TOWARDS AN UNDERSTANDING OF ANTECEDENTS AND CONSEQUENCES OF TEAM SENSEMAKING: EMPIRICAL EVIDENCE FROM PAKISTAN

DISSERTATION
SUBMITTED TO THE DEPARTMENT OF BUSINESS
AND THE COMMITTEE FOR ADVANCED STUDIES AND RESEARCH
OF LAHORE SCHOOL OF ECONOMICS
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY

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April 2020

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ANTECEDANTS AND CONSEQUENCES OF TEAM SENSEMAKING

by
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Submitted to the Department of Business Administration
in April 2020 in Partial Fulfillment of the
requirements for the Degree of Doctor of Philosophy
in Business Administration

Abstract

The purpose of this research is to investigate the notion of sensemaking in a team context. Building on the sensemaking theory this research conceptualizes and examines the antecedents and consequences of team sensemaking. This research adopted the cross-sectional research design and collected data from respondents who were the part of a team. Chapter Two has conceptualized and examined the positive relationship between transactive memory systems (TMS) and team sensemaking. Also, this study has identified different levels of task conflict and reward interdependence as the boundary conditions that have enabled the relationship between TMS and team sensemaking. Results showed that transactive memory systems were positively related to team sensemaking when both task conflict and reward interdependence were high. Further identifying the antecedents of team sensemaking, Chapter Three has examined the relevance of social environment factors (team autonomy and cognitive diversity) regarding team sensemaking. In so doing, this chapter has also studied the facilitatory role of team sensemaking for the relationships of team autonomy and cognitive diversity with team creativity. The findings of the study suggest that managers in knowledge-intensive industries should promote cognitive diversity and autonomy to develop team sensemaking, which in turn can facilitate team creativity. Chapter Four examines the impact of team sensemaking on team bricolage and subsequently on team resilience. Moreover, this study conceptualizes and tests whether task interdependence moderates the mediation of team bricolage for the relationship between team sensemaking and team resilience. The results show that team bricolage mediates the relationship between team sensemaking and team resilience and this mediation of team bricolage is moderated by task interdependence. Overall, this study

makes important following three key contributions with respect to team sensemaking. First, this study has demonstrated the relevance of transactive memory systems, task conflict and reward interdependence for enabling team sensemaking. In this manner, this study has conceptualized and investigated the key antecedents of team sensemaking. Second, this research has illustrated that team autonomy and cognitive diversity are positive contributors for team sensemaking which in turn has a positive influence on team creativity. Third, the pertinence of team sensemaking has been established with respect to team resilience to underscore the consequences of team sensemaking. The study improves the understanding of the relationship between team sensemaking and team resilience by examining how team bricolage facilitates this link when task interdependence is present. Drawing on the findings of the study, team managers can tap on TMS to structure tasks so that the team is granted autonomy and possesses diverse cognitive resources to encourage team sensemaking. Team sensemaking as an important resource can be further used to influence team creativity, team bricolage and team resilience.

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Chapter 1: Introduction

1.1 Research Background

Organizations are currently faced with a complex and dynamic competitive environment (Açıkgöz, Kuzey & Zaim, 2016; Algesheimer, Dholakia, & Gurău, 2011; Cooke, Salas, Kiekel, & Bell, 2004; Drach-Zahavy, 2004; Harrison, McKinnon, Wu, & Chow, 2000; Turk, France & Rumpe, 2014). While the contextual complexity has grown, the need to respond to environmental cues quickly and accurately has also been continuously increasing (Waeger &Weber, 2019). In this dynamic and complex context, the traditional decision-making mechanisms that heavily rely on organizational hierarchies have become constrained (Ashmos, Duchon & McDaniel, 2000). Consequently, work teams have emerged as a structural response to this complexity (Cooke et al., 2004; Drach-Zahavy, 2004). It has been widely argued that the arrangements around team structure can offer optimal solutions to complex organizational problems and make positive contribution towards organizational competitiveness (Oshri, & Newell, 2005; Strang, 2005). Indeed, the recent times have observed increased dependence of organizations on work teams to attain superior performance (Katzenbach & Smith, 2008; Katzenbach & Smith, 2015; Jamshed & Majeed, 2019).

Ashmos et al. (2000) have argued that while mechanistic organisational forms could work well in stable settings, more organic organisational forms are needed in dynamic settings. Teams play a central role in how well an organization performs in a complex environment (Mathieu, Maynard, Rapp, & Gilson, 2008; West, Patera & Carsten,

2009). Fortune 100 and other top firms have steadily increased the use of team-based structures over the past few decades (Hollenbeck, Beersma, & Schouten, 2012). The popularity of teams is in direct response to the increase in environmental complexity (Turk et al., 2014; Açıkgöz et al., 2016). Sensemaking in teams includes extracting relevant environmental stimuli, placing these stimuli in a team's performance context, and elaborating the meaning of these stimuli to form a plausible framework. This framework provides both an elaborate system of cue-response contingencies and reasoning of why certain responses might be more or less appropriate contingent upon the situation at hand (Zaccaro, Rittman & Marks, 2001; Fielder, 1971; Kerr, 1974).

The Information, Communication, and Technology (ICT) industry in Pakistan was the subject of this thesis. According to the Pakistan Economic Survey (2018-2019), Pakistan's export of Information Technology (IT) and IT-enabled services (ITES) have crossed US $ 3.3 billion a year. It is one of the most vibrant sectors of Pakistan economy. Not only is it among the top 5 net exporters of the country but in fact is the highest contributor to net exports in the services industries.

The ICT industry is suitable for the purpose of the study because the work is usually done in teams and there is an ongoing need to make "sense" of the client preferences and to be resilient in face of unforeseen circumstances (Holm & Østergaard, 2015). Pakistan Software Houses Association for IT and ITES (P@SHA), is a leading representative body of Pakistan's software industry. P@SHA was first founded to create a functional trade body for the IT industry in Pakistan and has since then expanded its scope scope to include other IT enabled services companies such as Internet Service Providers, Call Centers, etc. It has

290 members listed in their membership directory. The list of all organizations listed in P@SHA's directory served as the sampling frame for this study.

1.2 Research Questions and Objectives

Building on the sensemaking theory derived from literature by Weick (1993;1995; 2005), this research conceptualizes and examines the antecedents and consequences of team sensemaking. In so doing, this thesis also refines the existing dimensions of the team sensemaking borrowed from the sensemaking theory. The present research explored sensemaking in the context of teams in knowledge-intensive industries. Three studies sought to answer the following three research questions. *1) What is the influence of transactive memory systems (TMS) on team sensemaking in the presence of relevant boundary conditions namely, task conflict and reward interdependence? 2) What is the relevance of team sensemaking as a facilitatory mechanism for the relationship of social environment factors (team autonomy and cognitive diversity of team) with team creativity? 3) How and when does team sensemaking influence team resilience?* The overall contribution of the study is to conceptualize and test the antecedents and outcomes of team sensemaking. In order to answer the following research questions, the following research objectives are developed and pursued in this thesis.

- To operationalize the notion of team sensemaking with respect to knowledge-intensive industries. *(Chapter 2).*
- To determine the relationship of TMS with team sensemaking in the presence of task conflict and reward interdependence. *(Chapter 2).*

- To examine the facilitating role of team sensemaking for the relationship of team autonomy and cognitive diversity with team creativity. *(Chapter 3)*
- To explore the relevance of team bricolage as an underlying mechanism in the presence of task interdependence regarding the link between team sensemaking and team resilience. *(Chapter 4)*

1.3 Significance of the research

Teams can serve as an important means for achieving organizational outcomes (Stashevsky, Burke, & Koslowsky, 2006). Teams offer an organization the potential for increased creativity and resilience. As a consequence, research investigating ctalysts that promote team performance has gained significance(Wang, Kim & Lee; 2016; Hülsheger, Anderson, & Salgado, 2009). Among these facilitators, the scholars have not only emphasized the relevance of sensemaking in the context of modern organization (Maitlis & Christianson; 2014) but they have also documented the central role of sensemaking in the success of organizational teams (Ancona, 2012; Morgeson, Rue & Karam, 2010; Lei, Waller, Hagen & Kaplan; 2016; Banks, Pollack & Seers, 2016). Despite the growing interest in team sensemaking as a phenomenon of interest, there is ambiguity regarding antecedents and consequences of team sensemaking (Akgun, Keskin, Lynn & Dogan, 2012). Given the importance of team sensemaking and its potential role in meeting organizational goals, this study aims to explicate the antecedents and consequences of team sensemaking.

Sensemaking theory has gained popularity in terms of theoretical extension through qualitative research in the organizational setting (Crawford, Thompson & Ashforth, 2018;

Rahim, 2018; Matilis and Christianson, 2014). Teams face uncertain and ambiguous tasks and one of the key assumptions of sensemaking is that people are continuously moving from states of uncertainty to certainty (Hosseini & Akhavan, 2017; Perminova, Gustaffson & Wikstrom, 2008). Furthermore, team sensemaking facilitates teams to focus on both certainty (simple patterns and order) and uncertainty (complexity and chaos) (Perminova et al., 2008).

In this context, team sensemaking can help to reduce uncertainty by seeking additional information or extrapolating from available information (Lipshitz & Strauss, 1997). Also, it provides frames of reference and allows for reflection among team members. Through reflection, team members can deploy experiences/insights gained in previous tasks to current tasks in the form of standardized processes and procedures (Perminova et al., 2008; Davies, Brady & Hobday, 2006). The combined use of mental maps, effective communication and reflection increase the capacity of teams to deal with uncertainty. Despite the growing interest in team sensemaking as a phenomenon of interest, there is ambiguity regarding antecedents and consequences of team sensemaking (Akgun, Keskin, Lynn & Dogan, 2012).

Usually, team members know about the individual expertise of other team members and this know-how facilitates their mutual interaction for task completion (Mohammed & Dumville, 2001). This interaction can help a team to build a collective reservoir of team memory (Austin, 2003; Kozlowski and Bell, 2007). This memory reservoir as the manifestation of TMS can enable team members in exchange of information and better coordination of team activities (Oshri, Van Fenema, & Kotlarsky, 2008). While TMS and team sensemaking are important socio-cognitive aspects of team work they are distinct in

that transactive memory represents knowledge of task related expertise (Rau, 2005; Mohammed & Dumville, 2001), team sensemaking represents the "shared" process by which team mebers explain the present situation and to anticipate future scenarios (Klein, Wiggins & Dominguez, 2010). Due to these attributes of TMS, it is believed that TMS may facilitate team sensemaking, especially under different boundary conditions (Hsu, Shih, Chiang & Liu, 2012; Bachrach et al., 2019). Previous studies on teams have surprisingly ignored this important gap of sensemaking literature. This thesis fills this important gap by ascertaining the role of TMS as the antecedent of team sensemaking. Furthermore, the direct impact of TMS on team sensemaking is investigated by examining the relevance of two key boundary conditions namely task conflict and reward interdependence. This study of Chapter Two makes an important contribution by demonstrating the positive influence of TMS on team sensemaking when teams experience higher task conflict and higher reward interdependence. Particularly, this research highlights the role of TMS for enhancing team sensemaking at higher levels of task conflict when reward interdependence among team members is also high. In fact, team members leverage the task-related expertise through TMS to make sense of tasks at hand while considering alternate viewpoints under the situations of higher degree of reward interdependence.

Taking the discussion about the antecedents and consequences of team sensemaking further, Chapter Three identifies social environment factors as the antecedents of team sensemaking and examines the facilitatory role of team sensemaking for the link of social environment factors and team creativity. First, it specifically investigates the relationship of social environment factors (team autonomy and cognitive

diversity) with team sensemaking. Second, it also ascertains team creativity as an outcome of team sensemaking. In the face of intense competition and rapid technological changes, organizations rely on creativity to survive and thrive (Wang et al., 2016). This study makes an important contribution to both sensemaking and creativity literature by examining the direct effect of team sensemaking on team creativity. Additionally, it examines the role of team sensemaking as an intermediary mechanism through which, socio-environmental factors, such as team autonomy and cognitive diversity, affect team creativity. Instead of focusing on the direct consequences of team autonomy and cognitive diversity, the present study makes a significant contribution to bringing insights from the sensemaking literature (Weick; 2005) to the realm of team creativity. It sheds light on *how* team sensemaking facilitates the link of team autonomy and cognitive diversity with team creativity. In so doing, this study extends the limited research stream that focuses on the underlying process through which contextual inputs such as autonomy and cognitive diversity can influence team creativity.

Even successful business entities find it difficult to maintain growth momentum in current times (Kuppuswamy & Bayus, 2018). Setbacks and failures have become inevitable parts of the progression path of the modern organization (Edwards & Ashkanasy, 2018). It has been argued that rather than trying to avoid setbacks, it is important to appear unscathed from them (Snowden, 2000). The extant literature has provided limited understanding about the antecedents of team resilience including team sensemaking that is considered as one of the key antecedents (Chapman et al., 2018; Mathieu et al., 2008). With respect to the discussion of the consequences of team sensemaking, Chapter Four conceptualizes and examines the relationship of team sensemaking with team resilience. Moreover, this

relationship is ascertained through an integrated model of team resilience to comprehend *how and when* the consequences of team sensemaking can be stronger or weaker. For instance, Maynard and Kennedy (2016) argue that the processes that teams employ to develop resilience in the face of anticipated and unanticipated challenges remain largely unexplored. A similar call for further research is made by Carmeli, Friedman, and Tishler (2013) to deepen the understanding of team resilience and its processes that help build it. Chapter Four took this agenda forward and examined how team bricolage facilitates this relationship between team sensemaking and team resilience in the presence of task interdependence as a boundary condition. Given that teams often face resource scarcity when facing adversity, any approach that offers new solutions without presenting extra costs is helpful in promoting resilience. The literature suggests that team bricolage is one of the possible ways for teams to overcome resource-constraints challenges (Baker & Nelson 2005; Cunha, Rego, Oliveira, Rosado & Habib, 2014; Di Domenico, Haugh, & Tracey, 2010; Senyard, Baker, Steffens & Davidsson, 2014).

Through the above mentioned three studies of Chapters Two, Three, and Four, the current thesis makes key contributions in the existing literature. First, this thesis fosters the operationalization of team sensemaking as discussed in Chapter Two. Second, it conceptualizes and tests the antecedents and consequences of team sensemaking. For instance, Chapter Two draws upon the research of sensemaking and teamwork to suggest that TMS are an effective means to encourage team sensemaking in the presence of task conflict and reward interdependence. Chapter Three determines the relevance of social environment factors for team creativity through the facilitatory role of team sensemaking. Chapter Four provides insights with respect to the consequences of team sensemaking

regarding team resilience – an attribute of contemporary teams, which is desired in the current competitive milieu. It provides the empirical evidence of the link between team sensemaking and team resilience by demonstrating how team bricolage facilitates this link in the presence of task interdependence as a contextual factor. Finally, it examines sensemaking in an everyday context as the past studies have examined sensemaking under exceptional circumstances or crisis situations (Combe & Carrington, 2015; Stieglitz, Mirbabaie, Schwenner, Marx, Lehr & Brünker , 2017).

1.4 Research methodology

Tthis research relied on primary data collection. The questionnaire was developed and adapted to meet the requirements of the research problem sector under examination (See Appendices A , B, & C). The list of organizations involved in Information and Technology sector of Pakistan was collected from P@SHA. 290 ICT organizations in Pakistan were found listed. Hence, a sampling frame of 290 organizations was considered appropriate for this research (See Appendix D). According to the Economic Survey of Pakistan 2018-2019, the Information Technology sector has demonstrated consistent advancement. IT industry is the service industry's highest net exporter and one of the top five net exporters. The IT and Telecom sectors are growing and creating new jobs as companies use modern ICT technologies such as e-health, e-commerce, e-education, e-banking, e-health, and IT applications related business. Pakistan's IT exports are estimated to have exceeded $3.3 billion a year at present (Economic Survey of Pakistan, 2019, p.217). According to A.T Kearney's Global Global Services Location Index Pakistan is the third most financially attractive location worldwide for offshore services (Economic Survey of

Pakistan, 2019, p.218) . Hence, Pakistan's IT and ITEs has a promising future and it has the potential to become the largest export industry of the country.

Targeted respondents were part of work teams operating in the Information, Communication and Technology (ICT) sector of Pakistan. A work team was defined as a unit with two, or more team members (i.e., these supervisors' direct subordinates) who shared common objectives, performed interdependent tasks, and were jointly accountable for collective outcomes (Kozlowski & Bell, 2003).

It is widely argued that the research question should guide the use of single informant or multiple key informants (Schoenherr and Mabert, 2008; Lawson, Krause & Potter, 2015; Krause, Luzzini and Lawson 2018). Since all constructs are based on the cognitive perspective of a single team and thus it is put forth that a single key informant of a team is able to provide the view on these cognitive perspectives of a team (Schoenherr and Mabert, 2008; Lawson, Krause & Potter, 2015; Krause, Luzzini and Lawson 2018, p.46). The other consideration regarding the choice of single key informant versus multiple key informants is to weigh if the study constructs represent the cognitive perspectives of multiple external entities other than team members. If the study constructs require to do so then perspectives of each external representative must be taken into consideration (Krause, Luzzini and Lawson 2018, p. 46). Since the constructs in this current research relate to a team only and do not represent the views of external actors therefore; the use of single key informant approach is appropriate for this study.

Data was gathered from a single key informant of team who is considered as a knowledgeable and experienced respondent to provide information regarding team-based phenomena under investigation. In addition to the above arguments, our choice of single

key informant represents the notion that collection of data from right respondent (a single key informant) is more valid and reliable than multiple respondents (Schoenherr and Mabert, 2008; Krause, Luzzini and Lawson 2018, p. 45). A single key informant is the one who has recent first-hand experience and relevant knowledge about the phenomena under investigation (Krause, Luzzini and Lawson 2018, p. 45). More importantly, a single key informant is able and willing to give requested information. As argued by Krause, Luzzini and Lawson (2018), the single key informant is very likely to provide an unbiased and well informed opinion regarding the hypotheses based on the concepts that have been experienced.

Key persons were requested to identify members of teams within their organizations. Respondents had to satisfy two criteria: Employees were eligible to respond to the questionnaire, if they were part of a team that reported to a supervisor, and they interacted frequently with other team members in order to accompolish specific goals or purposes. Responses of only those respondents were considered valid, who had been a part of the organization since at least six months. By following this criteria, a total of 304 usable responses were received. In order to acquire data while also reducing time demands, we adopted a single key informant sampling approach as discussed earlier (Van de Ven & Ferry, 1980). Data collection process for team-level research is difficult and extremely time consuming (Kirkman & Chen, 2011). A key informant sampling approach offers a practical solution as it recognizes that a member of a team is competent to provide assessments of team level phenomenon. The informant approach relies on the fact that key informants have sufficient knowledge of the global experiences, in order to provide reasonably accurate assessments of team, or firm level phenomena. When determining a collective

perspective about a construct, a single key informant is likely to be able to provide such a view (Schoenherr & Mabert, 2008). Also, Lawson, Krause & Potter (2015) have argued that a key informant, who is capable of abstracting from the situation, is a suitable respondent.

Nunnally (1967) recommended that atleast ten observations per variable be considered the minimum sample requirement in order to perform structural equation modeling (SEM). Sensemaking research at the team level using survey employs sample size ranging from 40-300. Icobucci (2010) and Kline (2011) proposed a minimum sample of 200 for SEM. Keeping in mind these guidelines, a minimum sample of 200 will be considered adequate.

Furthermore, Hair, Black, Babin, and Anderson (2014) recommended conducting Barlett's test of sphericity and Kaiser-Meyer-Olkin (KMO). Measure of sampling adequacy. Bartlett's test of sphericity indicates if the variables are unsuitable for structure detection. Small values (less than 0.05) of the significance level indicate that factor analysis may be useful with the data. KMO is a measure of how suited the data is for factor analysis. A value exceeding 0.80 is considered meritorious, 0.70 or above middling, 0.60 or above mediocre. Both tests were conducted to assess the factorability and the sampling adequacy of the data.

The data was analyzed in SPSS and AMOS. To rule out common method variance (CMV), Harman's one factor test was performed. It is recommended that eigenvalues should exceed 1 for all variables (Podsakoff, MacKenzie & Podsakoff, 2012; Harman ,1967). As an additional measure, following the example of Flynn et al. (2010), all items were loaded onto a single factor when conducting confirmatory factor analysis (CFA). Poor

model fit indices of a single factor variable indicate that CMV is unlikely to be a concern. Mean, standard deviation and correlations among variables were calculated and reported as descriptive statistics. The data was analyzed through SEM by simultaneously conducting CFA and regression analysis (Hair, et al., 2006).

