passion and obsession in the entrepreneurial process," in: *Unpublished doctoral dissertation*, University of St. Thomas, St. Paul, 2005.
- Wong, S.-S. "Distal and local group learning: Performance trade-offs and tensions," *Organization Science* (15:6) 2004, pp 645-656.
- Woolley, A. W. "Putting first things first: Outcome and process focus in knowledge work teams," *Journal of Organizational Behavior* (30) 2009, pp 427-452.
- Yi, M. Y., and Davis, F. D. "Developing and validating an observational learning model of vcomputer software training and skill acquisition," *Information Systems Research* (14:2) 2003, pp 146-169.

Zimmer, J. C., Henry, R. M., and Butler, B. S. "Determinants of the use of relational and nonrelational information sources," *Journal of Management Information Systems* (24:3) 2007, pp 297-331.

Chapter 5 – Synthesis

Synthesis of the Dissertation

For many years, knowledge teams have been an important organizational form for new knowledge creation. Although not specifically labelled as knowledge teams, others such as research and development (R&D) teams, project teams, and new product development (NPD) teams have been used in organizations; and have captured the interest of many academic researchers. By using knowledge teams, many organizations can create new knowledge (which is embedded in the outcomes of knowledge teams) by combining the expertise of different parts of organizations. Numerous studies have investigated and integrated the impact of inputs, processes, and contextual and external factors on various aspects of knowledge team performance (Campion et al. 1993; Guzzo and Dickson 1996). Although *team creativity* and *individual members' learning* in knowledge teams are as important aspects of team performance measures as *effectiveness and efficiency*, more effort is still needed to explore new phenomena on team creativity and team members' learning in knowledge teams. Additionally, more effort is required to integrate the findings of creativity and learning in knowledge team environments in the extant literature.

My goal of this dissertation is to contribute to the body of knowledge on team creativity, individual learning, and the broad topic of knowledge management in team contexts, by writing three essays 1) that integrate current findings on team creativity and individual learning in knowledge team environments and 2) that propose and empirically test the role of passion on these

two outcomes through team knowledge processes (or through individuals' learning and helping behaviors). These three essays provide an integrated view of the current body of knowledge on team creativity and individuals' learning in knowledge team environments and also new insights about how to achieve successful team creativity and individual learning outcomes with team members' passionate participation in knowledge team activities. The next paragraphs provide brief summaries of each essay, followed by the overall contribution of this dissertation and suggestions for future research topics.

Essay I: A literature review on team creativity and individual learning

In the first essay (Chapter 2), literature on knowledge team creativity and individual learning under knowledge teams is reviewed to identify key properties of knowledge teams and integrate the empirical findings on the antecedents of team creativity and individual learning in knowledge teams. In part 1, I have proposed the characteristics of knowledge teams in terms of 1) team tasks, 2) team structure, and 3) team processes. Briefly, knowledge teams are formed by *diverse* members from *different areas of expertise* and work on *complex, open-ended, non-routine, and interdependent tasks*, under an *informal and less-hierarchical* team structure during a *limited time period* (i.e., held-temporarily). Team *communication and coordination* are important aspects of team processes for outcomes, and teams rely on *both f2f and ICT (Information Communication Technologies) for collaboration*. In part 2-1, forty four (44) empirical studies were reviewed to integrate the antecedents of knowledge team creativity. These antecedents are classified into team inputs (cognitive, psychological, and

structural inputs), team processes (internal interaction, knowledge management processes, tactical processes, conflict, and coordination), and external influences. In part 2-2, fourteen (14) empirical studies were reviewed to integrate the antecedents of individuals' learning outcomes in knowledge team contexts. The antecedents are classified into individual inputs (cognitive and psychological inputs), behaviors (internal and external learning behaviors), and external influences (team environment, technology support, and task characteristics). In part 3, based on the findings from the literature review, we have suggested several topics for future research.

Essay II: The role of shared team passion and expertise on team creativity

The goal of this study is to propose and test a research model on the impact of shared team passion and team expertise on team knowledge processes and team creativity. Based on Woodman et al. (1993)'s *input-process-output (with contextual factors)* research framework, we propose the roles of a team's psychological and cognitive inputs (passion and expertise), shared norms of ICT use, team knowledge processes, and team tasks characteristics on knowledge team creativity.

Team-level survey data (77 knowledge teams out of 163 targeted teams) were collected from knowledge teams at a large firm operating in the educational service industry in South Korea, and the data were analyzed using Partial Least Squares (PLS) analysis with SmartPLS (Ringle, Wende, and Will, 2005). We found that shared team passion is positively associated with both external knowledge sourcing and internal knowledge sharing processes, while team

expertise is positively associated with internal knowledge sharing. Both team knowledge processes (external sourcing and internal sharing), in turn, influence team creativity (rated by a senior manager who oversees all knowledge teams in this company). A post-hoc test to see the direct impact of team inputs (shared team passion and team expertise) on team creativity shows no significant relationship between shared team passion and team creativity, and between team expertise and team creativity. It is also found that shared norms of ICT use positively moderate the relationship between passion and external knowledge sourcing, and that explorative team tasks positively moderate that relationship between external knowledge sharing and team creativity.

The results of this study imply that shared team passion and team expertise are important team inputs that facilitate team knowledge processes, which in turn, enhance the creativity of team outcomes. The results also suggest that building shared norms on how to use ICT for team collaboration helps passionate team members find useful knowledge from external knowledge sources. Having more explorative tasks for team outcomes boosts the impact of external knowledge sourcing on team creativity.

Essay III: The impact of individual passion on learning outcomes in knowledge teams

This study proposes a model of individual team members' learning outcomes under knowledge team environments by highlighting the role of individuals' passion about knowledge team activities as an important input for their learning and helping behaviors within knowledge teams, which eventually

enhance individuals' learning outcomes. Based on Webb (1982)'s framework of individual learning under group environments, a research model is built to test the relationship among individuals' passion, internal knowledge sharing, external knowledge sourcing, OCB (organizational citizenship behavior)-helping, and individuals' learning outcomes, as well as the moderating impact of individuals' perceived psychological safety within a knowledge team on the relationship between passion and individuals' behaviors of internal knowledge sharing and helping others.

Conducting a PLS analysis with survey data (393 individual-level samples), we found that individual passion about knowledge team activities is positively associated with her/his internal knowledge sharing, external knowledge sourcing, and OCB-helping behaviors, and that internal knowledge sharing and OCB-helping positively influence individual learning outcomes under knowledge team environments. The relationship between passion and internal knowledge sharing, and the relationship between passion and OCB-helping are stronger when an individual's perceived psychological safety within a knowledge team is high.

The findings from this study imply that in knowledge team environments, individual members' situated learning can start with their psychological attachment (passion) to their team activities. This passion about team activities not only leads to the behaviors of sourcing and sharing knowledge, but also the behaviors of helping others, which enhance their learning outcomes. The findings also imply that psychological safety is an important team environmental factor

that helps passionate team members more actively engage in internal team interaction (internal knowledge sharing and helping others.)

Contributions of this Dissertation

Academic contributions

For academic contributions, first, the integrated findings on the antecedents of team creativity and individual learning in knowledge team environments not only provide us with *abroad picture of current knowledge on team creativity and individuals' learning in knowledge team contexts*, but also suggest several future research avenues, such as the identification of new psychological inputs for team creativity in knowledge teams (e.g. passion), the importance of input – processes (behaviors) – output models when investigating phenomena in knowledge teams, several aspects of team creativity at different stages of team development, the importance of investigating the role of ICT on knowledge team processes and creativity, and task characteristics relevant in knowledge team environments, some of which are actually investigated in Essays II and III.

Second, this study introduces “passion” in knowledge team environments and investigates the role of passion about team activities in team knowledge processes and individuals' behaviors within teams, which influence team creativity and individual learning. In the field of management, passion has been empirically investigated mostly in the sub-field of entrepreneurship (Cardon et al. 2009), although both theoretical arguments (Amabile 2000; Faraj et al. 2011) and

anecdotal evidence (Hirschhorn 2003) imply that passion should be an important factor for the creativity and success of groups. By proposing and empirically testing two research models involving the impact of passion on important knowledge team outcomes (team creativity and individual learning), this study contributes to the body of knowledge on passion, team knowledge management, organizational citizenship behaviors, creativity, and learning. The results of the two empirical essays suggest that passion can be good psychological team- and individual-level inputs in knowledge team environments, which influence team members' active engagement in knowledge management and helping behaviors, as well as successful team outcomes.