SEM is considered a superior technique compared to , factor analysis or multiple regression because it allows the researcher to simultaneously test the structural model and the measurement model. Specifically, SEM gives the researcher with the opportunity to: (a) construct unobservable latent variables; (b) statistically test apriori theoretical and measurement assumptions against observed data; and (c) hypothesize relationships among multiple exogenous and endogenous variables (Chin, 1998).

Each model that was tested was initially subjected to *measurement model testing.* CFA was carried out. A set of indices such as Chi-square, Root Mean Square Error Approximation RMSEA),CFI, and IFI was used to assess the model fit. Using set of indices to assess model fit is recommended over using a single index (Kline, 2005; and Hu and Bentler,1999). CFA helps establish reliability, unidimensionality, and validity of latent variables. After CFA data was subjected to *structural model testing:* The relationship between the predictor and criterion variables was tested using betas and p – values at 5% (Hair, et al., 2006). The error terms or residuals were not allowed to correlate in any of the models.

1.5 Key definitions:

The definitions of the key terms that have been used in this thesis are provided.

Teams. Team is defined as "a distinguishable set of two or more people who interact, dynamically, interdependently, and adaptively toward a common and valued goal /objective/mission" (Salas, Dickinson, Converse & Tannenbaum, 1992, p.4).

Sensemaking.

"Sensemaking is understood as a process that is (1) grounded in identity construction, (2) retrospective, (3) enactive of sensible environments, (4) social, (5) ongoing, (6) focused on and by extracted cues, (7) driven by plausibility rather than accuracy" (Weick, 1995, p. 17).

Team sensemaking. Team sensemaking is defined as "the mechanism by which a team manages and coordinates its efforts to explain the current situation and to anticipate future situations, typically under uncertain or ambiguous conditions" (Klein, Wiggins & Dominguez, 2010, p.304).

Team sensemaking is different from team reflection. While team reflection "includes behaviors such as questioning, planning, exploratory learning, analysis, diversive exploration, making use of knowledge explicitly, playfulness, learning at a meta-level, reviewing past events with self-awareness, and coming to terms over time with a new awareness" (West ,2000; p. 4). However, team sensemaking is a broader concept that comprises of social cognition, team communication and team reflection. In addition to reflection, sensemaking employs retrospect "to make sense of the puzzles observed" (Weick et al., 2005, p.412), uses shared mental models as" knowledge structures and shared understandings held by team members that enable them to form accurate explanations and

expectations for the task"(Akgun et.al, 2012, p.476) and relies on communication through which "information is clearly and accurately exchanged among team members." (Salas, Burke and Cannon-Bowers; 2000, p.343).

Transactive Memory Systems (TMS). TMS refer to "a shared awareness of who knows what within the group" (Peltokorpi, 2008, p.358).

While TMS and team sensemaking are important socio-cognitive aspects of team work they are distinct notions from each other. In fact, TMS represents knowledge of task related expertise (Rau, 2005; Mohammed & Dumville, 2001) whereas team sensemaking represents the "shared" process by which team members explain the current situation and anticipate future situations (Klein, Wiggins & Dominguez, 2010).

Task conflicts. Task conflict is defined as "disagreements among team members related to the content of their decisions and differences in viewpoints, ideas, and opinions about the task" (Jehn, Rispens, Jonsen & Greer, 2013, p. 352).

Reward interdependence. Reward interdependence refers to the degree to which the rewards that an individual reaps are dependent upon the performance of her/his team members (Wageman & Baker, 1997).

Team autonomy. Team autonomy has been defined as "the extent to which a team has discretion in deciding how to carry out tasks" (Langfred, 2005, p.514).

Cognitive diversity. Cognitive diversity is defined by the extent to which differences exist in terms of expertise, experiences, and perspectives amongst team members (Miller, Burke & Glick, 1998).

Team creativity. Team creativity is defined as "the production of novel and useful ideas concerning products, services, processes, and procedures by a team of employees working together" (Shin & Zhou, 2007, p. 1715).

Team resilience. Team resilience is a team's ability to rebound from setbacks, failure, and conflicts (West et al., 2009, p. 30).

Team bricolage. Team bricolage can be defined as "making do by applying combinations of resources at hand to new problems and opportunities" (Baker & Nelson,2005, p. 33).

Improvisation is closely related to the concept of bricolage; yet it is distinct. Moorman and Miner (1998, p.1) describe improvisation as "when the composition and execution of an action converge". Another definition of improvisation describes it as "processes and designs that are continuously restructured" (Wieck, 1993). In contrast, the most widely accepted definition of bricolage is "making do with the means or resources at hand" (Levi-Strauss, 1966). While improvisation and bricolage both are adaptive responses to environmental complexity, bricolage emphasizes ingenuous use of resources at hand while improvisation only emphasizes simultaneousness of planning and execution.

Task interdependence. Task interdependence in this study is viewed as the coordination requirements that are needed among team members to achieve efficacious performance outcomes. It is defined as "the degree to which interaction and coordination of team members are required to complete the assigned tasks" (Langfred, 2005, p. 514)**.**

1.9 Organization of the Thesis

In the foregoing section, Chapter One provided a brief overview of this thesis by emphasizing the antecedents and consequences of team sensemaking. This discussion is followed by the presentation of the research questions and objectives of this research thesis. Furthermore, a detailed explanation is given with respect to the significance of this research. Especially, the key contributions of three empirical studies of this research thesis are provided. The research methodology adopted for this research was explained. Key definitions were finally presented in this chapter.

Chapter Two has operationalized the key construct of this thesis – team sensemaking as social cognition, communication, and reflection. Exploratory factor analysis (EFA) and Confirmatory factor analysis (CFA) tested the rigor of the proposed measure. It further explored the relationship between TMS and team sensemaking in the presence of task conflict and reward interdependence. This nexus was explored by testing the moderating effects of task conflict and the interactive effect of task and reward interdependence as a moderator for the relationship between TMS and team sensemaking. The data was collected from respondents who are part of team working in the ICT sector of Pakistan. Using survey methods to collect data, the results of this study concluded that TMS has a positive impact on team sensemaking such that the relationship is moderated by the interaction between task conflict and reward interdependence.

Chapter Three analyzed the relationship between social environment characteristics and team creativity such that team sensemaking had facilitated this relationship. Using structural equation modeling (SEM), the results indicated that team autonomy and cognitive diversity had a positive relationship with team sensemaking and team sensemaking also facilitated relationships of team automomy and cognitive diversity with team creativity.

Chapter Four examined the impact of team sensemaking on team resilience. Team bricolage mediated the relationship between team sensemaking and team resilience when task interdependence was high. However, under conditions of low task interdependence, there was no evidence of the indirect effect of team bricolage. Hence, the results of the study support the conditional indirect effect of team sensemaking on team resilience through the facilitation of team bricolage when task interdependence is high.

Chapter Five explained the research findings in relation to the research questions, objectives and hypotheses. This thesis concludes the contributions of this thesis through the discussion of major theoretical and practical implications. This chapter highlights the novel contributions of this study to the existing literature of teams and sensemaking theory. Future research directions are discussed with respect to the research limitations.

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Chapter 2: The Effect of Transactive Memory Systems on Team Sensemaking: The Roles of Task Conflict and Reward Interdependence

Abstract

This research examines the relationship between TMS and team sensemaking in the presence of critical boundary conditions namely: task conflict and reward interdependence. In so doing, this study conceptualizes and examines the conditional effects of task conflict and reward interdependence with respect to the link between TMS and team sensemaking. Due to relevance of these enabling conditions, it is also conceptualized that the effect of TMS would be more salient for team experiencing high task conflict and high reward interdependence. In brief, this research investigates the three way interaction effect of TMS, task conflict and reward interdependence on team sensemaking. Furthermore, the data was collected from 304 employees who worked in 87 organizations of the ICT sector of Pakistan. Results showed that TMS have a positive impact on team sensemaking. Furthermore, findings suggest that task conflict and reward interdependence jointly moderate the relationship. Analyses revealed that transactive memory systems were most strongly and positively related to team sensemaking when both task conflict and reward interference were perceived to be high. This study is one of the first few attempts that examine the influence of transactive memory system on team sensemaking. In doing so, this study essentially explores the pivotal role of transactive memory systems which is directly linked with team sensemaking. Furthermore, this research has examined the salient roles of task conflict and reward interdependence in shaping the link of transactive memory systems with team sensemaking.

Keywords: Team sensemaking, transactive memory systems, task conflict, reward interdependence.

2.1 Introduction

Sensemaking is the process by which team members impose sense on a current situation in an effort to anticipate future situations and to reduce uncertainty or ambiguity (Ashmos & Nathan, 2002; Klein, Wiggins & Dominguez, 2010; Maitlis & Sonenshein, 2010; Fellows & Liu, 2016). Previous research indicates that sensemaking enhances team task performance because members develop a shared understanding of tasks and means of coping with the challenges at hand (Allen, Reiter-Palmon, Crowe & Scott, 2018; Bowen & Ostroff, 2004; Smith, Wallace, Vandenberg & Mondore, 2018).

Despite the growing interest in team sensemaking as a construct, there is limited consensus regarding the antecedents of team sensemaking (Akgun et al., 2012; Hekkala, Stein & Rossi, 2018; Feldman & Rafaeli, 2002). A growing body of research over the past two decades has focused on identifying factors important to sensemaking in team contexts (Maitlis, 2005; Maitlis and Lawrence, 2007; Maitlis and Christianson, 2014). These factors include human and machine intelligence (Malhotra; 2004), adaptive and recursive practices (Mantere; 2005), leaders' and (Maitlis and Lawrence, 2007; Sonenshein, 2010), middle managers' (Beck and Plowman, 2009) sensegiving and, role structures (Bigley and Roberts, 2001; Bechkey, 2006). Past research on team sensemaking has identified the role of communication (Weick, Sutcliffe, and Obstfeld 2005; Weick, 1995; Cornelissen, 2012; Sonensheim, 2010; Maitlis, 2005), common interpretation of unforeseen or ambiguous events –especially in times of crises or change (Maitlis and Sonenshein, 2010), and sociomateriality, the overlap of the social and the technological aspects of organizational life, (Bechky, 2003; Stigliani & Ravasi, 2012; Balogun, Jacobs, Jarzabkowski, Mantere &

Vaara, 2014) as enablers of sensemaking. However, the role of transactive memory systems (hereafter TMS) as an antecedent of sensemaking has been relatively unexamined (Barnier, Klein & Harris, 2018; Uitdewilligen, Waller & Zijlstra,2010; Weick & Roberts, 1993).

TMS refer to shared awareness of who knows what within the group (Peltokorpi, 2008). A team's transactive memory is the knowledge of the information held by other team members. This information of "who knows what" allows team members to carry out their duties in such a way that they can tap the experience within the team as a whole (Uitdewilligen, 2011). Laboratory experiments have demonstrated the positive effect of TMS on team performance (Moreland & Myaskovsky, 2000) and field studies (Austin 2003, Faraj and Sproull 2000, Lewis 2003). There is ambiguity regarding TMS's relationship with similar cognitive concepts (Peltokorpi; 2008). Past research has not examined TMS's impact on team sensemaking, though a few studies have investigated the impact of TMS on similar concepts such as shared mental models (Cannon-Bowers & Salas, 2001; Ellis, 2006).

This study is unique with respect to sensemaking theory as it provides three sets of contributions. First, it adds to understanding of what facilitates team members' sensemaking by identifying TMS as an important antecedent. Second, this study contributes to an understanding of the conditions that enhances the positive relationship between TMS and team sensemaking, namely task conflict and reward interdependence. Knowing more about these conditions also allows to ascertain the interaction between TMS and task conflict thereby providing an indepth understanding about the complexity of the relationship between TMS and team sensemaking rather than assuming a simple linear relationship. Given also the potential interaction between task conflict and reward

interdependence (Schaeffner et al, 2015), this study further investigates if the effect of TMS would be more salient for team experiencing high task conflict and high reward interdependence. In sum, this study aims to investigate the three way interaction effect of TMS, task conflict and reward interdependence on team sensemaking. In doing so, the current study makes an important contribution to the extant literature because that treatments of sensemaking as a construct are scarce (to say the least) as most studies regarding sensemaking are qualitative (Strike & Rerup, 2016; Weick et al., 2005). Also, the current study presents a pragmatic approach to sensemaking whereas it has been mostly used to understand crisis situations in teams (Hardy & Costargent, 2017; Stieglitz et al., 2017). Previous literature has examined crisis-triggered sensemaking as it occurs during an unfolding crisis (Christianson et al., 2009; Weick, 1988). Crisis are the situations which are characterized by ambiguity, confusion, and feelings of disorientation (Maitlis & Sonenshein, 2010). Studies revolving around crisis include Weick's analysis of Mann Gulch fire (1993), falling of the roof at the B&O museum (Christianson et al., 2009), and Bhopal disaster (2010). Limiting the study of sensemaking to only crises may lead to oversimplified models of sensemaking as this model takes only a few factors into account (Weick, 2010; Hernes, 2008). Events that can trigger sensemaking can be major planned and unplanned events or minor planned and unplanned events or a combination of above mentioned possibilities (Sandberg and Touskas (2014). In the words of Weick (2005, p.410), "The order in organizational life comes just as much from the subtle, the small,… and the momentary as it does from the conspicuous, the large, and the substantive". By excluding the "smaller" moments and focusing only on the "conspicuous", the field of

sensemaking would be limiting it Hence, this study makes a valuable contribution by extending insights based on sensemaking theory from crisis to the ordinary context.

2.2 Theory and Hypotheses Development

According to Wageman (1995, p.146), "Interdependence among teams can derive from several sources: (1) task inputs, such as the distribution of skills and resources and the technology that define the work; (2) the processes by which members execute the work; (3) the way that goals are defined and achieved; and (4) the way that performance is rewarded." The current study focuses on two forms of interdependence, cognitive interdependence and reward interdependence. According to Blau's social exchange theory (1964), an exchange occurs when there is a bidirectional transaction: something is given and something is received. If there was complete independence, the work outcomes would have been a product of solo effort or complete dependence and hence social exchange would not have existed (Cropanzano, 2005).

TMS can be viewed as cognitive interdependence (Wegner, 1987) and is usually considered as an exogenous construct (Austin, 2003; Choi, Lee & Yoo, 2010; Rau, 2005). The Transactive Memory Theory was developed by Wegner and colleagues (1985, 1987) to explain how individuals can increase their own limited memory capacity with external aids, including other people. Just as humans are limited in their capacity to process information by bounded rationality, their ability to recall information is also limited. Transactive memory theory explains that over and above the internal memory of an individual, a team also has an external memory, a recollection of what the individuals jointly know about the capability of other team members (Peltokorpi, 2008; Uitdewilligen,

2011; Dai, Du, Byun & Zhu, 2017). The external memory serves to augment the internal memory of individuals. TMS are a team level phenomenon that represents a team's shared systems for storing and retrieving information regarding team members' expertise (Chiang, Shih & Hsu, 2014). It reduces cognitive load on individuals by providing members access to a large information pool across knowledge domains (Seufert, Wagner & Westphal; 2017). Previous research indicates that TMS enhance group task performance because they allow members to specialize in roles, identify experts (Lewis & Herndon, 2011; Ren & Argote, 2011) and augment their knowledge by using team members as external cognitive aids (Kozlowski & Ilgen, 2006). Team members who share TMS, theorists suggest, can anticipate team member's responses and coordinate effectively to make use of limited resources such as time (Mathieu, Heffner, Goodwin, Salas, & Cannon-Bowers, 2000).

According to social exchange theory (Blau, 1964), team members regulate their dealings with other team members founded on a self-interested cost-benefit analysis. Such benefits may be intangible, as team members may interact with each other in hope of reciprocity in the future. (Endres & Chowdhury, 2019; Cabrera & Cabrera, 2005; Gouldner, 1960). Team members' willingness to develop specialized expertise and then share that expertise with other team members is based on the social exchange theory (Blau, 1964) and it's principle of reciprocity. It is expected that team sensemaking stands to benefit from TMS. Teams where members can rely on one another to acquire, process, and convey information from distinct knowledge repositories (Lewis, 2003) are able to engage in effective team sensemaking.

However, efficient TMS functioning depends on several other team factors (Peltokorpi, 2008). Rau (2005) found that the extent of relationship conflict in teams had a

moderating effect on the relationship between awareness of the experise centeres in a team and team performance. A recent study by O'Toole, Ciuchta, Neville, and Lahiril (2017) studied the effect of TC in moderating the relationship between TMS and team outcomes. This study informs the sensemaking theory by studying the role of TC on the relationship between a TMS of a team and its sensemaking ability.Task conflicts describe "disagreements among team members about the content of the tasks being performed, including differences in ideas, viewpoints, and opinions" (Jehn, 1995, p.258). While some authors believe that task conflicts can, under certain conditions, adversely affect team effectiveness (De Wit., Greer & Jehn, 2012), most past research has found task conflict to be positively related to team outcomes (De Church & Marks, 2001; De Dreu,2006; De Wit, Greer, & Jehn, 2012). As per social exchange theory, task conflict can engender the exchange of divergent ideas and under this condition, it has become relevant to examine the relationship betweenTMS and team sensemaking (O Toole et al., 2017).

Reward interdependence, another team factor, represents an important motivation mechanism to share knowledge, learn what others know (Serrano & Pons, 2007; Scager, Boonstra, Peeters, Vulperhorst & Wiegant, 2016) and overcome conflict. Reward interdependence is the degree to which rewards are contingent on team performance. Several researchers have argued that the extent of reward interdependence is critical for the consequences of task conflict on team performance (De Dreu, 2006; Farh, Lee, & Farh, 2010; Jehn, 1995). When team members are concerned about themselves and other team members, they have an inclination to select problem-solving strategies (Chiocchio, Forgues, Paradis, & Iordanova, 2011). Reward interdependence provides motivation for problem-solving and willingness to collaborate (Wageman & Baker, 1997). The study

addresses this stream of research by taking the extent of reward interdependence into account when examining the effect of TMS and task conflict on team sensemaking. More precisely, this study scrutinizes whether the potential of TMS and task conflict for enabling team sensemaking is contingent on the level of reward interdependence in teams.

2.2.1 Sensemaking

Sensemaking refers to how organization actors "structure the unknown so as to be able to act in it"(Ancona, 2012, p.3). It involves coming up with a plausible understanding, a map of a shifting world. This map is created in conjunction with relevant others. Sensemaking enables organization actors to have a better comprehension of what is going on in their environments, thus enabling other activities such as "visioning, relating, and inventing" (Ancona, 2012, p.3). Sensemaking and sense giving are complementary processes (Rouleau, 2005; Gioia and Thomas, 1996). Sensemaking revolves around creating order and making retrospective sense of ongoing events (Maitlis, 2005) and occurs when participants face events, matters, and actions that are novel, unprecedented, unexpected or puzzling (Gioia & Thomas, 1996; Weick, 1993, 1995).

One important debate in the discipline of sensemaking is whether sensemaking is an individual process or a social one, whether it takes place within individuals or between individuals (Maitlis and Christianson, 2014). A review of sensemaking definitions reveals that there are some authors that view sensemaking as an individual process. For instance, Hill and Levenhagen (1995) describe sensemaking as a vision or a mental model of one's environment. While it is valid to think of sensemaking in the context of individuals, it is most effective to articulate it as a social process. Multiple and sometimes divergent viewpoints are used to construct meaning (Coutu, 2003). The sensemaking will be richer

if a current situation is discussed from multiple people's viewpoints. Weick (1995) lists "social" as one of the seven important attributes of sensemaking. According to Weick et al., (2005) sensemaking is a social process that unfolds as members interact with each other and hence lend meaning to the environment collectively.

It is important to disntinguish sensemaking from two related but distinct concepts: sensegiving and knowledge management. Sensegiving is related to persuading relevant others. The concept of sensegiving is based on the concept that sensemaking is influenced by what information is shared with individuals, what they take for granted and what they accept or reject (Logemann, Piekkari, & Cornelissen, 2019). Hence, sensegiving is influencing other people's meaning-making (Gioia & Chittipeddi, 1991; Maitlis & Lawrence, 2007; Weick et al., 2005) through controlling cues and controlling interaction among individuals (Weick et.al, 2005; Kannan-Narasimhan & Lawrence, 2011)

Several authors have drawn a distinction between knowledge management and sensemaking. According to Boland and Yoo (2004), sensemaking is distinguished from the traditional view of knowledge management in that knowledge management treats the environment as independently knowable and expects managers to prospectively choose courses of action. Sensemaking differs in comparison as situations are viewed as equivocal and managers are expected retrospectively to impose sense.