Third, this study highlights the role of ICT on knowledge teams. Any contemporary teams have a certain degree of “virtuality” and rely on ICT for team collaboration, such as emails, team e-bulletins, file sharing systems, SMS, and video-conferencing (Gibson and Gibbs 2006). Contemporary knowledge teams, as well (including the focal knowledge teams of this dissertation), rely on ICT for team collaboration. Also, in many cases, knowledge team members are not always co-located, but they often communicate virtually during the tenure of their knowledge teams. Thus, ICT should play an important role for team processes. In this study, we found a significant moderating impact regarding the shared norms of ICT use on the relationship between team psychological input (passion) and one of the team knowledge processes (external knowledge sourcing). This result highlights the importance of building team-level norms in terms of how to use

ICT in knowledge teams. Further, we suggest that researchers should consider the role of ICT when they investigate the phenomena in knowledge teams.

Fourth, this study highlights the mediating role of knowledge processes on the relationship between team inputs and team creativity. A post-hoc test for direct relationships between two team inputs (shared team passion and team expertise) and team creativity suggest that neither shared team passion nor team expertise significantly influences team creativity. This finding implies that simply having team passion and expertise may not be enough for achieving creative team outcomes, and that the process of sharing knowledge internally and sourcing knowledge from external sources are important processes that link team inputs and creative team outcomes in knowledge teams.

Fifth, introducing OCB-helping and internal knowledge sharing as mediating factors for the link between passion and individual learning reconfirms that individuals' learning in organizations is situated in interaction within the communities of practitioners (Lave and Wenger 1991), as knowledge team environments have several commonalities with communities of practice, such as informal gatherings, ICT-enabled communications, collaborative knowledge creation, and so on.

Finally, the literature review suggests that little empirical effort exists to study the impact of psychological safety on individual-level learning outcomes in knowledge team contexts, although psychological safety is found to be a key factor for team learning (Edmondson 1999). The significant moderation impact of psychological safety on the relationship between passion and individuals' internal

(within their knowledge teams) behaviors re-confirm the importance of psychological safety on individuals' learning in team environments. This significant moderation impact also implies that perceived psychological safety provides a good environment for passionate individuals to engage in internal interaction with other members.

Practical implications

For practice, first, the literature review in chapter 2 (Essay I) provides a list of important factors for knowledge team leaders (or senior managers who oversee the activities of knowledge teams) to consider so as to achieve more creative team outcomes and better team members' learning.

Second, this dissertation introduces the importance of passionate participation in knowledge team activities, as well as the role of knowledge sourcing and sharing processes for more creative team outcomes. Thus, organizations that facilitate knowledge teams should emphasize passionate participation in knowledge team activities, and internal and external team knowledge processes for creative outcomes from knowledge teams.

Third, the findings on the moderating role concerning the shared norms of ICT for the relationship between team passion and external knowledge sharing emphasize the shared norm of using ICT in teams, where ICT are frequently used for team collaboration. Practitioners in knowledge teams should use ICT more mindfully. As a result, teams can form shared norms of using ICT for their collaboration during the tenure of their knowledge teams, which will improve the way team inputs take effect on knowledge team processes.

Fourth, practitioners should acknowledge that a knowledge team is not only helpful for an organization to create something new. Indeed, a knowledge team is also beneficial for individual participants to achieve situated learning by participating in complex, non-routine, and open-ended tasks with members having different expertise. When facilitating knowledge teams, organizations should emphasize passionate participation in team activities, not only for the team to achieve the most creative outcomes with the given situation, but also for individual participants get the most (learning) out of participating in knowledge team activities. Also, the significant impact of OCB-helping on individuals' learning outcomes implies that in knowledge team environments, helping others is actually beneficial for individual help-givers, as they can achieve better learning outcomes by helping others work in their knowledge teams.

Avenues for Future Research

I would like to conclude my dissertation by discussing some topics of future research on passion, knowledge processes, ICT, passion and, learning.

First, the key contribution of my dissertation is to introduce passion about team activities as an important psychological input, for both team processes and individual behaviors in knowledge team environments. I found that passion at the team level is significantly associated with team knowledge processes, and passion at the individual level is significantly associated with individuals' learning and OCB-helping behaviors, and that passion indirectly influences individual learning and team creativity in knowledge team contexts. These findings provide new

insights into the topics of team knowledge processes and organizational citizenship behaviors within teams or other types of collective environments. For example, passion may explain other types of team processes. As mentioned in chapter 2 (Essay I), coordination and conflict (resolution) are also important knowledge team processes for effective and creative outcomes. Shared team passion about team activities may explain the variance in these team processes, as passion leads to extra effort in order to do things better (Cardon et al. 2009). Also, as passion is found to be significantly related to OCB-helping in knowledge teams and is indirectly related to individuals' situated learning outcomes in teams (Essay III), passion should play an important role in other types of OCB or situated learning outcomes under other organizational environments. Thus, we suggest that future research may answer the questions as follows: How does team passion influence team coordination and team conflict (resolution)? How does individual passion influence other types of OCB (e.g., OCB-Voice) (Van Dyne and LePine 1998) behaviors? and, How does individual passion influence one's learning behaviors or outcomes in other types of informal learning environments (e.g., online communities)?

Second, I found that more effort is needed to explore the role of IT in knowledge teams. Although knowledge teams are not labelled as IT-enabled or Virtual Teams, most knowledge teams in contemporary organizational environments rely on ICT for collaboration. I found that little empirical effort has been made to look into the role of ICT in general, or the different impacts of various types of ICT on knowledge team processes or outcomes. Moreover,

currently new types of ICT actually help or enable new forms of team collaboration, such as cloud-computing, mobile communication devices, and social network systems. Future research may explore the impact of the new types of ICT on knowledge team processes, and dynamics and performance by answering the following research questions: How does the use of social network systems influence knowledge team creativity? or, How do different types of ICT influence knowledge team creativity differently?

Third, there are different aspects of team creativity during the lifetime of knowledge teams: *creativity from the idea-generation phase, creativity of team processes, and creativity of team outcomes (often rated by peers)*. I found that some inputs and team processes are important for one aspect of team creativity, but not for the other aspects of creativity. I also found that the same inputs or processes may influence different aspects of creativity differently (e.g., the impact of team communication on the creativity of ideas generated vs. on the creativity of final team outcomes) (Leenders, Engelen, and Kratzer 2003; Rietzschel, Nijstad, and Stroebe 2006). However, little empirical effort so far exists to investigate the impact of one or several antecedent(s) on the different aspects of knowledge team creativity. Thus, I suggest that future research should make more of an effort to investigate or integrate the key antecedents for the different aspects of knowledge team creativity (possibly with a longitudinal approach). That is, future research may answer the following research questions: What are the key antecedents for creativity in the idea-generation phase vs. creativity in the idea-selection and production phase vs. creativity of the final team outcome? or, How do some team

inputs (e.g., team member diversity) or team processes (e.g., internal knowledge sharing) differently influence different aspects of team creativity?

Fourth, this dissertation suggests a task characteristic of knowledge teams in terms of *the degree to which team tasks are explorative*. In the self-managed team environment dealing with open-ended tasks such as knowledge team environments, this task characteristic varies among different teams, according to the topics of team goals and is found to be a significant moderating force, in that the external knowledge sourcing process affects team creativity. This task characteristic may also explain other types of team processes or outcomes, such as team boundary work, innovativeness, and team learning, as exploration requires new perspectives from external knowledge sources. Therefore, I suggest that future research should consider *task characteristics in terms of exploration (or exploitation)* as important team task characteristics, if the focal teams of the research require creative outcomes or innovativeness.

Concluding Remarks

Working on this dissertation has been a great opportunity to generate good insights about the key aspects of knowledge team environments in terms of team inputs, team processes, contextual environments, and key outcomes. The main contribution of this dissertation is to focus on team creativity and individual members' learning and to empirically investigate the role of passion on these two outcomes of knowledge teams. To achieve more creative team outcomes and individual members' learning outcomes in knowledge teams, where team

members work on complex, non-routine, and open-ended tasks for creating something new, team members should participate in team activities with passion, build norms concerning how to use ICT for their teamwork, as well as they should find appropriate knowledge from external sources, share knowledge with team members, and help one another. Also, a psychologically safe work environment and more explorative team tasks form a better work environment for individual members' situated learning and more creative team outcomes, respectively.