According to Griffith, Sawyer and Neale (2003) knowledge can fully be appreciated if viewed in the context of sensemaking. While many models of knowledge management restrict themselves to cognitive aspects, a sensemaking model of knowledge allows incorporating the social dimensions, such as communication of knowledge

management. Hence "knowledge (is) both a subject and a product of sensemaking by individuals, groups, and organizations (Cecez-Kecmanovic; 2004).

2.2.2 Team Sensemaking

Team sensemaking as a social processs (Coutu, 2003; Weick, 1995; Weick et al., 2005) is considered an important factor in determining a team's performance (Akgun et al., 2012). Many cases of team failure can also be attributed to the failure in team sensemaking, where critical stimuli are not paid heed to and/or the team fail synthesize the available information (Klein et al., 2010).

A key challenge in identifying the dimensions of team sensemaking is that varying streams of literature ascribe different meanings to the notion of "sensemaking." For instance, there is a stream of research rooted in Social Cognition Theory (SCT), which views sensemaking as a cognitive mechanism (Russel, Stefik, Pirolli & Card, 1993; Qu and Furnas, 2005). In contrast, another stream of research attributes sensemaking as a communication. Externalized speech is the primary mechanism through which team members keep up with their team members' thoughts (Clarke and Cornellison, 2011) and in this manner, the collective interpretations and memory are talked into existence (Brown et al., 2008). Yet another stream of research focuses on the "attitude of wisdom" that sense makers must adopt. While the above-mentioned aspects of sensemaking focus on the classification of information and the articulation of information, the attitude of wisdom refers to the manner in which the information is held (Weick, 2003).

In the last decade, the business world has seen a growing interest in exploring the effects of team sensemaking on team outcomes. A careful review of the literature reveals

that the research on TSM can best be considered sparse (e.g. Rivas, 2018; Broda, 2017)., and more importantly these small numbers of existing papers are limited in their scope.. For instance, the studies of Neil, McKee and Rose (2007) and Gray, Butler, and Sharma (2015) investigated sensemaking from the individual's point of view . Neil, McKee and Rose (2007) only examined the strategic aspects of sensemaking. Gray, Butler, and Sharma (2015) explored the retrospective attention element of sensemaking, but they didn't investigate how team sensemaking may leverage communication and reflection to improve performance. While Akgun et.al. (2012) studied team sensemaking from a team's perspective, they did not account for retrospective attention, i.e, confirmatory encoding and representation shifting. Moreover, little effort has been made to formulate a sensemaking from ICT firm's perspective. Further research efforts are required to empirically examine team sensemaking efforts. This present researeach is an attempt to elaborate the concept and framework of team sensemaking.

It is natural that the lack of consensus as to what constitutes team sensemaking is reflected in the empirical studies, which seek to measure sensemaking. This lack of consensus also indicate the non-existence of a very well defined instrument to measure team sensemaking in its entirety. The sensemaking literature reflects remarkable inconsistency in defining the subconstructs of team sensemaking. For instance, Neil, McKee and Rose (2007) investigated whether sensemaking capability is a precursor to adaptive strategic marketing resources. They posit sensemaking consists of three dimensions namely: *communicative; interpretive;* and *analytical*. The communication aspect focuses on creating a shared vision in the minds of individuals through the sharing of relevant information. The interpretive function focuses on strategic complexity: what

information is received and how it is interpreted. The analytical portion consists of considering multiple perspectives and developing meaning of a strategic situation through sharing and debating multiple courses of action among decision-makers. Their unit of analysis was organization. The sub-constructs were strategic information exchange, strategic complexity, and multiple perspectives consideration. Strategic complexity was further divided into competitor, customer and macro-environmental orientations. There was very little attention paid to how the flux is arranged into orderliness and how the mental models were created. There was no mention of reflection or attitude of wisdom, a key component of sensemaking.

Gray, Butler, and Sharma (2015) present a slightly more complex view of sensemaking. They agree with Weick's (1995) view of sensemaking as an iterative effort to create and refine knowledge structures, to develop useful frames of reference leading to effective action. Therefore, Gray et al.'s (2015) view of sensemaking can be thought as an "emergent" view. They divide sensemaking into two dimensions: confirmatory encoding and representation shifting. When individuals face a new task they will create an initial cognitive representation based either on their experience or on their observation of others' experiences (Qu and Furnas, 2005). The act of organizing information within existing frameworks has been labeled as confirmatory encoding (Russell, Stefik, Pirolli and Card, 1993; Gray et al., 2015). Sometimes the information does not fit into the existing classification. Such information accumulates as "residue". When the residue becomes too substantial to ignore, the old cognitive schema can be modified or discarded and a new cognitive representation will be created. This process is called representation shifting (Gray et al., 2015).

The third attempt at quantitatively measuring sensemaking was made by Akgun et al. (2012). Their paper is relevant because it conceptualizes sensemaking from a team's point of view. The authors focus on creating a measure of team sensemaking capacity in the context of technological management innovation. The subconstructs of sensemaking have been defined as internal communication, external communication, information gathering, and information classification, building shared mental models and taking experiential actions. The model includes a construct labeled "building shared mental models", but it pays attention only to building a clearer understanding of the task at hand. However, confirmatory encoding and representation shifting are not incorporated in Akgun et al (2012) model. While Neill et al. (2007) view sensemaking strictly from a strategic point of view and additionally view it as a "one-shot" notion without taking into account the reflective thought process so integral to sensemaking, Gray et al. (2015) focus singularly on retrospective attention: confirmatory encoding and representation shifting. Akgun et al. (2012) do not take into account the confirmatory encoding and representation shifting. Hence, the extant literature does not offer a complete framework of team sensemaking.

In this theoretical background, it is argued that the elements of team sensemaking are derived from the enactment theory. The enactment theory suggests that teams are surrounded by a flux of events. The sensemaking is initiated by noticing and bracketing of what is relevant to the ongoing task. Cues are lent meaning through deciding what information is relevant and what explanations are relevant. Information can either be preserved in pre-existing cognitive representations or cognitive representations can be modified in response to new information (Gray et al., 2015). According to Weick et

al.(2005, p.412) "sensmaking involves labelling and categorizing to stabilize the streaming of experience". Moreover, team sensemaking is a social process and team members make sense "through communication, of the circumstances in which they find themselves" (Weick et al, 2005, p.412). Lastly, even as information is retained and communicated, an attitude of wisdom is adopted and a possibility is entertained that current schema and interpretations might be accurate and necessary. Reflection as an attitude of wisdom is considered as a necessary element of sensemaking (Weick et al., 2005).

Based on the conceptualization of sensemaking as a social process (a team effort) that deals both with the mundane and novel situtauions, and address both big and small discrepancies, this study proposes that team sensemaking is a multidimensional construct. For this study, it consists of three subdimensions namely: social cognition; communication; and reflection. Social cognition consists of three further sub-dimensions namely: confirmatory encoding; representation shifting; and team situation models.

Teams (organization actors) are surrounded by a flux of events. The information received via the stimuli is sorted into pre-existing classifications via confirmatory encoding or the classification structure is updated through representation shifting (social cognition). Team members communicate with each other and create a collective mental representation or team situation model. The last component of team sensemaking is reflection. Reflection represents an attitude of wisdom where information is retained and preserved while simultaneously considering the possibility that the current schema and classification might require future refinement. Reflection is a necessary feature of sensemaking because it creates the possibility through which current schema and classification can be evaluated for their accuracy and refined accordingly. Employing confirmatory encoding,

representation shifting, team situation models and articulation and reflection team members can develop a plausible story around ongoing events.

The conceptualization of team sensemaking in this research allows for the top-down and bottom-up approach by taking into account: (a) new information is being sorted into the mental schemas; and (b) in the presence of substantial information that does not lend itself to classification within the current schema, in other words, the "residue" , the schema itself is subject to refinement and updating.

Social Cognition is a key component of team sensemaking. One of the sub-dimensions of social cognition is confirmatory encoding. Confirmatory encoding is primarily driven by the question if the situation at hand is the same as or different than previous experiences. For instance, if new information is similar to prior information then it is stored in pre-existing representations and it can be retrieved through confirmatory encoding. The second dimension of social cognition is representation shifting. Sensemaking involves the continuous search for newer representation and in this quest the representations are chosen and shifted in response to new stimuli. (Russel et.al; 1993). A novel or disruptive bit of information or accumulation of small pieces of information that cannot be classified in the current schema leads to "representation shifting". As the sensemaker's knowledge and understanding about a situation or a task grows, s(he) might feel that the initial representation was not adequate and hence new information would lead to representation shifting (Qu and Hansen;2008). The final dimension of social cognition is team situation model. Team situation model is the shared understanding and dynamic mental map concerned exclusively with the present task, environment and the team itself. As team members develop perception of the environment through scanning they form

assessments and discuss relevance of stimulus to the current situation, and its potential impact on the future (Sutcliffe, 2004). The outcome is a shared cognitive map held by the team (Haar, Li, Segers, Jehn & Bossche; 2015). Cook et al.(2004) refer to such dynamic awareness as transitory shared knowledge. Through these shared team situation models, teams can make sense of the situation by assigning meaning to environmental cues. Shared mental models also help the teams condense the influx of data gathered from a complex environment into a more manageable set of cognitive representations (Akgun et.al, 2012).

Assigning labels and categories is an important part of sensemaking. It helps stabilize the streaming of experience (Gray et al., 2015; Johnson et al, 2013; Neill et al.,2007). Organizing new information that is similar to prior experience is classified in existing frameworks. This process is called "confirmatory encoding." According to Gray et al. (2015) confirmatory encoding can be defined as a means of organizing information related to tasks within preexisting cognitive representations.

Not all information fits neatly into existing frameworks. Sensemaking involves making sense of the ongoing tasks by refining representations (Gray et al., 2015). Representations are chosen and changed in response to new stimuli (Russel et al., 1993). A novel or disruptive bit of information or accumulation of small pieces of information that cannot be classified in the current schema leads to "representation shifting". As the sensemaker's knowledge and understanding about a situation or a task grows, he might feel that the initial representation was not adequate. The information that does not fit into existing frameworks accumulates as residue. Over time, the residue becomes too large or too costly to ignore. Hence, new information will lead to representation shifting rather than

confirmatory encoding (Qu and Hansen; 2008). The old cognitive representation will be modified (or discarded) and a new representation will be created.

Team situation model is the shared understanding and dynamic mental map concerned exclusively with the present task, environment and the team itself (Haar et al., 2015). As individuals develop a perception of the dimensions in the environment through scanning, the comprehension of their relevance, and its meaning in the future, they share their individual assessments. The result is a shared cognitive map held by the team (Haar, Segers, Jehn, Bossche (2015). Cook et al (2004) refer to such dynamic awareness as fleeting shared knowledge.

Communication is at the heart of sensemaking. The social process of sensemaking is facilitated through communication (Weick et al., 2005). Tacit knowledge is made explicit through communication and information sharing. Shared mental representations are developed by asking questions and listening carefully. Through reliable patterns of communication, knowledge is integrated and understanding of complex problems is reached (Gardner, Gino, and Staats, 2012). Communication is a continuous process of information exchange and allows members to continually engage in transfer and updation of knowledge (Cornelissen, Mantere and Vaara, 2014; Gardner et al., 2012; Mahyar & Tory, 2014; Weick et al., 2005). In words of Weick et al., (2005, p.412) "sensemaking is a social process of making sense through communication, of the circumstances in which people collectively find themselves."

Reflection can be defined as the process by which the reciprocal exchange between actors and environments are preserved. It has been described as the critical scrutiny of a process, such that it can be subsequently adjusted in response to new information"

(Edmondson, 2002). At the team level, reflection refers to behavior that encourages team members to develop insights about the processes and performance of a team. Plausible stories are built around events (Hodgson, 2007; Brown et al., 2008). Some fall to the wayside while others are carried forward (Rutledge; 2009). Reflection as a key feature of team sensemaking is dynamic and acts as an integral component of team sensemaking. Weick (1995, p.43) stated that people are always in the middle of things and reflection permits team members to take a step back from an experience and draw mindful inferences (Wiedow & Konradt , 2011).

2.2.3 TMS and team sensemaking

TMS emphasize the unique and distinctive knowledge that team members hold (Ilgens, Hollenbeck, Johnson & Jundt, 2005). Yuan, Fulk & Monge (2007) describe TMS as emerging from individual level expertise directories. Mere storage of expert knowledge does not make it automatically usable. TMS provide connections among otherwise isolated pockets of expert knowledge. There are only a few studies in field settings that test the relationship between TMS and other cognitive concepts (Peltokorpi; 2008). There are three possible explanatory mechanisms for how TMS may positively impact team outcomes such as team sensemaking. First, role specialization allows team members to develop deep expertise as specialization facilitates differentiated structure of team membership knowledge (Harvey, 2010; Austin, 2003; Lewis, 2003). Second, less time is spent searching for relevant information; team members know who to tap to augment their internally held knowledge. Last, uncertainty about how team members will behave in a given situation is reduced (Converse, Cannon-Bowers & Salas, 1993; Lewis 2004).

Theory of TMS suggests that through TMS, a team's members come to possess specialized expertise. The expertise in turns facilitates reliance on another for specific aspects of task-relevant knowledge, and coordination of information processing and task activities (Lewis, 2003). Without TMS, team members are less likely to trust each other's advice, have faith in their team member's capability and hence it is likely there will be greater discord among team members. TMS does not only have the potential benefits in terms of enhancing team resources by positively contributing to learning (Akgun, Byrne, Keskin, Lynn, & Imamoglu, 2005), knowledge sharing (Choi, Lee, & Yoo, 2010) and creativity. It also has the potential to dampen resource depletion by mitigating discord among team members (Lewis, 2004; Bachrach, Hood, Lewis & Bendoly, 2014). Hood, Bachrach & Lewis (2014) argue that teams with a less developed TMS encounter more conflicting task-related information. In the absence of TMS, the pressure on resources such as time and cognitive ability increases because team members do not know where the team expertise resides and what the credibility of the information shared is.

Both TMS and team sensemaking are important team level phenomena as they represent socio-cognitive aspects of team work. Transactive memory emphasizes task-oriented domains of expertise (Rau, 2005; Mohammed & Dumville, 2001).Team sensemaking on the other hand is the "shared" process by which a team manages and coordinates its efforts to explain the current situation and to anticipate future situations, typically under uncertain or ambiguous conditions (Klein, Wiggins & Dominguez, 2010, p.304). Hence, the following hypothesis proposes a positive link between TMS and team sensemaking.

Hypothesis 1: TMS are positively related with team sensemaking.

2.2.4 Interactive effect of TMS and Task Conflict

Task conflicts refer to "differences among team members related to the content of their decisions and differences in viewpoints, ideas, and opinions about the task" (Jehn et al., 2013, p. 352). Researcher have examined conflict in teams by focusing on the negative aspects of conflict (Amason, 1996; De Dreu, 1997; De Dreu & Weingart, 2003; Jehn, 1997; Turner & Pratkanis, 1997). Task conflict is associated with negative outcomes such as low team performance and poor team satisfaction (Gladstein, 1984; Saavedra, Earley, & Van Dyne, 1993; Wall & Nolan, 1986; Janssen & Giebels, 2013). Task conflict can take place when there are differences about resource allocation, policies and procedures , and comprehension of facts (De Dreu & Weingart, 2003). Hence, it is believed that the TMS will not be fully able to impact team sensemaking in the presence of high task conflict and therefore, it is relevant to investigate the moderating role of task conflict. Task conflict occurs when team members consider a number of alternatives from a variety of diverse perspectives (Ensley, Pearson & Amason, 2002). Hence, task-focused disagreement can lead to information hoarding and breakdown in team sensemaking. As per the above discussion, it is postulated in the following hypothesis that task conflict can buffer the poaitive relationship between TMS and team sensemaking.

Hypothesis 2: Task conflict moderates the relationship between TMS and team sensemaking, such that the relationship between TMS and team sensemaking is stronger under conditions of low task conflict.

2.2.5 Three way interaction: Moderated moderation effect of task conflict and reward interdependence

In the previous section the negative outcomes of task conflict wre discussed. However, an opposing stream of research has suggested that task conflict might have positive effects on team work (Jehn, 1995; Jehn, Northcraft, & Neale; 1999). Simons and Peterson (2000) summarized the literature by noting that teams affected by task conflict appear to make better decisions because the dispute promotes a more comprehensive interpretation of the problem under consideration. In the absence of conflict a team may fall prey to group think and team will not be able to engage in team sensemaking (Janis, 1982; Gibson, 2001, Rahim, 2017). In the following section, reward interdependence is discussed, as a positive motivational mechanism that helps overcome the buffering effect of task conflict.

Reward interdependence is defined as "the extent to which the rewards that an individual reaps are dependent upon the performance of his team members" (Wageman & Baker, 1997, p.142). This study proposes that reward interdependence interacts with team conflict to impact team outcome – team sensemaking. There are some authors who have highlighted the overall positive impact of task conflict (Jehn & Bendersky, 2003; De Dreu, 2006), while other have focused on the conditions under which task conflict may be detrimental (Farh, Lee & Farh, 2010). Moreover, researchers have conflicting viewpoints on the impact of intra team conflict on team efficacy. One viewpoint is that conflict increases cognitive load on a team and negatively impacts performance. Contrasting viewpoint reckons that conflict can stimulate team cognition (Schwenk, 1990; Simons & Peterson, 2000; Gibson, 2001). While relationship conflict is largely believed to have a negative impact on team outcomes, the empirical evidence about of task conflict is mixed. Hence, this study tries to unpack under what conditions task conflict can benefit team

outcomes. This investigation of task conflict can also facilitate to address the above mentioned research gaps due to mixed findings.

In this backdrop, the current study proposes that the negative effects of task conflicts are dampened by increasing the reward interdependence. Reward interdependence acts as an effective control mechanism to keep the negative effects of intra-team conflict in check. Teams with high reward interdependence interact frequently to develop shared ex***-*pectations, language and norms (Stewart and Barrick, 2000). Team members learn from each other through close interactions (Trist, 1981) and put collective goals ahead of individual needs (Adler and Kwon, 2002; Hoegl and Parboteeah, 2006). Indeed, reward interdependence creates pro-social motivation and willingness to better manage conflict, learn more, and perform more effectively (De Dreu, 2007). Reward interdependence engenders information exchange and team productivity (Moser & Wodzicki, 2007; Comeau & Griffith, 2005).

The theory of social interdependence (Deutsch, 1949 ; Johnson & Johnson, 2009) indicates that group rewards generate a collaborative (rather than competitive) environment, thus encouraging team members to pool their resources (Beersma, Hollenbeck, Humphrey, Moon, & Conlon, 2003). Also, the rational actor model underlying reward interdependence theory suggests that reward interdependence will create a rational motivation for team members to help one another. When a team member believes that their rewards depend on the performance of the other members, he or she will increase knowledge exchange interactions to improve the effectiveness of knowledge boundary spanning to prompt the performance of another in order to maximize collective rewards (Moser & Wodzicki, 2007). According to social exchange theory, reward interdependence

may activate the team level aspects of reciprocity and group cohesion, which together will motivate helping a colleague in need (Frenkel & Sanders, 2007).

While on the positive side, task conflict can enhance team performance by consideration of differing opinions (Chen & Chang, 2005; Farh, Lee, & Farh, 2010; Salas et al., 2015; Lee et. al., 2019), this study argues that team members are mindful of the potential costs of task conflict. For example, previous studies have shown that there is a likelihood of task conflict leading to relationship conflict (Jimmiesona, Tucker & Campbell, 2017; Simons & Peterson, 2000). It is possible that task conflict is inferred as personal assault (Jehn, 1997) or hidden agendas (Amason & Sapienza, 1997; Eisenhardt & Bourgeois, 1988). Another possibility is that while expressing task conflict, team members may resort to emotionally abusive language (Pelled, 1996) which can lead to bad feelings. If costs associated with task conflict are perceived to be high and are not offset by the expectation of a shared reward, team members may hesitate to offer differing opinions. It might also lead to reluctance amongst team members to ask internal experts for help. This can substantially impede the positive effect of TMS on team sensemaking. In conclusion, it is expected that if team members are working under a configuration where task conflict is high but the reward interdependence is low, the positive relationship between TMS and team sensemaking will be strained.

Task conflict encourages discussion and consideration of multiple points of views. However, synergy cannot be achieved if low reward interdependence disincentives open discussion. Therefore, while TMS and high task conflict may be enablers of effective sensemaking, high reward interdependence can be a necessary condition to leverage the benefits of TMS and task conflict on team sensemaking. It cannot be assumed that team

members will always have egalitarian and trustful relationships (Gibson, 2001). Knowledge sharing and a spirit of cooperation, so critical to team sensemaking might differ across varying configurations of task conflict and reward interdependence. In this context, it has become interesting to examine the three way interaction or moderated moderation effect of TMS, task conflict and reward system as proposed in the following hypothesis.

Hypothesis 3: There is a three way interaction among TMS, task conflict and reward interdependence such that the positive relationship between TMS and team sensemaking is strongest when task conflict is high and reward interdependence is also high.

2.2.6 Research Model

Figure 2.1 depicts the conceptual framework proposed for this research. The purpose of this paper is to examine team sensemaking by leveraging a conceptual framework based on the theories of transactive memory system, task conflict and reward interdependence. Given that many organizations rely on teams, the current study examines the impact that TMS on team sensemaking. Additionally, this study examines the constraining and enabling effects of task conflict and reward interdependence.

This study develops a contingency perspective that views team sensemaking as a function of the interaction between TMS, degree of task conflict, and reward interdependence. A fundamental assumption underlying the model is that TMS affects the social system in which team members perform in different ways. Accordingly, this study does not focus exclusively on team sensemaking, and expect to obtain a thorough understanding of how TMS facilitates it. Instead, a multifaceted approach that includes multiple contingent factors (Levitt et al, 1999) is necessary. This study chooses these two

boundary conditions because these are the most proximal to team sensemaking. The impact of TMS on team sensemaking is considered to be contingent on both degree of task conflict and the degree of reward interdependence.

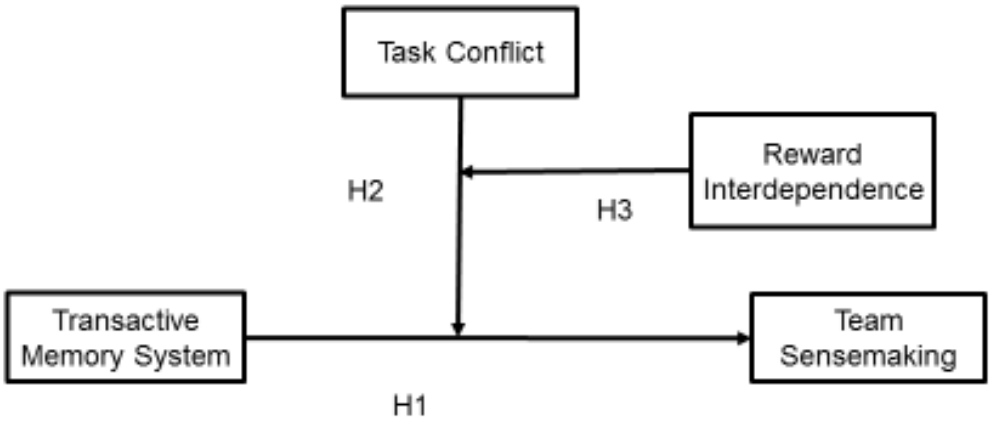

Figure 2-1: Conceptual Framework: Three-way interaction

2.3 Methodology

2.3.1 Instrument Refinement

The theoretical model conceived team sensemaking as a third-order construct with three dimensions of team sensemaking namely: social cognition, communication, and reflection such that social cognition has further three sub-dimensions: confirmatory encoding, representation shifting, and team situation models.

Following the guidelines outlined by Nunnally (1967), Gerbing and Anderson (1988), and Churchill (1979), a stepwise procedure was employed to refine the instrument of the construct. Three apriori dimensions were specified after exhaustive literature review

as discussed earlier. A list of relevant items for the dimensions of team sensemaking was selected from relevant literature. The list of items thus generated were discussed in detail first with three PhD canidates of organization behavior and afterwards two focus group sessions were conducted with individuals who work as teams in ICT firms. In each focus group, six participants were invited including two team leaders, two I/S designers, and two domain representatives. A team leader is a person who manages the focal project. Designers are professionals who have expertise in I/S technology, system development, programming, Domain representatives are professionals whose primary responsibility is to act as customer representative and ensure customers' functional needs are being met. The participants of focus groups were probed as to how a team functions. They were shown the items selected and were asked if any aspect of their teamwork in "making sense" of their task had not been captured. The participants of the focus groups deemed the items adequate in capturing team sensemaking. As a final step three PhD students performed a Q-Sort procedure. The students were provided with conceptual definitions of each construct and sub-construct (see Appendix-A). They were also provided a list of items and were requested to match each item to a construct/sub construct. Collectively, the discussions with academicians and the practitioners helped to establish the content validity of the instrument.

The initial list comprised of 29 items. After removing 7 items that were either not correctly matched to the definition or were deemed confusing or repetitious, 22 items were retained. The breakdown of these items is as follows: Confirmatory Encoding (4), Representation Shifting (4), Team situation Models (5), Communication (5) and Reflection (4). A sample item of *confirmatory encoding* is "Team members refer to other team

members to understand the finer points of a topic"; a sample item of *representation shifting* is "Team members frequently seek out other team members to get a very different point of view on a particular topic"; a sample item of *team situation models* is "The team members have a shared understanding of the customer's needs and wants", a sample item of *communication* is "Team members ask each other questions if something is unclear", and a sample item of *reflection* is "We consider what we can do about things that didn't work out as planned". These items are presented in Appendix-B.

Data was collected from 106 professionals working in teams for a pilot study. 5 responses were considered incomplete. The remaining 101 responses were used to conduct exploratory factor analysis (EFA). Initially, the factorability of the 22 items was examined. Several well-recognized criteria for the factorability of a construct were used. First, it was observed that all 22 items were correlated with at least one other item, suggesting reasonable factorability. Second, the Kaiser-Meyer-Olkin measure of sampling adequacy was 0.779, above the commonly recommended value of 0.60 (Kaiser & Rice, 1974). A value of greater than 0.6 indicates that the data can factor well. Furthermore, Bartlett's test of sphericity was significant (χ_2 (660) =, $p < .001$). Finally, the communalities were all above .5, further confirming that each item shared some common variance with other items. Given these overall indicators, factor analysis was deemed to be suitable with all 22 items.

To conduct exploratory factor analysis, principal components analysis was used because the primary purpose was to identify and compute composite scores for the factors underlying the team sensemaking instrument. The rotation method specified was Varimax. A total of 7 items were removed because they did not meet the criterion of minimum 0.4 loading or did not load to the hypothesized sub-construct (Brown, 2015). A five-factor

solution was obtained that matched closely to the apriori structure proposed conceptually. The exploratory factor analysis lends support to the model specified. These 15 items were used to measure team sensemaking for this study.

Respondents were asked to indicate the extent the degree to which they agree with the items using a 1 (strongly disagree) to 5 (strongly agree) Likert scale. A 6-item scale was used to measure TMS. The items were adopted from (Choi, Lee & Yoo, 2010). A 3-item scale was employed to measure task conflict. The items were adapted from Jehn and Mannix (2001). A 3-item scale was employed to measure reward interdependence. The items were adopted from Xie, Song, and Stringfellow (2003).

2.3.2 Sample Size and respondents

The ICT industry in Pakistan was the subject of the study. The ICT industry is suitable for the purpose of the study because the work is usually done in teams and there is an ongoing need to make "sense" of the client preferences and to be resilient in face of unforeseen circumstances (Holm & Østergaard, 2015). Pakistan Software Houses Association for Information Technology (IT) and (ITES) (P@SHA), is a leading representative body of Pakistan's software industry. It has 290 members listed in their membership directory. The list of all P@SHA members served as the sampling frame for this research.

2.3.3 Data Collection

An email was sent to each company listed with P@SHA to obtain their preliminary agreement to participate in the study. The email highlighted the research objectives and

promised confidentiality to the respondents. Out of the 290 companies contacted, representatives of 87 companies agreed to participate in the survey by return email. Two reminder emails were sent and several reminder phone calls were made to improve response rate. The response rate was 30%. The response rate is consistent with response rates of similar studies soliciting team level data (Srivastava, Bartol & Locke, 2006; Zacher & Rosing, 2015). This rate is comparable to 20% (Smith, Loftin, Murphy-Hill, Bird & Zimmermann; 2013), and 33-36% (Kim, Zimmermann, DeLine, & Begel; 2018) that were reported for other surveys in knowledge-intensive firms.

A second email was then sent to the human resource mangers of the firms that had agreed to participate to identify 'key informant' to participate in the research. Two reminder emails were sent after an interval of three weeks. Since the unit of analysis was a team, multiple teams from the same organization could participate. A total of 304 questionnaires were regarded useful after dropping the questionnaire for missing information. Only two teams participated from 2 firms, three teams responded from 51 firms, four teams responded from 23 firms and five teams responded from 11 firms. A total of 304 useable responses was attained from 87 ICT firms. (refer to appendix E)

The key informant approach was used to collect data for this research (Seidler 1974). The key informant technique is a method for collecting information on a social setting by interviewing (or surveying) a selected number of participants (Phillips & Bagozzi , 1986). The use of key informants as a methodology to study team-level issues has traditionally been associated with a qualitative approach (Gillespie, Gwinner, Chaboyer & Fairweather,2013), however several researchers have used the key informant methodology to collect data for survey items measuring quantifiable constructs of team

characteristics (Akgun et al, 2012; Akgun, 2020; Algesheimer, Bagozzi & Dholakia, 2018; Philps & Bagozzi, 1981; Seidler, 1974; Tang, Mu & Thomas, 2014).

Informants were carefully selected based on the following three criterion. First, respondents had to have substantial team responsibilities (Akgun et al., 2012). They were required to be either project manager, I/S designer, or domain representative to remain in the study. Second, respondents with more than 3 years of experience with the organization were included in this study. The final criterion was that only respondents with a minimum of six months of experience with the team could be considered as key informants. These criteria were put in place because (1) team leaders, I/S designers and domain representatives are likely to have a bigger picture view of ongoing tasks (Hendreson & Lee, 1992) (2) adequate time spent in the organization and as a part of a team is likely to result in having a keener understanding of overall team constructs. Earlier studies such as Akgun et al. (2012) and Neill et al. (2007) have used similar criteria to qualify key informants.

After the respondent was chosen, each respondent was told that their response would remain anonymous and would not be connected to them personally or to their companies. This was done to ensure anonymity so that the respondents would have no fear of potential reprisals and would fully cooperate with the researcher. Furthermore, the participants were ensured that there were no correct or incorrect responses and they could answer the questions as honestly as possible. When responding to the items in the questionnaire, the respondents were requested to bear in mind the team as a whole and not just his or her own involvement.

While one school of thought believes that relying on single informnts may introduce perceptual bias (Tallon & Pinsonneault, 2011), previous studies have established

that analyzing single informant versus aggregating teams yields consistent results (Atuahene-Gima & Murray, 2004). Other studies such as Akgun (2020), Akgun et al. (2012) and Neill et al. (2007) have relied on a single key informant when investigating higher-level phenomena, such as sensemaking.

2.3.3 Control Variables

Team co-location and team psychological safety were introduced as control variables for several reasons. First, previous studies have demonstrated that team co-location (Coradi, Heinzen, & Boutellier, 2015; Gibson & Gibbs, 2006) and team psychological safety (Edmondson, 1999; Bradley et. al., 2012; ; Kessel, Kratzer, & Schultz, 2012) could exert influence on team functioning and outcomes. Co-location positively influences team outcome because social ties are weakened when team members are dispersed geographically (Gibson & Gibbs, 2006). Team psychological safety can be defined as "a shared belief that the team is safe for interpersonal risk taking" (Edmondson, 1999, p. 354). It was included as a control variable because recent research has shown that it is a critical factors in determining team performance (Cauwelier, Ribière & Bennet, 2016; Edmondson, 2018).

2.4 Results

2.4.1 Descriptive Statistics and Correlation

Table 2.1 presents means, standard deviation and coefficients of Pearson correlations among all variables. As expected, TMS, task conflict and reward interdependence were positively correlated to team sensemaking. TMS, task conflict and reward interdependence were found to be positively co-related to team sensemaking with

Pearson's correlation coefficient 0.586 ($p<0.01$), 0.283 ($p<0.01$) and 0.445 ($p<0.01$) respectively.

Table 2-1: Means, Standard Deviations and Pearson's Correlation Coefficients

Factors	Mean	SD	Team Sensemaking	Transactive Memory System	Task Conflict	Reward Interdependence
Team Sensemaking	2.02	0.478	(0.779)			
Transactive Memory Systems	1.96	0.524	0.586**	(0.834)		
Task Conflict	1.91	0.662	0.283**	0.240**	(0.702)	
Reward Interdependence	1.74	0.570	0.445**	0.403**	0.263**	(0.731)

Note: Diagonal values in parenthesis are valus of square root of AVE(s)
*p < 0.05, **p < 0.01, ***p < 0.001.

2.4.2 Measurement Model

To assess the validity of the measurement model, a number of indices are recommended to determine if the specified model is a good fit to the data. It is recommended that to assess model fit researchers should rely on multiple indices. Two of the most commonly reported measures are normed χ^2 and root mean square error of approximation (RMSEA). Normed χ^2 is the minimum discrepancy divided by its degrees of freedom. It assesses overall fit and the discrepancy between the sample and fitted covariance matrices. Various studies have suggested using ratios as low as 2 or as high as 5 to denote an acceptable fit (Marsh and Hocevar, 1985). Byrne (2016) suggested that the value of chi square should not exceed 3. The RMSEA is "an index of the difference

between the observed covariance matrix per degree of freedom and the hypothesized covariance matrix which denotes the model (Chen, 2007)". RMSEA produces a better quality of estimation when the sample size is large compared to smaller sample sizes. Two additional fit measures are reported, the Tucker–Lewis index (TLI) and comparative fit index (CFI). A value of 0.8 and above for CFI and TLI indicates a good fit. The Comparative Fit Index (CFI) measures the extent to which the fit of a target model is better than the alternate model established with manifest covariance matrix (Chen, 2007). The Tucker-Lewis Index (TLI) is an incremental fit index. The key advantage of this fit index is the fact that it is not affected significantly by sample size (Schermelleh-Engel and Moosbrugger, 2003).

Confirmatory Factor Analysis (CFA) was conducted to separately examine the measurement model of social cognition, the second-order construct. The results are presented in Table 2.2. Confirmatory factor analysis showed factor loading above 0.4 against each item for social cognition. For each of the three sub-dimensions, composite reliability was discovered to be higher than 0.7. The estimates for composite reliability for confirmatory encoding, representation shifting, and team situation models were 0.771, 0.774 and 0.834 respectively. Convergent validity was evaluated by average variance extracted (AVE). The value of AVE for each sub-variable exceeded 0.5. The estimates for AVE for confirmatory encoding were 0.530, for representation shifting 0.534 and for team situation models were 0.628. The goodness of fit statistics showed a good fit of measurement model to the data. In the measurement model for social cognition, the indices are as follows: Normed $\chi^2 = 1.640$; RMSEA = 0.046; CFI=0.984, TLI=0. 976.

Table 2-2: Confirmatory Factor Analysis of Social Cognition

Sub- variable	**Items**	**Factor loading**	**AVE**	**CR**	**Model Fit**
		(> 0.40)	(> 0.50)	(>0.70)	
Social Cognition			0.530	0.771	
Confirmatory Encoding	CE1	0.680***			Normed $\chi 2$= 1.640
	CE2	0.775***			
	CE3	0.721***			CFI= 0.984
Representation Shifting	RS1	0.715***	0.534	0.774	TLI= 0.976
	RS2	0.708***			RMSEA= 0.046
	RS3	0.768***			
Team Situation Models	TSM1	0.805***	0.628	0.834	
	TSM2	0.856***			
	TSM3	0.710***			

***p < .0001

After testing the measurement models for social cognition, CFA was again performed to assess team sensemaking (refer to Table 2.3). This effort to evaluate the measurement model in two steps is compatible with Neill et al's., (2007) proposed evaluation methodology. A list of fifteen final items representing the dimensions and sub-dimensions and their respective factor loadings are presented in Table 2.3. The factor loadings for the second-order construct, *social cognition,* range from 0.685 to 0.858. The

factor loadings for *communication* range from 0.690 to 0.769 while the factor loadings for reflection range from 0.665 to 0.834. The value of the AVE for social cognition was 0.504, for communication 0.546 and for reflection 0.557.

Table 2.3: Confirmatory Factor Analysis of Team Sensemaking

Sub- variable	**Items**	**Factor loading**	**AVE**	**CR**	**Model Fit**
		(> 0.40)	(> 0.50)	(>0.70)	
Social Cognition			0.504	0.748	
Confirmatory Encoding	CE1	0.685***			Normed $\chi 2$= 2.011
	CE2	0.775***			
	CE3	0.720***			CFI= 0.951
Representation Shifting	RS1	0.701***			TLI= 0.938
	RS2	0.703***			RMSEA= 0.058
	RS3	0.786***			
Team Situation Models	TSM1	0.801***			
	TSM2	0.858***			
	TSM3	0.714***			
Communication	Com1	0.756***	0.546	0.783	
	Com2	0.769***			
	Com3	0.690***			
Reflection	Ref1	0.730***	0.557	0.789	
	Ref2	0.834***			
	Ref3	0.665***			

***p < .0001

. The value of composite reliability for social cognition was found to be 0.748. Communication (0.783) and reflection (0.789) also had values of composite reliability above the recommended value of 0.70. The goodness of fit indices show an acceptable fit for team sensemaking measurement model. The indices are as follows: Normed χ^2 = 2.011; RMSEA = 0.951; CFI=0.938, TLI= 0.938.Based on the factor loadings and fit indices reported in Table 2.3, social cognition, communication and reflection are dimensions of team sensemaking and confirmatory encoding, representation shifting, and team situation models are sub-dimensions of cognition.

Finally, confirmatory factor analysis was conducted for all factors: team sensemaking, TMS, and task conflict and reward interdependence. The results are shown in Table 2-4. CFA helps determine the reliability and validity of the latent constructs (Ki & Hon, 2007; Shah & Goldstein, 2006). To test for reliability, Fornell and Larcker (1981) criteria was used. Fornell and Larcker (1981) and Kim (2009) indicated that for the variable to be considered reliable, the value of composite reliability should exceed 0.7. All constructs met the criteria. The composite reliability for team sensemaking was 0.818, for TMS 0.817, task conflict 0.741 and for reward interdependence 0.722. Average variance extracted (AVE) was used to test the convergent validity. Convergent validity is maintained if the AVE exceeds 0.5 (Hair et al., 2006). The value of AVE for team sensemaking was 0.608, for transactive memory systems 0.696, and for reward interdependence 0.535. The value of AVE for task conflict was 0.50.

Table 2.4: Confirmatory Factor Analysis for Four-factor model

Variable	Items	Factor loading	CR	AVE	Model Fit
		(> 0.40)	(>0.70)	(> 0.50)	
Team Sensemaking			0.818	0.608	
Social Cognition					
Confirmatory Encoding	CE1	0.671***			Normed χ^2= 1.776
	CE2	0.770***			CFI= 0.913
	CE3	0.736***			TLI= 0.903
Representation Shifting	RS1	0.693***			RMSEA= 0.051
	RS2	0.703***			
	RS3	0.793***			
Team Situation Models	TSM1	0.802***			
	TSM2	0.852***			
	TSM3	0.718***			
Communication	Com1	0.701***			
	Com2	0.748***			
	Com3	0.769***			
Reflection	Ref1	0.732***			
	Ref2	0.831***			
	Ref3	0.666***			
Transactive Memory Systems	TMS1	0.720***	0.817	0.696	0.333
	TMS2	0.749***			
	TMS3	0.716***			
	TMS4	0.649***			
	TMS5	0.578***			
	TMS6	0.499***			

	TMS7	0.694***		
	TMS8	0.717***		
Task Conflict	TC1	0.647***	0.741	0.493
	TC2	0.839***		
	TC3	0.598***		
Reward Interdependence	RI1	0.606***	0.722	0.535
	RI2	0.852***		
	RI3	0.716***		

***p < .001

In order to establish discriminant validity the value of inter factor corelations was compared with with the value of square root of AVE (Fornell & Larcker, 1981). If the value of the square root of AVE of a construct is greater than correlations of that particular construct with all other constructs, discriminant validity exists between the constructs (Batra & Sinha, 2000). Fornell-Larker criteria was met as the square root of AVE of each latent construct was greater than its inter factor corelations with all other latent constructs (Gefen & Straub, 2005).The comparison of interfactor corelations and square root of AVE is shown in Table 2.1.