References of Chapter 1 (Overview of Thesis) and Chapter 5

(Synthesis)

- Akgun, A. E., Byrne, J., Keskin, H., Lynn, G. S., and Imamoglu, S. Z. "Knowledge networks in new product development projects: A transactive memory perspective," *Information & Management* (42:8), Dec 2005, pp 1105-1120.
- Amabile, T. M. "Stimulate Creativity by Fueling Passion," in: *Handbook of Principles of Organizational Behavior*, E.A. Locke (ed.), Wiley, 2000.
- Ancona, D. "Outward bound: Strategies for team survival in an organization," *Academy of Management Journal* (33) 1990, pp 334-365.
- Ancona, D. G., and Caldwell, D. F. "Bridging the boundary: External activity and performance in organizational teams," *Administrative Science Quarterly* (37) 1992, pp 634-665.
- Baum, J. R., and Locke, E. A. "The Relationship of Entrepreneurial Traits, Skill, and Motivation to Subsequent Venture Growth," *Journal of Applied Psychology* (89:4) 2004, pp 587-598.
- Baum, J. R., Locke, E. A., and Smith, K. G. "A Multidimensional Model of Venture Growth," *Academy of Management Journal* (44) 2001, pp 292-303.
- Billow, R. M. "Passion in Group: Thinking about Loving, Hating, and Knowing," *International Journal of Group Psychotherapy* (52:3) 2002.
- Campion, M. A., Medsker, G. J., and Higgs, A. C. "Relations Between Work Group Characteristics and Effectiveness: Implications for Designing Effective Work Groups," *Personal Psychology* (46) 1993, pp 823-850.
- Cardon, M. S., Wincent, J., Singh, J., and Drnovsek, M. "The nature and experience of entrepreneurial passion," *Academy of Management Review* (34:3) 2009, pp 511-532.
- Caya, O. "Information technologies, knowledge integration, and performance in virtual teams," in: *Information Systems*, McGill University, Montreal, Quebec, 2008.
- Chen, X., Yao, X., and Kotha, S. "Entrepreneur Passion and Preparedness in Business Plan Presentations: A Persuasion Analysis of Venture Capitalists' Funding Decisions," *Academy of Management Journal* (199-214:52) 2009, p 1.
- Cheng, J. L. C. "Organizational Coordination, Uncertainty, and Performance: An Integrative Study," *Human Relations* (37) 1984, p 829.
- Csikszentmihalyi, M. *Creativity: Flow and the psychology of discovery and invention* Harper, New York, 1996.
- Curtis, B., Krasner, H., and Iscoe, N. "A field Study of the Software Design Process for large Systems," *Communications of the ACM* (31:11) 1988, pp 1268-1287.
- Dayan, M., and Di Benedetto, C. A. "Team intuition as a continuum construct and new product creativity: The role of environmental turbulence, team experience, and stress," *Research Policy* (40:2), Mar 2011, pp 276-286.

- Edmondson, A. C. "Psychological safety and learning behavior in work teams," *Administrative Science Quarterly* (44) 1999, pp 350-383.
- Faraj, S., Jarvenpaa, S. L., and Majchrzak, A. "Knowledge Collaboration in Online Communities," *Organization Science* (22:5) 2011, p 10.
- Faraj, S., and Sproull, L. "Coordinating Expertise in Software Development Teams," *Management Science* (46:12) 2000, pp 1554 -1568.
- Faraj, S., and Yan, A. "Boundary Work in Knowledge Teams," *Journal of Applied Psychology* (94:3) 2009, pp 604-617.
- Gibson, C. B., and Gibbs, J. L. "Unpacking the Concept of Virtuality: The Effects of Geographic Dispersion, Electronic Dependence, Dynamic Structure, and National Diversity on Team Innovation," *Administrative Science Quarterly* (51:3) 2006, pp 451-495.
- Grawitch, M. J., Munz, D. C., and Kramer, T. J. "Effects of member mood states on creative performance in temporary workgroups," *Group Dynamics-Theory Research and Practice* (7:1), Mar 2003, pp 41-54.
- Guzzo, R. A., and Dickson, M. W. "Teams in Organizations: Recent Research on Performance and Effectiveness," *Annual Review of Psychology* (47) 1996, pp 307-338.
- Henderson, J. C., and Lee, S. "Managing I/S Design Teams: A Control Theories Perspective," *Management Science* (38:6) 1992, pp 757-777.
- Hirschhorn, L. "Passion and Group Life," *Center for Applied Research* (Philadelphia, PA) 2003.
- Jansen, J. J. P., Van Den Bosch, F. A. J., and Volberda, H. W. "Exploratory Innovation, Exploitative Innovation, and Performance: Effects of Organizational Antecedents and Environmental Moderators " *MANAGEMENT SCIENCE* (52:11) 2006, pp 1661-1674.
- Janz, B. D., Colquitt, J. A., and Noe, R. A. "Knowledge Worker Team Effectiveness: The Role of Autonomy, Interdependence, Team Development, and Contextual Support Variables," *Personnel Psychology* (50:4) 1997, pp 877 - 904.
- Jarvenpaa, S. L., and Leidner, D. E. "Communication and Trust in Global Virtual Teams," *Organization Science* (10:6) 1999, pp 791-815.
- Katz, R., and Allen, T. J. "Investigating the Not Invented Here (NIH) syndrome: a look at the performance, tenure, and communication patterns of 50 R&D Project Groups," *R&D Management* (12:1) 1982, pp 7-19.
- Kotlarsky, J., and Oshri, I. "Social ties, knowledge sharing and successful collaboration in globally distributed system development projects," *European Journal of Information Systems* (14:1) 2005, pp 37-48.
- Kraut, R., and Streeter, L. "Coordination in large scale software development," *Communications of the ACM* (38:3) 1995, pp 69-81.
- Lave, J., and Wenger, E. *Situated Learning: Legitimate Peripheral Participation* Cambridge University Press, Cambridge, UK, 1991.
- Leenders, R., Engelen, J., and Kratzer, J. "Virtuality, communication, and new product team creativity: a social network perspective," *Journal of Engineering and Technology Management* (20) 2003, pp 69-92.