2.4.3 Hypotheses Testing

To validate the three hypothesis advanced before, three analytical steps were conducted. In order to test the first hypothesis, a multiple linear regression analysis was done. Hypothesis 1 predicted a positive linear relationship between TMS and team sensemaking. Before testing the hypothesis, control variables were added in the first step.

The results presented in Table 2. 5 show that team colocation and task interdependence were positively related to team sensemaking and explained 25% of the variance.

In Step 2, TMS and the two moderators, task conflict and reward interdependence were added. There was a significant main effect of TMS, supporting Hypothesis 1. The effect of TMS on team sensemaking is significant and positive; for every unit change in TMS, team sensemaking increases by 0.40 units (β=0.40, $p<0.001$). This supports Hypothesis 1. Moreover, both moderators, task conflict and reward interdependence, were found to significantly predict team sensemaking. When task conflict increases, so does team sensemaking (β=0.16, $p=0.003$). Similarly, a positive relationship was observed between reward interdependence and team sensemaking(β=0.11, $p<0.001$).

In the final step, the two-way interaction between TMS and task conflict, the two-way interaction between TMS and reward interdependence, the two-way interaction between task conflict and reward interdependence and the three-way interaction between TMS, task conflict and reward interdependence were added. Hypothesis 2 predicted an interaction between TMS and task conflict. The interaction effect between TMS and task conflict was found to be significant (β=-0.34, $p<0.05$). Figure 2.2 shows the moderating effect of task conflict on the positive relationship between the transactive memory system and team sensemaking. The results indicate that task conflict has a buffering effect on the relationship between TMS and team sensemaking. Figure 2.2 depicts the significant interaction between TMS and task conflict on team sensemaking. Teams with lower levels of task conflict exhibit a lower level of team sensemaking as compared to teams that experience high degree of task conflict. The rate of change in response to a unit increase in TMS differs for teams that experience lower levels of conflict compared to teams that

experience higher levels of conflict. As can be seen in the figure, TMS are positively related to team sensemaking and this relationship is stronger when teams have low levels of reward interdependence.. As the level of TMS increases, teams with lower task conflict experience a bigger change in team sensemaking per unit increase in TMS compared to teams exhibiting high task conflict.

Table 2.5: Hierarchal Linear Regression

		Regression 1		Regression 2		Regression 3	
	Variables	B	p-value	β	p-Value	Beta	p-value
	TL	0.268***	0.000				
	PS	0.396***	0.000				
	TL			0.158***	0.000		
	PS			0.233***	0.000		
	TMS			0.403***	0.000		
	TC			0.156***	0.000		
	RI			0.113***	0.000		
	TL					0.105**	0.001
	PS					0.149***	0.000
	TMS					0.872*	0.021
	TC					0.666*	0.025
	RI					0.644	0.132
	TMS*TC					-0.342*	0.026
	TMS*RI					-0.318	0.121
	TC*RI					-0.355	0.038
	TMS*TC*RI					0.200*	0.013
R^2		0.250***		0.480***		0.515***	
Change in R^2		0.250		0.230		0.035	

*p<0.05, **p<0.001, ***p < .0001
Note: Dependent variable= team sensemaking;TL=Team co-location, PS=Psychological safety; TMS=Transactive Memory Systems, TC=task conflict; RI=reward interdependence

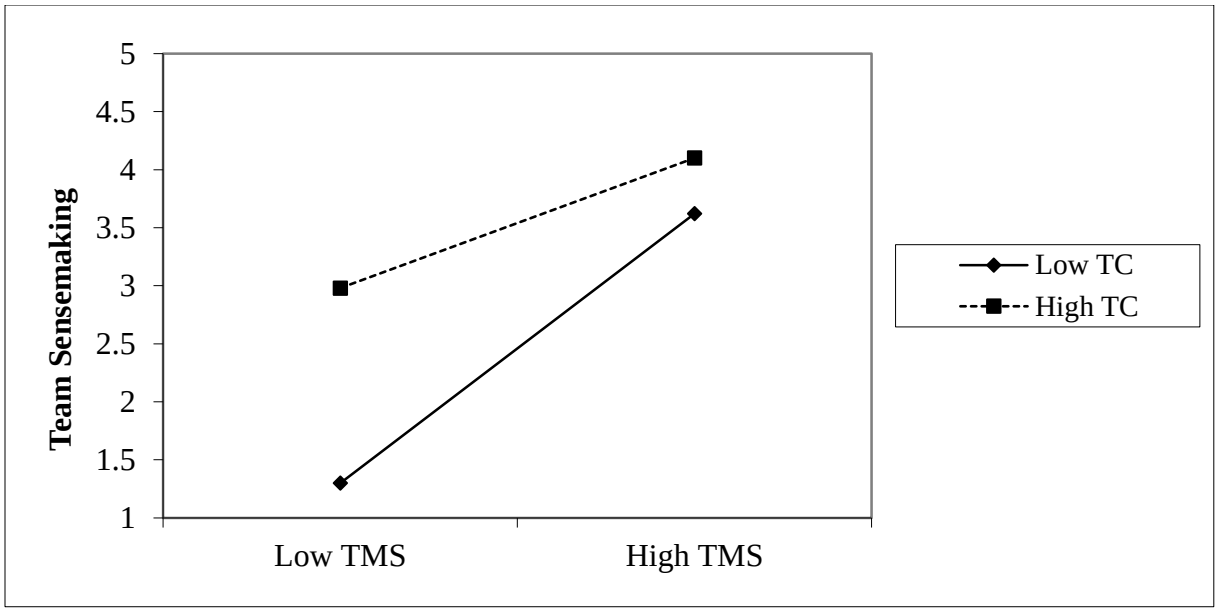

Figure 2-2: Moderating effect of task conflict

Hypothesis 3 predicted a combined effect of TMS, task conflict and reward interdependence to positively influence team sensemaking. This three-way interaction was found to be statistically significant (β=0.20, $p<0.05$), meaning that there is a 95 % probability that the interaction coefficient is not zero. The addition of interaction accounts for an additional 3.5 % of the variance of the model (incremental R^2), with a total R^2 of 0.515. Hence, the results of the study supported Hypothesis 3.

Additional analysis was conducted using the PROCESS script (Hayes, 2014) employing bootstrapping.. Using the PROCESS script allows to study conditional effects at different levels of the primary moderator (task conflict) and secondary moderator (reward interdependence) by employing the bootstrapping method. Bootstrapping involves repeatedly sampling from the data set and repeatedly estimating the effect in each resampled data set. A bootstrap value of 5000 was specified.. The conditional effects of TMS on team sensemaking are presented in Table 2.6 at low, medium, and high levels of

the primary moderator, task conflict, and low, medium and high levels of secondary moderator (reward interdependence).

In the case of *low reward interdependence*, the relationship between TMS and team sensemaking is the strongest when task conflict is low (β=-0.335, $p<0.001$). As the degree of task conflict increases from low to medium, the relationship between TMS and team sensemaking becomes weaker (β=-0.254, $p<0.001$) and further deteriorates, when task conflict becomes high (β=-0.172, $p<0.05$). For the *mean value of reward interdependence*, the relationship between TMS and team sensemaking remains almost consistent for low, medium and high levels of conflict(β=-0.326, $p<0.001$, β=-0.330, $p<0.001$, β=-0.335, $p<0.001$) respectively. When *reward interdependence is high*, the relationship between TMS and team sensemaking is weaker when task conflict is low (β=-0.317, $p<0.001$). As the degree of task conflict increases from low to medium, the relationship between TMS and team sensemaking becomes stronger (β=-0.407, $p<0.001$) and further strengthens, when task conflict becomes high (β=-0.496, $p<0.001$). Overall, the relationship between TMS and team sensemaking is weakest under the combination "low reward interdependence, high task conflict" and strongest when both reward interdependence and task conflict are high.

Table 2-6: Conditional effects for different values of the moderators

	Low TC **(Mean-1SD)**	LLCI	ULCI	Medium TC (Mean Value)	LLCI	ULCI	High TC **(Mean+1SD)**	LLCI	ULCI
Low RI (Mean-1SD)	0.335***	0.1726	0.4966	0.254***	0.134	0.373	0.172*	0.0177	0.3272
Medium RI (Mean Value)	0.326***	0.2014	0.4501	0.330***	0.2448	0.4152	0.335***	0.2263	0.4421
High RI (Mean+ISD)	0.317***	0.1473	0.4866	0.407***	0.3004	0.5125	0.496***	0.3729	0.6191

*p<0.05;**p<0.01;***p<0.001
LLCI=Lower Limit of Confidence Interval; UCLI= Upper Limit of Confidence Interval

The results indicate that there exists a three-way interaction effect among TMS, task conflict and reward interdependence. When the value of the secondary moderator, reward interdependence, is low, TMS predicts team sensemaking at low levels of task conflict but is a considerably weaker predictor at high levels of task conflict as illustrated in Figure 2.3. However, when the value of the secondary moderator, reward interdependence, is moderate to high, the relationship between the independent variable, TMS, and the dependent variable, team sensemaking remains significant across all three levels of primary moderator, task conflict as shown in Figures 2.4 and 2.5. Overall the results suggest that high level of task conflict and low level of reward interdependence is the most detrimental to the positive relationship between TMS and team sensemaking.

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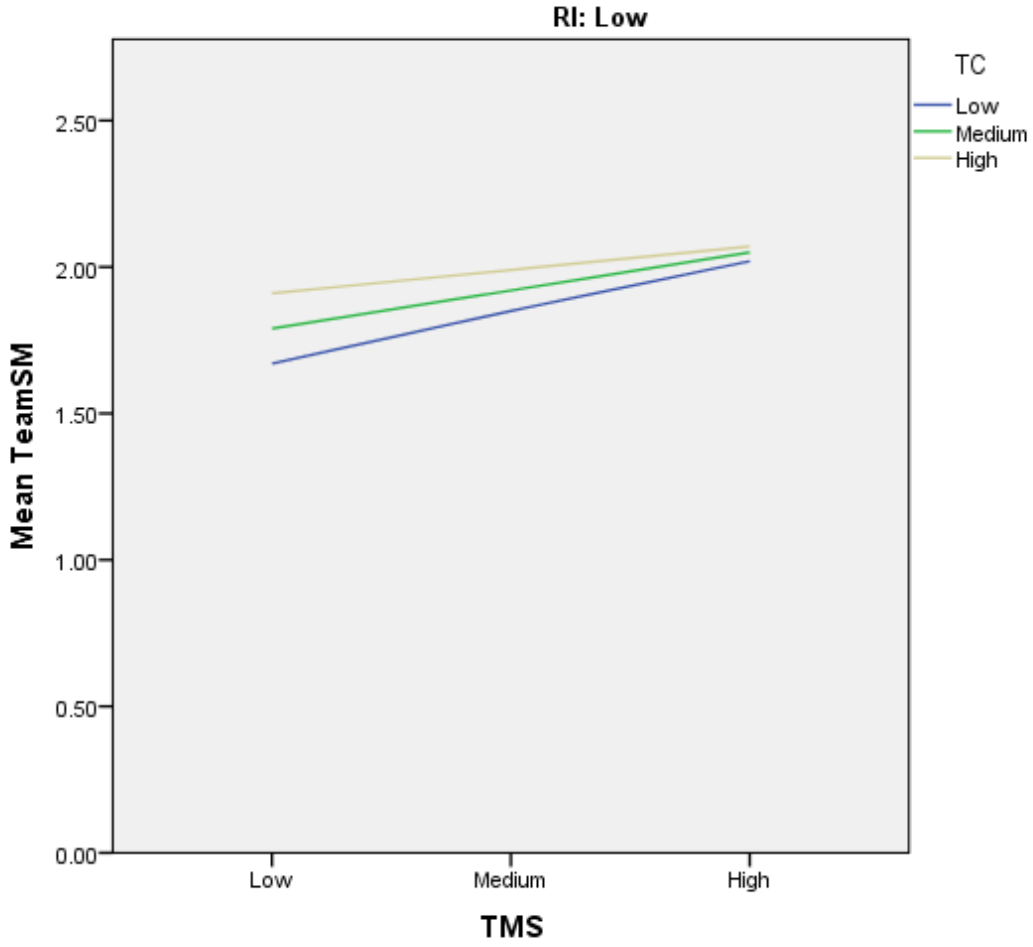

Figure 2-3: Interaction effect of the transactive memory system, task conflict, and reward interdependence

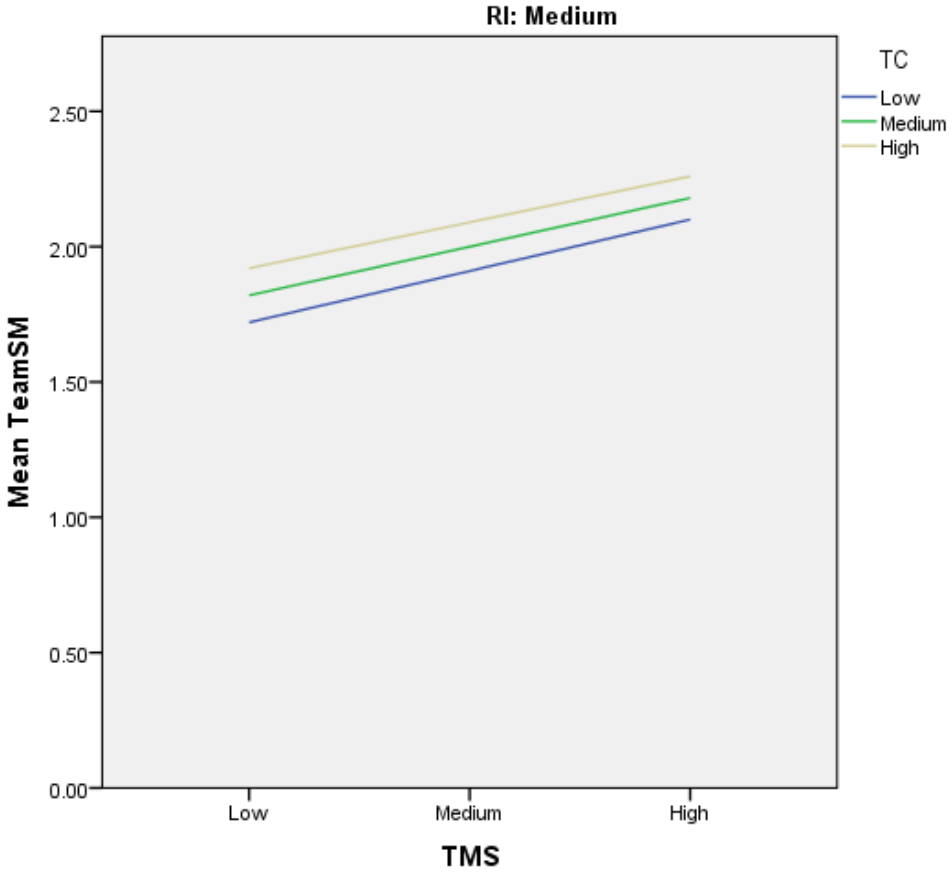

Figure 2-4 Interaction effect of the transactive memory system, task conflict, and reward interdependence

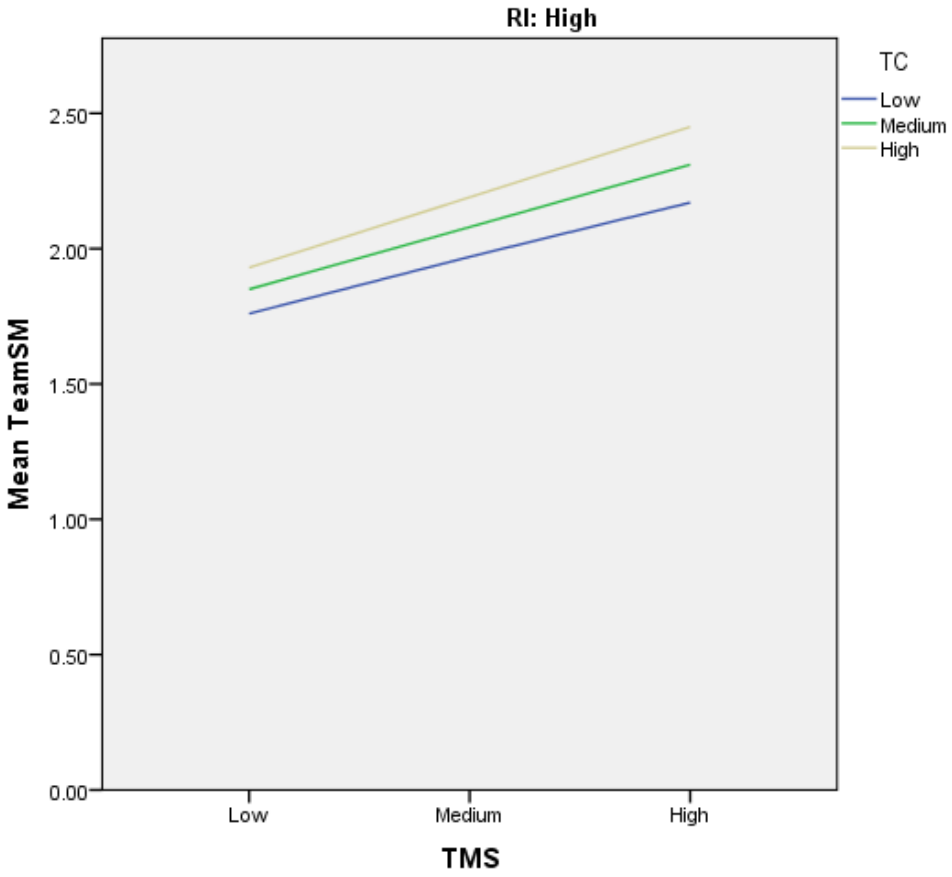

Figure 2-5: Interaction effect of the transactive memory system, task conflict, and reward interdependence

2.5 Discussion

From a theoretical perspective, this study contributes to research on team sensemaking by elaborating that two critical team factors (task conflict and reward interdependence) affect the instrumentality of TMS for team sensemaking. The fact that there was little attention paid to this issue is somewhat surprising, because of the widespread presence of teams in the organizations, the salience of TMS, and widespread recognition that knowledge of "who knows what" helps in quicker and better assimilation, integration and communication of knowledge.The current study posited that TMS helps

employees leverage task conflict into enhanced team sensemaking in the presence of high degree of reward interdependence. Conversely, a low degree of reward interdependence hampers this process. The current study's findings regarding the positive impact of TMS on team outputs echo similar findings by Dai, Du, Byun and Zhu (2017). Tacit knowledge stored in a team's memory is a significant resource and a source of positive team outcomes.

The extant literature has focused on qualitative studies of sensemaking; the treatments of sensemaking as a variable are scarce. This study presents a pragmatic approach to sensemaking; it is one of the few studies that investigates team sensemaking in everyday organizational life rather than in crisis situations.From a practical perspective, this study suggests that to stimulate team sensemaking, managers should encourage team members who are familiar with each other's strengths and weaknesses to continue working together. Teams may possess a unique resource: members' knowledge of other members (Gardner, Gino & Stats, 2012; Nonaka and Takeuchi 1995). Human resource managers unwittingly forego synergistic benefits when they do not leverage team member familiarity by disrupting team structures or by assigning new members to a team or by rotating team members very frequently.

For academicians and human resource managers it is a matter of great interest to understand the conditions under which task conflict enhances team sensemaking. When task conflicts exist in a team, team sensemaking is adversely effected. Teams must have a high level of reward interdependence so that repositories of knowledge within the teams can be tapped to fully make sense of ambiguous and novel situations in day to day operations. On the basis of the findings, it is recommend that in case of strong disagreement among team members about the direction the team should take (i.e., high task conflict),

reward interdependence creates common goals for the entire team. Since earning the reward is a compelling goal but cannot be achieved by individual effort, team members tend to cooperate toward the common goal, i.e. earning the team reward. Reward interdependence incentivizes attention on teamwork, thereby stimulating cooperation among team members (van Vijfeijken, 2004).

2.6 Limitations and Future Research Directions

This study has some drawbacks that provide avenues for future studies.. First, care must be exercised before drawing any causal inference, since the study was cross sectional. Although this study has grounded the hypotheses in extant theory, future researchers could employ longitudinal designs to investigate the causal processes that link TMS and team sensemaking. Second, the focus of this study was to explain the phenomenon of team sensemaking rather than the performance outcomes of team sensemaking. Future research could focus on various measures of team performance measures such as speed-to-market, customer satisfaction, and customer retention, to extend this conceptual framework,.

Third, by concentrating on two particular contingency factors, this study overlooked alternative factors that may be important to the positive effect of TMS on team sensemaking. For example, it would be interesting to examine the moderating roles of team empowerment in the relationship between task conflict and team sensemaking. It would also be interesting to exmine the potential role of other types of intra team conflict, such as relationship conflict and processs conflict, on the relationship between TMS and team sensemaking. For example, given the potential interaction between task and relationship conflict (Simons and Peterson, 2000; Dreu & Weingart , 2003), future studies could

examine if the effect of a transactive memory systems would be more salient for team experiences high task conflict but low relationship conflict. Fourth, the results are based on the ICT sector in Pakistan. Although the theoretical arguments raised were general and not country-specific, there is a potential for cultural factors to interfere with the conceptual framework. For example, in a country where there is a high degree of uncertainty, such as Pakistan, employees may be very sensitive to the stress caused by task conflict (Hofstede, 2001). Cross-country studies are likely to offer better explanation of the relative importance of the interaction between task conflict and reward interdependence in determining the relationship between TMS and team sensemaking.

Chapter 3: Antecedents of team creativity: A sensemaking perspective

Abstract:

The literature has extensively addressed the impact of team autonomy and cognitive diversity on team creativity but *how* this effect is facilitated by team autonomy and cognitive diversity of team on team creativity still remains unresolved. This chapter examines the role of team sensemaking as an intermediary factor for the link of social environment factors with team creativity. Data from a sample of 304 team informants working in the ICT industry of Pakistan was collected to test the hypotheses. The findings of the study suggest that cognitive diversity and team autonomy have a positive relationship with team sensemaking, and team sensemaking has a positive impact on team creativity. Further, autonomy and cognitive diversity are indirectly related to team creativity through team sensemaking. The results support the conclusion that mangers in knowledge-intensive industries should promote cognitive diversity and autonomy to develop team sensemaking, which in turn can stimulate creativity. This study extends the limited research stream that focuses on the underlying process through which inputs such as autonomy and cognitive diversity are related to team creativity. By identifying team sensemaking as an intermediary mechanism, this research helps develop a more nuanced explanation of *how* team autonomy and cognitive diversity impact team creativity through team sensemaking.

Keywords: Cognitive diversity, team autonomy, team sensemaking, team creativity.

3.1 Introduction:

In the face of intense competition and rapid technological changes, organizations depend on creativity to survive and thrive (Wang et al., 2016). Teams can provide a significant means for the advancement of creative ideas and these work units have gained prominence lately as the focal structure to attain organizational creativity (Dong, Bartol, Zhang & Li, 2017; Wang et al; 2016). As a result of the rise of teams in organizations, research investigating antecedents of creativity has increased over the past decades (Wang et al., 2016; Hülsheger, Anderson, & Salgado, 2009). Furthermore, research has shown that teamwork in organizations has a positive informance on measures of team performance such as increased productivity, innovation, commitment and employee satisfaction (Chuang, Jackson & Jiang, 2016; Katzenbach & Smith, 2015; Ramdhani, Ramdhani, & Ainissyifa, 2017; West, Borrill, & Unsworth, 1998; West & Hirst, 2003). Among these outcomes, the most desired outcome of teamwork is team creativity (Wang et al., 2016; Farh, Lee & Farh, 2010). "The production of novel and useful ideas concerning products, services, processes, and procedures by a team of employees working together" can be termed as team creativity (Shin & Zhou, 2007, p. 1715).

Despite the pervasiveness of teams, little attention has been paid to how teams achieve creativity (Cai, Lysova, Khapova & Bossink, 2019; Hoever, Zhou & van Knippenberg, 2018). This is a critical omission, as most organizations rely on teams to generate creative solutions in the face of demanding and continuously evolving competitive environment (Boon, Vangrieken & Dochy, 2016). There is an intuitive ground to believe that since a team's collective knowledge, experiences, perspectives and ideas are greater and richer than an individual worker's, thereby, a team is more likely to be creative. Nevertheless,

previous study on brainstorming and the generation of ideas demonstrates that organizations are not always as effective in generating thoughts (Diehl and Stroebe 1987; Mumford, Feldman, Hein & Nagao. 2001). In fact, individuals do generate relatively greater number of ideas but the ideas produced by teams tend to be more creative (Mumford et al., 2001). One of the factors for this may be that team members can build on a shared concept jointly. In this regard, extant literature has highlighted the importance of sensemaking in the organizational context (Maitlis & Christianson; 2014) and sensemaking has attained a central role in the success of teams (Ancona, 2012; Morgeson, Rue & Karam, 2010; Lei, Waller, Hagen & Kaplan; 2015; Banks, Pollack & Seers; 2016). Teams can develop fresh and comparatively original thoughts thorugh sensemaking (Paulus and Brown, 2007). It is therefore the social interaction that takes place in teams and the intermediate mechanisms that enable teams to be more creative. In this context, it is therefore important to investigate the underlying mechanism through which teams achieve better creativity (Liu, Chen & Yao, 2011; Lu, Brockner, Vardi & Weitz, 2017).

In recent times, there has been renewed interest in investigating the relationship between social environment factors and team creativity in the workplace (Smith & Shalley, 2014; Gilson & Shalley, 2004), often drawing on componential theory of creativity that is proposed by Amabile (2012). As per the componential theory creativity, team autonomy is considered as an important social environment factor that can facilitate team creativity as argued by the following researchers (Liu et al., 2011; Zhou, 1998; Amabile 1988). Studies demonstrated that teams with a high degree of autonomy were more likely to be creative in performing their tasks (Yoo et al., 2018; Chang, Huang & Choi, 2012; Amabile et al 1996; Paolillo & Brown, 1978).

Also, prior research underscores the importance of cognitive diversity of teams and its influence on team creativity (Reynolds & Lewis, 2017; Wang et al., 2016; Mitchell & Nicholas, 2006; Kurtzberg, 2005; Amabile 1988). Cognitive diversity refers to the extent to which team members vary in their perspectives (Van der Vegt & Janssen, 2003). Cognitive Diversity can potentially both enhance and inhibit overall cognition of teams (Aggarwal & Woolley, 2018). According to social categorization theory, diversity escalates conflict and communication problems which adversely affects team outcomes (Cady and Valentine, 1999; Kearney & Gebert, 2009). Past research shows that team CD is associated with negative performance measures such as commitment and decision quality (e.g., Baugh & Graen, 1997; Olson, Parayatim & Bao, 2007). In contrast, Perry-Smith and Shalley's (2003) support the value-in-diversity view. The argument put forward by value-in-diversity view is that considering a number of different perspectives by team members inspires innovative ideas. Under the value-diversity view, teams composed of dissimilar members participate in constructive debate. By considering differing viewpoints such teams are better able to generate creative solutions (Chow, 2018). In light of these divergent views, this study seeks to make an important contribution by examining the relevance of the team CD. Similarly, the extant literature does not examine the underlying mechanisms through which precursors of TC namely TA and TEAM CD can influence TC (Van Knippenberg, De Dreu, and Homan, 2004).

This research proposes and tests a conceptual model that links team autonomy and cognitive diversity with team creativity through a central underlying mechanism of team sensemaking. The past research has been mainly focusing on the direct consequences of

team autonomy and cognitive diversity and therefore,the current study moves beyond such examination. It investigates the relevance of team sensemaking with respect to the direct links of team autonomy and cognitive diversity with team creativity. This study extends the limited research stream that focuses on the underlying mechanism through which inputs such as team autonomy and cognitive diversity of teams can be related to team creativity. By identifying team sensemaking as an intermediary process, this research develops and tests a more nuanced explanation of *how* team autonomy and cognitive diversity through team sensemaking can impact team creativity (Liu, Chen & Yao, 2011; Wang et al., 2016). In fact, within team creativity literature, researchers have argued that intervening mechanisms that can facilitate the impact of autonomy and team diversity on team creativity need further investigation (Chow, 2018; Sun et al., 2016; Shin, Kim, Lee & Bian, 2012). This study uses sensemaking theory to propose that team sensemaking is an integral intermediary factor that encourages information exchange and knowledge integration for better team creativity when teams are more autonomous and diverse cognitively. It aims to provide a unique perspective that can highlight the relevance of an integral factor through which team inputs can impact team creativity.

3.2 Theory and Hypotheses Development

The factors effecting team creativity have received an increased attention in the recent past. This research advances the understanding of what makes the teams creative by elaborating the role of team sensemaking. Team sensemaking can be described as a process through which the team members manage their current conditions and prognosticate future situations usually under complex and uncertain circumstances. Certainly, sensemaking facilitates better communication, refection and social cognition

thereby it can influence team outcomes (Lei et al., 2015; Banks et al., 2016). Particularly, the awareness of surroundings through communication and reflection among team members can equip them to develop and verify their initial hunches (Maitlis & Christianson; 2014). The above mentioned dimensions of sensemaking enable members of teams to extract relevant environmental stimuli for the development and refinement of their collective cognition. Their social cognition along with communication and reflection empowers the teams to make improvised responses in the form of better team performance including creativity (Maitlis & Christianson; 2014; Weick, 2012). Researchers have called for better articulation of underlying mechanisms including team sensemaking with respect to link between social environment factors of team and team creativity (Liu, Chen & Yao, 2011). The inclusion of the underlying mechanism – team sensemaking can elaborate how the relationships of team cognitive diversity and team autonomy with team creativity are facilitated (Hoever, Van Knippenberg, Van Ginkel, & Barkema, 2012).

In addition to the team autonomy, the direct impact of team cognitive diversity has been examined on team creativity by a number of recent studies (Chen et al. 2019; Wang et al., 2016). A team is believed to be high on cognitive diversity if team members perceive differences in thinking styles, knowledge, skills, values, and beliefs among themselves (Dahlin, Weingrat, & Hinds, 2005). Cognitive diversity leads to a wider, more varied pool of task-relevant information from which teams can draw from. Such information resources can contribute to the quality of team decision-making, team creativity and innovation (Knippenberg & Mell, 2016). As per the value-in diversity notion, it is generally believed that novel idea is more likely to generate based on the dissimilar thoughts and ideas expressed by cognitively diverse team members (Mednick, 1962; Men, Fong, Luo, Zhong,

& Huo, 2017; Paulus, 2000). Kurtzberg (2005) found that teams with high cognitive diversity had generated more creative ideas than the teams of low cognitive diversity. In this regard, recent attempts have been made to better explain how the interactions among team members lead to creativity. Hoever et al. (2012) found that diversity of perspectives in teams had a positive effect on team creativity and this relationship was influenced by the information elaboration. Wang et al., (2016) validate the intrinsic motivation of teams as an intermediary mechanism for the relationship between cognitive diversity and team creativity.

This study advances the understanding of what makes the teams creative by furthering the debate of team sensemaking. Team sensemaking can be described as a process through which the team members manage their current conditions and prognosticate future situations usually under complex and uncertain circumstances. Certainly, sensemaking facilitates better communication, refection and social cognition thereby team sensemaking can influence team outcomes (Lei et al., 2015; Banks et al., 2016). Particularly, the awareness of surroundings through communication and reflection among team members can equip them to develop and verify their initial hunches (Maitlis & Christianson; 2014). The above-mentioned dimensions of sensemaking enable members of teams to extract relevant environmental stimuli for the development and refinement of their collective cognition. Their social cognition along with communication and reflection empowers the teams to make improvised responses in the form of better team performance including team creativity (Maitlis & Christianson; 2014; Weick, 2012).

This research shifts the focus to understanding *how* team autonomy and cognitive diversity can lead to team creativity (Naotunna & Zhou, 2018; Sun, Zhang & Chen, 2012;

Liu et al., 2011). Researchers have called for better explanation of underlying mechanisms team and team creativity (Liu et al., 2011). The inclusion of the underlying mechanism can elaborate how the relationships of cognitive diversity of teams and team autonomy with team creativity are facilitated, through team sensemaking (Hoever et al., 2012). The inclusion of team sensemaking as an intermediary mechanism regarding the link of autonomous team and cognitively diverse teams with team creatively can also assist to fill the research gaps (Hulsheger et al., 2009; Jackson & Joshi, 2011; Hoever et al., 2012). Hence, team sensemaking can act as an important intermediary mechanism to explicate the contributions of cognitive diversity and team autonomy towards team creativity and provide better insights about social environment factors of team creativity.

3.2.1 Team autonomy and team sensemaking

An important stream of research has investigated the role of team autonomy as an enabler of team performance (Kirkman, Tesluk & Rosen, 2004; Wang et al.,2016; Zhang, Jex , Peng & Wang, 2017). Team autonomy has been defined as "the extent to which a team has considerable discretion and freedom in deciding how to carry out tasks" (Langfred, 2005, p.514). Autonomy has been a popular mechanism to devolve decision making to lower levels of hierarchy and increasing employee involvement (Chen & Tesluk, 2012; Maruping and Magni, 2015). Autonomous teams have greater authority and responsibility than traditional teams (Haas, 2010). In the face of complex business environment, team autonomy equips teams with the authority to make their own decisions regarding how their work has to be done (Hammer & Champy, 1993). Autonomy is reported to increase the innovation, happiness, and productivity of employees (Nielsen et

al., 2017). Many researchers have applied the concept to teams or workgroups (Hempel, Zhang & Han, 2012; Luciano & Ruddy, 2013; Fausing, Joensson, Lewandowski & Bligh; 2015).

Previous research has shown a positive relationship between team autonomy and team performance (Luciano, Mathieu & Ruddy, 2014; Chen et al., 2007; Kirkman, Rosen, Tesluk, & Gibson, 2004; Mathieu, Gilson & Ruddy, 2006; Spreitzer, Noble, Mishra & Cooke, 1999). Many authors have contended that autonomy is the most critical task characteristic in knowledge worker teams, as knowledge workers prefer autonomy more than any other job characteristic (Liu, Wang & Yao, 2017; Janz, Colquitt & Noe, 1997). When a team experiences low levels of autonomy, it indicates that the task is mainly structured from outside. Hence, the need make collective decisions or to manage internal processes does not arise in such situations. Conversely, if a team experiences high level of autonomy, the team members are required to structure the task collaboratively. The greater the team's task autonomy, the greater the need to interact and develop a collective understanding of the task at hand (Rico, Molleman, Mazanares, & Vegt, 2007). Greater autonomy leads to greater interaction and among team members, hence enabling team sensemaking.

Team autonomy also provides a useful buffering mechanism against external stakeholders seeking to influence the team interest in the selection of problems and their solutions (Hass, 2006). Many teams working in knowledge intensive industry are assigned non-routine tasks (Cohen & Bailey, 1997) and face considerable uncertainty (Alvesson, 2004). Team members must participate in an ongoing process of sensemaking to construct meaning from the various stimuli (Weick, 2001). Not only do the team members struggle

to make sense of inconsistent or conflicting viewpoints of members that make up the team; the challenge is compounded when the team members seek and obtain more information from sources outside the team (Haas, 2006). There is a possibility that external stakeholders may push their own agendas and interests by distorting information provided, or by demanding loyalty in return for their contributions (Pettigrew, 1973). Teams that do not enjoy sufficient autonomy cannot buffer against attempts to impact their choices excessively. Members of autonomous teams, however, in case of conflict with external information providers, have the freedom to fully adapt to the team's local context (Hajro, Gibson & Pudelko, 2017) and make decisions that are aligned closely with the team members. TA is perceived as a sign of prestige (Mazmanian, Orlikowski & Yates; 2013) and hence team members perceive an opportunity to contribute to a team that is highly regarded by others as helpful to their careers (Langfred 2000). Lastly, TA acts as a shield against unnecessary attempts to influence team decision making and this buffering can improve the sensemaking capabilities of teams by permitting team members to focus more effort on task-related operations (Mehta & Bharadwaj, 2015).

Outsiders are reluctant before attempting to influence the members of more autonomous teams because they recognize that their efforts are unlikely to succeed (Haas, 2006). Since TA is interpreted as an indicator that a team is sufficiently competent, the outsiders are less likely to interfere in the guise of improving team performance (Haas, 2006; Langfred 2000). In light of the above discussion, a positive and direct link between team autonomy and team sensemaking is proposed in the following hypothesis.

Hypothesis 1: Team autonomy is positively related to team sensemaking.

3.2.2 Cognitive diversity and team sensemaking

Cognitive diversity is defined by the degree to which team members differ in terms of expertise, experiences, and perspectives (Miller, Burke & Glick, 1998). Many authors have stressed the importance of examining the relationship between cognitive diversity and team sensemaking (Kearney & Gebert, 2009; Shin & Zhou, 2007). With respect to the cognitive diversity of teams and team outcomes, there are two schools of thought (Shin Kim, Lee & Bian, 2012). One school of thought ascribes to "similarity attraction" (Pfeffer, 1983). If team members perceive other team members are similar to them in their cognitive attributes then it encourages greater acceptance of their viewpoints and suggestions (Chung & Jackson, 2013; Harrison, Price, Gavin, & Florey, 2002). Similarity attraction notion suggests that dissimilarity may lead to us-them distinction amongst team members and may lead to lesser cohesion within a team (Mannix & Neale, 2005). The other school of thought ascribes to the "value in diversity" perspective. A key element of sensemaking is considering divergent viewpoints. Exposure to differing viewpoints may stimulate better sensemaking. Team diversity is likely to positively impact team performance because team members bring unique cognitive attributes to the team (Hoever et al., 2018).

Cognitive diversity is likely to encourage information integration by providing team members with a wide range of ideas, perspectives, knowledge and values (Harrison et al., 2002; Horwitz & Horwitz, 2007; Jehn et al., 1999; Joshi & Roh, 2009; van Knippenberg, De Dreu & Homan 2004). Cognitive diversity improves the team sensemaking for several reasons. First, cognitive diversity means individuals have complementary expertise and anticipate receiving support from each other (Gibson & Vermeulen, 2003). The complementary nature of skills engenders anticipation of support which in turn encourages team members to express opinions and to share knowledge with

other team members (Nemeth & Goncalo, 2005). In fact these exchanges promote team sensemaking by encouraging information processing, combining different ideas, building on others' ideas and experimenting with the ideas of those with different perspectives (Harrison et al., 2002; Horwitz & Horwitz, 2007; Jehn et al., 1999; Joshi & Roh, 2009; van Knippenberg et al., 2004; Tang & Naumann,2016). In fact, cognitive diversity is likely to stimulate the elaboration of task-relevant information (Knippenberg & Schippers, 2007). Moreover, divergent perspectives on the task associated with diversity may invite a team to reflect on its own performance (Schippers, Hartog, Koopman & Wienk; 2003). Team members are likely to value other team members with distinct knowledge, perspectives, and resources (Chung, Liao, Jackson, Subramony, Colakoglu & Jiang 2015; Chung & Jackson, 2013). Members with distinct perspectives as a source of unique resources and opinions are well sought and respected (Chung et al., 2015). Therefore, cognitive diversity among team members can allow them to engage more with team sensemaking and for this purpose, the positive relationship has been proposed between cognitive diversity of team and team sensemaking, in the following hypothes.

Hypothesis 2: Cognitive diversity is positively related to team sensemaking.

3.2.3 Team sensemaking and team creativity

Team sensemaking is an important antecedent to team creativity (Drazin, Glynn & Kazanjian, 1999; Dong et al., 2017; Farmer, Tierney, & Kung-McIntyre, 2003; Unsworth & Clegg, 2010). The sensemaking process allows team members to interpret the meaning of environmental cues and forms the core to the creative process (Tierney & Farmer, 2004). Ford (1996) applies the sensemaking perspective to organization life and presents creative actions and habitual actions as two options available to organization actors in the face of a

given problem. Similarly, Drazin et al. (1999) argue that sensemaking facilitates the process of creativity by negotiating multiple frames of reference held by different stakeholders.

As has been discussed earlier, team sensemaking has been conceptualized as a third-order variable. It comprises of three dimensions: i) social cognition; ii) communication, and iii) reflection. Social cognition refers to shared knowledge or belief structures (Badke-Schaub, Neumann, Lauche & Mohammed, 2007). These shared knowledge structures enable team members to form accurate explanations to coordinate their tasks and to adopt creative and flexible behaviors (Converse, Cannon-Bowers & Salas, 1993). One of the key motivations for forming teams is to share knowledge, ideas and opinions to arrive at informed decisions (Shreeve, Ralph, Sawyer, & Stacey; 2015). There is an established field of research that explores the role of social interactions in the creative processes (Mahaux et al, 2013; Harvey, 2014). Previous studies suggest a positive effect of social cognition on adaptation (Burke et al., 2006).

Based on these affirmative findings, this study extrapolates a positive relationship between social cognition and team creativity (Santos, Uitdewilligen & Passos, 2015). Social cognition fosters team creativity because it enables team members to anticipate the needs and actions of other team members and adapt their actions as per the demands of their colleagues and team tasks (Converse ei al., 1993; DeChurch & Mesmer-Magnus, 2010). In the complex task environments, confirmatory encoding, representation shifting and a shared vision for the task can assist team members to adapt their routines for creative solutions (Santos et al., 2015).