- Madhavan, R., and Grover, R. "From Embedded Knowledge to Embodied Knowledge: New Product Development as Knowledge Management," *Journal of Marketing* (62:4) 1998, pp 1-12.
- March, J. G. "Exploration and exploitation in organizational learning," *Organization Science* (2:71) 1991, p 17.
- Miles, R. E., and Snow, C. C. "Organizations New concepts for new forms," *California Management Review* (18:3) 1986, pp 62-73.
- Reilly, R. C. "Is expertise a necessary precondition for creativity? A case of four novice learning group facilitators," *Thinking Skills and Creativity* (3) 2008, pp 59-76.
- Rietzschel, E. F., Nijstad, B. A., and Stroebe, W. "Productivity is not enough: A comparison of interactive and nominal brainstorming groups on idea generation and selection," *Journal of Experimental Social Psychology* (42:2), Mar 2006, pp 244-251.
- Robert, J., Lionel P., Dennis, A. R., and Ahuja, M. K. "Social Capital and Knowledge Integration in Digitally Enabled Teams," *Information Systems Research* (19:3) 2008, pp 314-334.
- Saunders, C. S., and Ahuja, M. K. "Are All Distributed Teams the Same? Differentiating Between Temporary and Ongoing Distributed Teams," *Small Group Research* (37:6) 2006, pp 662-700.
- Sense, A. J. "The project workplace for organizational learning development," *International Journal of Project Management* (29:8), Dec 2011, pp 986-993.
- Tiwana, A., and McLean, E. R. "Expertise integration and creativity in information systems development," *Journal of Management Information Systems* (22:1), Sum 2005, pp 13-43.
- Tu, C. Y. "A multilevel investigation of factors influencing creativity in NPD teams," *Industrial Marketing Management* (38:1), Jan 2009, pp 119-126.
- Van Dyne, L., and LePine, J. A. "Helping and Voice Extra-Role Behaviors: Evidence of Construct and Predictive Validity," *Academy of Management Journal* (41:1) 1998, pp 108-119.
- Webb, N. M. "Student Interaction and Learning in Small Groups," *Review of Educational Research* (52:3) 1982, pp 421-445.
- Wong, S.-S. "Distal and Local Group Learning: Performance Trade-Offs and Tensions," *Organization Science* (15:6) 2004, pp 645-656.
- Woodman, R. W., Sawyer, J. E., and Griffin, R. W. "Toward a Theory of Organizational Creativity," *The Academy of Management Review* (18:2) 1993, pp 293-321.
- Woolley, A. W. "Putting first things first: Outcome and process focus in knowledge work teams," *Journal of Organizational Behavior* (30) 2009, pp 427-452.

Appendix: Ethics Certificate

Please see the next page for the official Ethics Certificate (Research Ethics Board Renewal form approved, which was effective from April 15, 2011 to April 15, 2012). Actual data gathering with survey took place within this period.