The second dimension of team sensemaking is communication. Team communication can be defined as an "exchange of information occurring through both verbal and nonverbal channels between two or more team members" (Marlow, Lacerenza, Paoletti, Burke & Salas, 2018, p.146). Team communication is considered integral to a majority of team processes (Marks, Mathieu & Zaccaro, 2001). Communication is believed to enhance team creativity by distributing crucial information about task, environment and situational factors among team members (Salas, Sims & Burke, 2005; Marlow et al., 2018). The flow of information through communication can enhance team coordination and clarify misunderstandings among team members (Marks et al., 2001; Fletcher & Major, 2006). Consequently, improved communication and information exchange can enhance team creativity (Hargadon & Bechky, 2006). As a result, teams can reach a higher level of creativity when members collectively approach and utilize knowledge available within the team (Tagger, 2002).

Team reflection refers to the process in which team members reflect upon the objectives, strategies, and processes. The team reflection can help team members to adapt to current or anticipated situations (West, Beyerlein, Jhonson & Beyerlein, 2000). Team reflection assists teams in reconciling differences between their objectives and present performance in order to achieve required output (DeShon et al. 2004). Team reflection benefits creative performance of teams by considering past experiences. Combining the cognitive abilities of team members based on accumulated knowledge and shared understanding helps team members in finding creative solutions (Schippers et al. 2008; Shin, Kim & Lee, 2014). Moreover, team reflection sharpens the team's strategic focus and leads to increased effort towards problem-solving and team creativity (Kukenberger,

Mathieu & Ruddy, 2015; Marks et al., 2001; Shin et al., 2017). In sum, team sensemaking makes use of shared mental maps and language that allows for better communication and shared reflection in real-time and therefore, this study proposes a positive link between team sensemaking and team creativity the following hypothesis.

Hypothesis 3: Team sensemaking is positively associated with team creativity.

3.2.4 Mediating role of team sensemaking

The current study aims to investigate the role of team sensemaking as an underlying mechanism for the relationship social environment factors of team and team creativity. In doing so, the study also answers the question of how teams high on autonomy and cognitive diversity achieve higher levels of creativity. The theoretical framework posits that teams high on autonomy and cognitive diversity are better at creativity because such teams are better poised to make sense of tasks at hand. Thus, this study extends existing research that has explored contingencies of autonomy and cognitive diversity (Kearney and Gilbert, 2009; Wallace et al., 2011). The inclusion of team sensemaking as a mediatory variable has permitted this study to conceptualize an inclusive model to provide a deeper understanding of the antecedents of team performance (Marks et al., 2001).

The proposed mediation model postulates that team sensemaking can act as an intermediator for the relationships of team autonomy and cognitive diversity with team creativity. Team sensemaking as a collaborative process allows interpretation and reinterpretation of information and new meaning and shared understandings to be derived. Studies evaluating creativity and innovation in organizational settings find that collaboration is critical for team creativity and innovation (Mitchell, Boyle, & Nicholas, 2009; Drach-Zahavy & Somech, 2001).

3.2.4.1 Team autonomy and team creativity: Mediating role of team sensemaking

The componential theory of creativity suggests that one of the central channel through which autonomy can impact team creativity is intrinsic motivation (Amabile 1988, 2012). Teams are more likely to be creative when they are driven primarily by the satisfaction, enjoyment, interest, and nature of the work itself , as opposed to external pressures and this phenomenon is known as "intrinsic motivation principle of creativity" (Amabile, 1996; Amabile & Pratt, 2016). Intrinsic motivation is the stimulus to do work because it is interesting and stimulating. Researchers have called for better explanation of these motivational mechanisms that link social environment factors to creativity (George, 2007)

Recently efforts have been made to explore alternative mediating mechanisms leading to creativity. For example, Liu, Chen & Yao (2011) demonstrated that harmonious passion facilitated the relationship between team autonomy and team creativity. Taking this discussion further, the present research conceptualizes and demonstrates team sensemaking as an effective intrinsic motivational mechanism that can mediate the relationship between social environment factors and team creativity. A recent meta-analysis by Cerasoli, Nicklin, and Ford (2014) notes that intrinsic motivation is a strong predictor of team creativity. Team sense-making is a drive to simplify representation of the world. In a team setting, there exists an innate 'drive for sense-making' (Chater & Loewenstein, 2016) which can motivate people to collect, attend to, and process information in a fashion that promotes team creativity. Deci and his colleagues (Deci, 1975; Deci & Ryan, 1985) propose that intrinsic motivation arises when people feel both independent and competent. Team autonomy allows self-determination and the team

members believe that they are the "origins" of their behavior rather than "pawns" of other people (deCharm, 1968; Amabile 1996). Autonomous information processing by itself is insufficient to convert disparate information into simple representations (Chater & Loewenstein, 2016). The second condition for intrinsic motivation is competence. Team sensemaking supports a sense of competence. It helps evade information avoidance and confirmation bias. Hence team sensemaking can act as an effective mediating mechanism between team autonomy and team creativity. In fact, team autonomy grants team members with more control and authority over structuring tasks. Team sensemaking leverages team members' knowledge of their role in the team and how their role ties with other roles in the team to augment creativity (Peronard, 2016). The development of shared mental models effective communication and real-time reflection via team sensemaking can allow team members to better focus on their tasks in a productive and rapid manners (DeRue & Rosso, 2009). According to the above discussion, this study proposes a positive and mediatory role of team sensemaking for the relationship between team autonomy and team creativity..

Hypothesis 4: Team sensemaking mediates the relationship between team autonomy and team creativity.

3.2.4.2 Cognitive diversity and team creativity: Mediating role of team sensemaking

Extant literature reports mixed findings regarding the effect of cognitive diversity on creativity and innovation. On the one hand, it is positively associated with creativity due to divergent thinking (Paletz & Schunn, 2009). Conversely, it is associated with

unproductive conflict and making it difficult to achieve a shared vision among team members (Gebert, Boerner, & Kearney, 2006; Kurtzberg & Amabile, 2000-2001; Mannix & Neale, 2005; van Knippenberg & Schippers, 2007). These mixed findings represent research gaps and this study aims to fill this gap by including team sensemaking.

Cognitive diversity generates multiple perspectives (Reynolds & Lewis, 2017). However, to benefit from different beliefs among members, a team and its processes need to be structured in order to effectively communicate around these diverse perspectives (Ackermann et al. 2005; Eden and Ackermann, 2001). Team sensemaking as an intrinsic motivational factor can allow diverse perspectives to be considered, weighed and debated before reaching a plausible solution in a diverse team. From the creativity perspective, team sensemaking can play a vital intermediary role by preserving multiple interpretations in teams, which are critical for comprehending complex environments (Neill et al., (2007). Team sensemaking involves both the retrieval of existing knowledge from memory and the combination of various aspects of existing knowledge into novel ideas (Mumford, Mobley, Uhlman, ReiterPalmon, & Doares, 1991; Nijstad & Stroebe, 2006; Ward, Smith, & Vaid, 1997). Sensemaking can provide a mechanism for information exchange and communication. This mechanisms of information exchange can allow team members to take advantage of the multiple perspectives of diverse team members with varying expertise, perspectives, and experiences. Without effective team sensemaking the benefits of diversity in team are not fully realized.

Denning (2012) has emphasized the notion of "super additivity" in illustrating how cognitive diversity can be beneficial for creativity. Super additivity represents a situation in which a collection of people work together and a single improvement made by one

person then leads others to improve upon the solution even further. Likewise, teams often face difficult decisions and conflicting views which require sensemaking for the refinement of current and future outcomes of teams (Edmondson & Smith, 2006). Teams can perform better if their members are adept at questioning and challenging their own assumptions and communicating effectively by inquiring into the thinking of other members with genuine interest (Edmondson & Smith, 2006). The genuine interest to engage in sensemaking makes it intrinsically motivated for diverse team members and therefore, the following hypothesis postulates a mediatory role of team sensemaking for the link between cognitive diversity of team and team creativity.

Hypothesis 5: Team sensemaking mediates the relationship between cognitive diversity and team creativity.

3.2.5 Research Model

Figure 3.1 illustrates the conceptual framework proposed for this study. The model depicts that team autonomy and cognitive diversity have a direct impact on team sensemaking and team sensemaking has a direct impact on team creativity. In addition, building on componential theory of creativity (Amabile 1988, 2012), it is proposed that team sensemaking is an important intrinsic motivational mechanism. While team autonomy allows self-determination, team sensemaking can act as an effective mediating mechanism between team autonomy and team creativity because it helps overcome information avoidance and confirmation bias. Team sensemaking also acts an an intermediary mechanism in facilitating the link between cognitive diversity and team creativity. Cognitive diversity has been termed a double edged sword and has the potential to lead to social categorization (Kearney, Gebert & Voelpel, 2009). Team sensemaking

allows diverse perspectives to be considered, weighed and debated which aids comprehending complex environments and coming up with creative solutions (Neill et al., 2007). In this theoretical background, it has become pertinent to conceptualize and test the facilitatory role of team sensemaking.

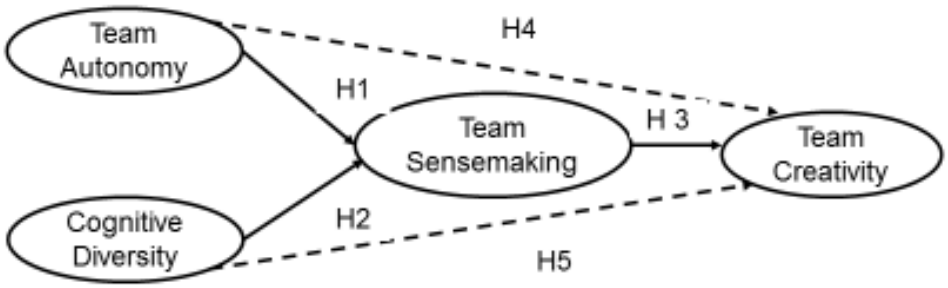

Figure 3-1: Conceptual Framework

3.3 Methodology

3.3.1 Sample and data collection

The ICT industry in Pakistan was the subject of the study. It is suitable for the purpose of our study because the work is usually done in teams and there is an ongoing need to make "sense" of the client preferences. Pakistan Software Houses Association for IT and ITES, (P@SHA), is a leading representative body of Pakistan's software industry. It has 290 members listed in their membership directory. This list served as the sampling frame. Teams from 162 firms agreed to participate in the survey. A total of three hundred and four usable responses were used to analyze the data.

Key persons within software houses were contacted via e-mail to explain the academic nature of the study. It was explained that the confidentiality of the data will be maintained and the data collected will only be used for academic purposes. Participants will be able to request a report of findings of this study.Teams from 87 firms agreed to participate in the survey by return email. Two reminder emails were sent and several reminder phone calls were made to improve response rate. A total of 304 usable responses were used to analyze the data.

3.3.2 Operationalization of variables

The team informants were asked to indicate the extent to which each statement was reflective of their team on the following Likert scale where 1 denoted “strongly disagree" to 5 indicated "strongly agree". The measurement instrument was designed by using existing measurement items of the literature.

Team sensemaking was conceptualized as a third-order construct with three subdimensions namely: social cognition; communication; and reflection. Social cognition has further three subdimensions namely: confirmatory encoding; representation shifting; and team situation models. Items to measure each subdimension have been borrowed from existing literature (Neill et al., 2007; Gray et al., 2015; Akgün, Lynn & Dogan, 2012; and Ortel & Antoni, 2014). Team autonomy was assessed using three-items taken from Kirkman et al. (2004). The cognitive diversity of team was assessed using three-items borrowed from Van der Vegt and Janssen (2003). Team creativity was assessed using three-items adapted from Rego, Sousa, Marques and Cunha (2007).

3.3.2 Data Analysis

This research used Confirmatory Factor Analysis (CFA) to establish the reliability and validity of constructs. Constructs' reliability was verified through composite reliability measure with the benchmark value of 0.7 (Shook, Ketchen, Hult, & Kacmar, 2004; Hair et al, 2017). The data was examined for discriminant validity and convergent validity. Average Variance Extracted (AVE) was computed to check the convergent validity. Convergent validity is maintained if the AVE exceeds 0.5 (Hair et al., 2006).

Discriminant validity was examined by comparing AVE value with square correlation value (Fornell and Larcker, 1981). If the square root of AVE of the construct is greater than its correlations with all other construct, the criterion for discriminant is met (Batra & Sinha, 2000). A number of indices are recommended to determine if the specified model is a good fit for the data in order to determine if the measurement model is valid. It is suggested that researchers depend on various indices to evaluate model fit. Two of the most frequently reported measures are normed chi-square ($\chi 2$) and approximate root mean square error (RMSEA). RMSEA is "an index of the difference between the observed covariance matrix per degree of freedom and the hypothesized covariance matrix which denotes the model" (Cangur & Ercan, 2015, p.157). Lower the values of RMSEA, better the fit, with values less than .10 considered acceptable (Browne & Cudeck, 1993).Normed chi square is the is the ratio of the chi-square value to degrees of freedom. Researchers have recommended values as low as 2 or as high as 5 to indicate a reasonable fit (Marsh and Hocevar, 1985; Stank et al., 2003; Vachon, 2007). Byrne (2013) suggested that ratio should have a maximum value of 3. Two additional fit measures have been calculated, the

Tucker–Lewis index (TLI) and comparative fit index (CFI). Values of above 0.8 obtained for TLI and CFI are considered a good fit.

Using Amos 25, structural equation modeling (SEM) has been employed to evaluate the hypotheses. Bootstrapping method was used to conduct the test of mediation. Bootstrapping requires that the investigator repeatedly draws samples from the data set and estimate the indirect effect in each resampled data set. In the current study, a confidence interval of 95% was specified and the bootstrapped resample size was set as 5000. If the value of zero does not lie in the CI, the indirect effect is considered meaningful (Preacher & Hayes, 2008).

3.3.3 Assessing Common Method Variance

The data were collected from the same respondent for the independent and dependent variables, so presence of common method bias cannot be ruled out (Podsakoff, MacKenzie & Podsakoff, 2012). A Harman's single factor test was conducted to see if the majority of the variance could be explained by a single factor. The test revealed four factors with Eigenvalues greater than one and it had shown 63% of the variance. The first factor explained 19% of the total variance. It can be interpreted as evidence that common method bias is unlikely (Rhee et al., 2010). In addition, common latent factor test was also performed using confirmatory factor analysis. All items loaded onto a single factor indicated a poor fit (Normed χ^2/=10.168, and RMSEA= .178). The results of these tests confirm the absence of problems related to common method variance.

3.4 Results

3.4.1 Descriptive Statistics and Correlation

Table 3.1 presents means, standard deviation and Pearson's correlations among all variables. As expected, team sensemaking, team autonomy, and cognitive diversity were positively correlated to team creativity. The Pearson's correlation coefficient for team sensemaking was 0.545 ($p<0.01$), for team autonomy 0.463 ($p<0.01$) and for cognitive diversity 0.600 ($p<0..01$).

Table 3-1: Means, Standard Deviations and Pearson's Correlation Coefficients

Factors	Mean	SD	Team Creativity	Team sensemaking	Team autonomy	Cognitive diversity
Team creativity	1.89	0.669	(0.791)			
Team sensemaking	2.02	0.480	0.545***	(0.781)		
Team autonomy	1.91	0.608	0.463***	0.43***	(0.738)	
Cognitive diversity	1.89	0.669	0.600***	0.447***	0.483***	(0.723)

Note: Diagonal values in parenthesis are valus of square root of AVE(s)
*p < 0.05, **p < 0.01, ***p < 0.001.

3.4.2 Measurement Model

Before testing the hypotheses, a CFA was conducted to test the factor structure as well as the convergent and discriminatory validity of the measurement model including team autonomy, cognitive diversity, team sensemaking and creativity of team. A confirmatory factor analysis was performed on the four team-level constructs (cognitive diversity, team autonomy, team sensemaking, and team creativity). The model fit was assessed by reviewing a set of indices namely, Normed Chi-square, Comparative Fit Index (CFI), Tucker-Lewis index (TLI) and RMSEA. The threshold values recommended in the literature are as follows: CFI, NFI, and TLI > 0.9 (Bentler and Bonett, 1980; Byrne, 2016); RMSEA < 0.08 (Browne and Cudeck, 1993; Hair et al., 2006), Normed Chi-square < 3.0

(McIver & Carmines, 1981; Bollen, 1989). The four-factor model provided a good fit to the data (Normed Chi-square =2.25, CFI= .905, TLI =0.890, and RMSEA= .064).

Table 3-2: Confirmatory Factor Analysis

Variable	**Items**	**Factor loading**	**CR**	**AVE**	**Model Fit**
		(> 0.40)	(>0.70)	(> 0.50)	
Team Sensemaking			0.822	0.61	Normed χ^2=
Social Cognition					2.25
Confirmatory Encoding	CE1	0.678			CFI= 0.905
	CE2	0.771			TLI= 0.890
	CE3	0.729			RMSEA=0.064
Representation Shifting	RS1	0.692			
	RS2	0.706			
	RS3	0.791			
Team Situation Models	TSM1	0.800			
	TSM2	0.858			
	TSM3	0.714			
Communication	Com1	0.699			
	Com2	0.764			
	Com3	0.753			
Reflection	Ref1	0.727			
	Ref2	0.833			
	Ref3	0.669			
Team Autonomy	TA1	0.683	0.782	0.545	
	TA2	0.765			
	TA3	0.763			
Cognitive Diversity	CD1	0.578	0.763	0.523	
	CD2	0.785			
	CD3	0.786			
Team Creativity	TCr1	0.839	0.834	0.626	
	Tcr2	0.764			
	TCr2	0.769			

Next, the composite reliability of the instrument was analyzed. All scales fulfilled the minimum recommended values of 0.7 (Shook, Ketchen, Hult & Kacmar, 2004). The composite reliability for team creativity was 0.83, for team sensemaking 0.82, for team autonomy 0.782, and for cognitive diversity 0.76. Hence, all constructs exhibited composite reliability. Two types of validity measures were tested namely convergent validity and discriminant validity. The convergent validity was tested using the average variance extracted (AVE). Convergent validity holds if the AVE is greater than 0.5 (Hair et al., 2006). The value of AVE for team creativity was 0.62, for team sensemaking 0.61, for team autonomy 0.55, and for cognitive diversity 0.52. Hence, all constructs met the criteria for convergent validity.

Discriminant validity was tested by comparing value of inter factor corelations with the value of square root of AVE (Fornell & Larcker, 1981). For discriminant validity to hold the square root of AVE of the construct, it should be greater than its correlations with all other construct (Batra & Sinha, 2000). The results are shown in Table 3.2.

3.4.3 Hypotheses testing

The following section investigates the direct effects of cognitive diversity and team autonomy on team creativity and the indirect effects of cognitive diversity and team autonomy on team creativity via team sensemaking. Hypotheses were tested using a latent variable model that included both latent variables and observed variables. Unlike the path analysis which assumes no measurement error, the latent variable model helps researchers not only to identify prediction and measurement error but also to accurately evaluate constructs and proposed phenomena (Sila & Ebrahimpour, 2005).

Table 3.3 shows the results of the structural model, which was tested using AMOS 25.0. The results showed a good fit between model and the dataset (Normed χ^2= 2.250, CFI= .905, TLI =0.890, and RMSEA= .064). To test for mediation effect, a bootstrap sample size of 5000 was specified. The model was tested at a 95% confidence interval.

Table 3-3: Results of the bootstrapping method for mediating effect

	Bootstrapping		Direct Effect				Indirect Effect			
Independent Variables	Mediator	Dependent Variables	β	P	LLCI	ULCI	β	p	LLCI	ULCI
Team autonomy	Team sensemaking	Team creativity					0.144***	0.004	0.039	0.279
Team autonomy		Team sensemaking	0.345***	0.004	0.119	0.558				
Team autonomy		Team creativity	0.042	Non-significant	-0.159	0.240				
Team sensemaking		Team creativity	0.416***	0.001	0.230	0.611				
Bootstrapping			Direct Effect				Indirect Effect			
Independent Variables	Mediator	Dependent Variables	β	p	LLCI	ULCI	B	p	LLCI	ULCI
Cognitive diversity	Team Sensemaking	Team creativity					0.147***	0.001	0.054	0.268
Cognitive diversity		Team sensemaking	0.354***	0.001	0.145	0.554				
Cognitive diversity		Team creativity	0.510***	0.001	0.288	0..724				
Team sensemaking		Team creativity	0.416***	0.001	0.23	0.611				

*p<0.05;**p<0.01;***p<0.001
LLCI=Lower Limit of Confidence Interval; UCLI= Upper Limit of Confidence Interval

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Hypothesis 1 predicted a positive effect of team autonomy on team sensemaking. The standardized direct effect of team autonomy on team sensemaking is 0.345 and is

significant at 0.01 level of significance. Hypothesis 2 predicted a positive effect of cognitive diversity on team sensemaking. The standardized direct effect of cognitive diversity on team creativity is .354($p<0.01$). This explains when cognitive diversity increases by a unit, team creativity increases by 0.51 units. Hypothesis 3 predicted a positive effect of team sensemaking on team creativity. Team sensemaking is positively related with the team creativity ($\beta=0.416$, $p<0.001$). That is, when team sensemaking increases by a unit, team creativity increases by 0.416 units. Hence, the results found the support for Hypotheses 1, 2 and 3.

The standardized direct (unmediated) effect of team autonomy on team creativity is .042 and non-significant ($p=0.688$). The standardized direct (unmediated) effect of cognitive diversity on team creativity is 0.51 0($p<0.001$). That is, due to the direct (unmediated) effect of cognitive diversity on team creativity, when cognitive diversity increases by a unit, team creativity increases by 0.51 units. This is in addition to any indirect (mediated) effect that cognitive diversity may have on team creativity. The standardized indirect (mediated) effect of team autonomy on team creativity is .144. That is, due to the indirect (mediated) effect of team autonomy on team creativity, when autonomy increases by a single unit, team creativity increases by 0.144 units. Moreover, the standardized indirect (mediated) effect of team autonomy on team creativity is significantly different from zero at the 0.01 level of significance. The standardized indirect (mediated) effect of cognitive diversity on team creativity is .147. That is, due to the indirect (mediated) effect of cognitive diversity on team creativity, when cognitive diversity increases by a single unit, team creativity increases by 0.147 units. The standardized indirect (mediated) effect of cognitive diversity on team creativity is

significantly different from zero at the 0.01 level of significance (p=.001). Consistent with Hypothesis 4, team sensemaking mediates the relationship between team autonomy and team creativity. Furthermore, team sensemaking also mediates the relationship between cognitive diversity and team sensemaking, thereby supporting Hypothesis 5.

Results indicate that the standardized total (direct and indirect) effect of team autonomy on team creativity is 0.186. That is, due to both direct (unmediated) and indirect (mediated) effects of team autonomy on team creativity, when team autonomy increases by a single unit, team creativity increases by 0.186 units. The standardized total (direct and indirect) effect of autonomy on team creativity is significantly different from zero at the 0.10 level (p=.079). The standardized total (direct and indirect) effect of cognitive diversity on team creativity is 0.658 (p=0.01). That is, due to both direct (unmediated) and indirect (mediated) effects of cognitive diversity on team creativity, when cognitive diversity increases by a single unit, team creativity increases by 0.658 units and the effect is significantly different from zero at the 0.01 level of significance.

3.5 Discussion

The current study contains several important findings. First, the results suggest that autonomy exerts a positive influence on team creativity. According to self-determination theory autonomy leads to increased motivation (Ryan & Deci, 2000) to perform better which in turn leads to the creative and flexible behaviors of team members. This study also supports the notion of positive effect of team cognitive diversity on team sensemaking. The research further reveals that team sensemaking has a positive impact on team creativity. When team members enact sense in collaboration with each other they are better able to

come up with out of box solutions that no team member would have thought of acting in her/his individual capacity (Mathieu, Maynard, Rapp & Gilson, 2008; West, Patera & Carsten, 2009). Additionally, this study further explores the mediating role of TSM as the underlying mechanism for the relationship of team utonomy and team cognitive diversity of team with team creativity.

There has been scant empirical research on the facilitating role of team sensemaking on other team outcomes despite the fact that conceptual arguments have been made that a core function of team sensemaking is to help integrate distributed information to come up with plausible solutions (Ancona, 2012; Hekkala, Stein & Rossi, 2018). By focusing on team sensemaking as an intermediary mechanism, this study demonstrates how team sensemaking as an intrinsic motivational factor can facilitate social environment factors (team autonomy and cognitive diversity of team) to positively impact team creativity. One possible explanation for the mediating role of team sensemakingis that if team members do not build shared mental models, effectively seek and contribute information, and mindfully update information on ongoing tasks then the benefits of team cognitive diversity and autonomy remain unrealized.

Interestingly, this study finds that cognitively diverse teams are more creative when team members have engaged in team sensemaking. Diverse perspectives do not greater team creativity automatically (Dahlin, Weingart, & Hinds, 2005). Instead, this demands that the members of diverse teams devote cognitive energy in gaining the knowledge of teammates expertise and then communicate effectively to facilitate meaningful information exchange and reflection (Hoever et al., 2012). This finding may also explain why previous studies have not found direct positive relationships of team cognitive

diversity to creativity (Kurtzberg, 2005). This finding supports the notion that team cognitive diversity will have a greater positive influence on team creativity in the presence of meaningful and efficient team mechanisms such as team sensemaking are in place to harness the spillover of team cognitive diversity (Hennessey & Amabile, 2010).

Many studies already explain that autonomy can enable team performance (Das and Joshi, 2007; Tatikonda and Rosenthal, 2000). However, there has been a dearth of empirical research that has explicitly considered the relevance of team autonomy with respect to team sensemaking. Some scholars suggest that team autonomy can enable teams to adapt actively and flexibly to rapidly changing environments, resulting in better team performance (Langfred, 2005; Patanakul, Chen & Lynn, 2012). While team autonomy represents control and authority over structuring tasks (Ryan & Deci, 2005), Team sensemaking provides an understanding of the interaction among team members (Peronard, 2016). Team sensemaking acts as a catalyst by providing enabling intrinsic motivation mechanism to fully leverage the benefits of team autonomy. Furthermore, the results suggest that team sensemaking acts as an effective mediating factor in enhancing the potential benefits of team autonomy on team creativity.

These findings offer numerous practical implications for knowledge-intensive teams. We suggest that high autonomy has benefits for team creativity. Autonomy allows teams to self-determine the "how" component of the work. Team sensemaking as an intermediary variable provides a useful lens to acquire a deeper insight into the relationship between team autonomy and team creativity. For the managers of teams, these findings imply to bring together teams with higher team cognitive diversity and to encourage team sensemaking to take advantage of different perspectives. Team cognitive diversity has the

capacity to positively impact team creativity because it makes available distinct and non-redundant sets of knowledge; nevertheless the relationship between team cognitive diversity and team creativity is not straightforward (Jiang & Zhang, 2014). Indeed, team sensemaking in a diverse team setting can encourage vision and knowledge sharing and consideration of divergent viewpoints through team sensemaking can impact team creativity (DeDreu & West, 2001; Dreu 2002).

3.6 Limitations and Future Research Directions

This research has some limitations that open opportunities for future researches. First, the sample is based on teams from the ICT sector of Pakistan. However, it is possible that teams from other industries may have unique work patters. Future research can investigate how job design characteristics can affect team sensemaking and team creativity across multiple industries. Another limitation of the current study is that it has followed cross-sectional research design. Future researchers should use a longitudinal research design to better determine the causality between the variables.

The study relies on self- reported data from individual respondents which may be inherently biased. Considering objective measures of team performance or using multiple informants could further improve the research design. Finally, the current study merely considered two contextual factors. Future research can model the relationship among other job design features and social environment factors to fully understand the potential of sensemaking mediation. Pakistani employees tend to place high value on in-group collectivism (Nadeem & de Luque, 2018). In other studies drawing samples from highly collectivist cultures, pressure for conformity (Goncalo & Staw, 2006) is believed to offset

benefits of cognitive diversity. This study contributes to creativity literature by examining the effect of autonomy and cognitive diversity in a highly collectivist culture. Future studies can examine these relationships in other countries to improve the external validity of the model. As of now, the present study shows that team sensemaking can help turn cognitive diversity of team and team autonomy into drivers of team creativity. Indeed, these results have stimulated team sensemaking literature and researchers can afford to conduct much close scrutiny to the pertinent role of team sensemaking for facilitating the social environment factors teams for better team outcomes.

Chapter 4: An integrated model of team resilience: Exploring the roles of team sensemaking, team bricolage and task interdependence

Abstract:

The contemporary work environment calls for team members to be more resilient in the face of likely setbacks that are routinely experienced at a modern workplace. This study examines the impact of team sensemaking on team bricolage and subsequently on team resilience. It further investigate whether task interdependence moderates the mediation of team bricolage for the relationship between team sensemaking and team resilience. A sample of 213 team members participated in the self-administered survey. Findings show that team sensemaking has significant positive impact on team resilience. The results also show that team bricolage mediates the relationship between team sensemaking and team resilience. This study improves the understanding about the relationship between team sensemaking and team resilience by examining the boundary conditions under which the relationship is the strongest. The mediating effect of team bricolage indicates *how* the relationship between team sensemaking and team resilience is facilitated especially *when* the task interdependence is higher.

Keywords: Team sensemaking, team resilience, team bricolage and task interdependence.

4.1 Introduction

Organizations operate in complex environments and rely on teams to combat the complexity of the environment in which businesses operate (Salas, Sims & Burke, 2005; Meneghel, Martínez, & Salanova, 2016). Often, these teams are required to respond to sudden and unexpected demands for performance (Cook & Nemeth, 2006; Meneghel et al., 2016). In this regard, resilience is of great importance to teams, as they are increasingly expected to operate effectively and efficiently in knowledge-intensive organizations. Team resilience is a team's ability to rebound from setbacks, failure, and conflicts (Morel, Amalberti, & Chauvin, 2008; West et al., 2009). Success is fragile, and even successful entities find it difficult to maintain an upward momentum (Hamel & Valkanas, 2003). Setbacks and failure are almost an inevitable part of modern organizational life, hence, it is important to appear unscathed from setbacks, rather than trying to avoid them altogether (Snowden, 2000).

Despite the reliance of teams to overcome adverse events, the mechanisms through which they bounce back from adverse events are still not well understood (Stoverink, Kirkman, Mistry & Rosen, 2018; Gucciardi et al., 2018). The extant literature provided a limited understanding of the antecedents that enable and constrain team resilience (Mathieu et al., 2008). Also, there is dearth of research about *how* and *when* team resilience is usually achieved (Carmeli et al., 2013; Maynard & Kennedy, 2016). Especially, it is noteworthy that the existing literature does not adequately explicate the set of conditions and circumstances, where the effects of the antecedents may be stronger. For instance, Maynard and Kennedy (2016) argue that the processes which teams employ, in order to develop resilience in the face of anticipated, and unanticipated challenges, is an aspect that remains

largely unexplored. A similar call for further research, in an effort to deepen the understanding of team resilience, and the processes that help build this capacity, has been made by Carmeli et al. (2013). The current study aims to fill this important gap and proposes to examine the relevance of team sensemaking, as an important antecedent of team bricolage, and resilience, in the presence of task interdependence as a boundary condition. In so doing, this study seeks to explain *how*, (processes) and *when* (conditions) team sensemaking leads to team resilience. A detailed investigation of processes, such as team sensemaking and team bricolage, can provide useful insights about team resilience, especially in the presence of task interdependence as a boundary condition. Thus, this study examines the direct impact of team sensemaking on team resilience, as well as how this relationship is facilitated through team bricolage, under the boundary condition of higher task interdependence.

Teams are expected to have a reservoir of capacities which allows them to minimize the potential damage and to capitalize on opportunities (Burke, Hess & Salas, 2006). Organizational actors, including teams, dwell in systems that are uncertain and interdependent (van Kleij, Molenaar & Schraagen, 2011). To combat this perpetual phenomenon, resilience is a necessary team capability, because disruptions are both inevitable, and surprising (Boin & van Eeten, 2013; Brugnach, Dewulf, Pahl-Wostl & Taillieu, 2008). Within the organizational structure, there are a great number of events that are plausible, though not highly probable. Hence, it is not possible to deploy resources for every possible scenario. In a complex and dynamic environment, resilience is a desirable outcome. Investing in resilience promises to be a better alternative as compared to deploying resources that are aimed at controlling the environment or fighting specific

threats (Boin & van Eeten, 2013). According to conservation of resources (COR) theory, resources might be impactful in caravans, i.e., resources travel in packs (Hobfoll, Halbesleben, Neveu & Westman, 2018). T This implies that ecological conditions under which teams operate, may inhibit or foster team resilience. Hence, this study proposes and examines an integrated model that articulates relevant processes and enabling conditions of team resilience.

Weick (2005) identified sensemaking and bricolage as the key potential sources of resilience at the team level. Team sensemaking is likely to have a positive impact on team resilience because a team working towards a shared goal in a cohesive manner, is likely to achieve superior results, compared to the individual effort (Pollock, Paton, Smith & Violanti, 2003). People working in teams expect to reap synergies so that they are better able to understand situations and execute the appropriate actions (Carmeli et al., 2013; Kozlowski, Gully, Salas & Cannon-Bowers, 1996). Each team member may have only partial information, but teams composed of individuals with distributed, segmented and partial images of a complex environment can collectively construct a plausible representation of reality, that no individual in the group could have created on his own (Taylor & van Every, 2010). For example, Weick (1993) has emphasized the relevance of team resilience, especially when teams face novel, unprecedented situations, and are also expected to handle them with professionalism. Resilience is a necessary capability, especially when dealing with situations where disruptions are likely to occur (Lengnick-Hall & Beck, 2009; Grøtan, Størseth & Skjerve, 2008).

In order to effectively explain the link between team sensemaking, and team resilience, this study contributes to the existing knowledge in three ways. First, the study

proposes and tests the role of team sensemaking as an important antecedent of team resilience. Team sensemaking is an effective system that leads to superior team performance, yet only a few studies have empirically tested its effect on team resilience (Lundberg, Törnqvist, & Nadjm–Tehrani, 2012; Weick, 1993; Beunza & Stark, 2004). Second, this study examines the mediating role of team bricolage, between the team sensemaking and team resilience relationship, and empirically investigates how team bricolage can facilitate this link. Currently, there is limited empirical research on the mechanisms, through which team sensemaking influences team members' ability to cope with unexpected events (Uitdewilligen, Rico & Waller, 2018). Therefore, it was deemed relevant to test the mediating role of team bricolage for the relationship between team sensemaking and team resilience. Previous research has shown that the ability to improvise and bricoler is a central aspect of coping with adverse events (Mallack & Yildiz, 2016; Darrow, 2017). Finally, this study aims to broaden the understanding of the relevance of task interdependence, by exploring the moderating role of task interdependence for the relationship between team bricolage, and team resilience.

According to the interactionist perspective, the capacity for resilience can be effected by the interaction between different varables , such as emergent states (e.g. team bricolage) and task characteristics (e.g. task interdependence) (Woodman & Schoenfeldt, 1990; Woodman et al., 1993). Task interdependence can provide the motivation for team members to think collectively, and put their heads together to solve the problems at hand (Van den Bossche, Gijselaers, Segers & Kirschner, 2006). That is to say that employees working on highly interdependent tasks are more likely to bricoler. However, previous studies have paid little attention to the moderating role of task interdependence, while

investigating the relationship between perceived team bricolage and team resilience. Therefore, the integrated model of this research has hypothesized and tested that both task interdependence and team bricolage can be relevant in explicating the antecedent of team resilience.

4.2 Theory and Hypotheses Development

In order to study the association between team sensemaking, and team resilience, this study draws on the input-mediator-output (IMO) approach, as proposed by Ilgen, Hollenbeck, Johnson & Junt (2005). Ilgen et al. (2005) coined the phrase input-mediator-outcome (IMO) model, so as to differentiate this approach from the conventional input-process-output (IPO) framework. The primary difference between IPO and IMO is that the IMO framework differentiates between team processes and emergent states. Team sensemaking can be viewed as a team process (Weick 2005). Marks et al., (2001, p.357) define team processes as "interdependent acts that convert inputs to outcomes through cognitive, verbal, and behavioral activities".

The notion of team sensemaking is composed of three sub-dimensions namely, communication, reflection, and social cognition. It reflects a team's effort to codify, update, communicate, share and reflect upon the knowledge that they have access to. The research on teams increasingly incorporates emergent states as an important mediator between team inputs, and outcomes, as well as between team processes, and team outcomes. Emergent states describe the cognitive, motivational, and affective states of teams, as opposed to the nature of their members' interaction (Mathieu et al., 2008).

In most occupational settings, individuals complete tasks within teams to achieve a common objective (Sundstrom, de Meuse, & Futrell, 1990). The ubiquity of teams in

orgainizations underscores the significance of optimizing the ability of team members as a collectivity to repel, bounce back, or recover from adversity (Chapman et al 2018). Team adversity can take many forms. It can range from long-standing stressors such as role overload and collective fatigue to acute shocks, such as technology failure, or loss of a team member (Stoverink et al., 2019). While resilient teams overcome setbacks, for example, a resilient team may recover from loss of a key member by role, reconstruction whereas a brittle team would fail to do so and hence is more susceptible to break down in critical team processes (Sims & Salas, 2007). Most of the previous research has focused to understand the individual or organizational level resilience and therefore researchers have strongly advocated examining the phenomenon of resilience at a team or group level (Luthans, Youssef-Morgan & Avolio 2015; Gucciardi et al., 2018; Stoverink et al., 2019). In the hypotheses section, this study identifies the relevant factors that can facilitate teams to overcome adversity and enables teams in resisting, rebounding or recovering from adverse events that threaten their functioning, feasibility or growth (Gucciardi et al, 2018).

It is evident that there are structural differences between teams and other work settings of modern times. Among these differences, the key differential is the extent of task interdependence in teams compared to other modern work arrangements (Wageman, 1995; Gucciardi et al., 2018; Stoverink et al., 2019). In fact, interdependence is considered highest in teams and is the main aspect that differentiates team constructs from individual or organizational constructs (Courtright, Thurgood, Stewart, & Pierotti, 2015). One can argue that interdependence exists in organizations but it is much weaker than teams. For instance, interdependence between individuals is more prevalent within teams but at the organizational level interdependence can be much weaker between any two individuals or

subunits (Stoverink et al., 2019). Therefore, these underlying reasons emphasize the need to conceptualize and test team level resilience in its unique setting distinct from its organizational and individual counterparts (Gucciardi et al., 2018; Stoverink et al., 2019).

4.2.1 Team sensemaking and team resilience

Extant literature recognizes that traditional management practices cannot foster resilience (Heinimann & Hatfield, 2017) . Coutu (2002) emphasizes that resilience is not about a one-time effort in order to meet a one-time challenge. It is, in fact, about continuously anticipating, and adjusting to ever-shifting trends, with the belief, expectation, and aim that renewal must be an outcome of an organization's innate resilience. If it is accepted that uncertainty, stemming from from imperfect information, insufficient understanding, or ambiguous alternatives, (Lipshitz & Strauss, 1997) is a way of business life then it must also be accepted that sensemaking is a necessary capability that is needed to survive in such unpredictable environments (Snowden, 2005). While the short term objective of sensemaking is developing a common understanding of what the team is doing amongst team members; the longer term objective is to ensure that the team modifies itself according to its dynamic environment. (Choo, 1996). Without sensemaking, team members might find themselves paralyzed and unable to act upon what is expected of them (Lipshitz & Strauss, 1997; Luscher & Lewis, 2008), or they may even indulge in ignoring weak cues, and suppressing uncertainty (Lipshitz & Strauss, 1997). In brief, the notion of sensemaking can be considered as an important input component for the team resilience – a form of team outcome (Klein et al., 2010; Lengnick-Hall & Beck, 2009; Grøtan et al., 2008).

Sensemaking is the way through which organizational actors choose between multiple possible explanations, in order to interpret the various environmental cues, and as a result, act in such a way that helps them determine, and respond to their environment (Weick et al., 2005). Over a period of time, substantial a Weick et al., 2005mounts of information is collected, and categorized in the mental schema of team members. Shared mental maps help identify what situation team members are in, and what is the appropriate course of action in the given situation (March, Schulz & Zhou, 2000). Sometimes, interpretations might yield the conclusion that the team faces a novel situation. In such a situation, in addition to shared meaning, the team would have to rely on shared learning, in order to come up with a customized and all encapsulating solution.

Team sensemaking facilitates resilience through respectful interaction between the team members. Communication is the key to dispersing up to date, relevant, and accurate information, and accepting information from other team members allows for real-time updating of reality as, and when, it emerges. In fact, team sensemaking employs reflection in sizing up a particular situation at hand. Team sensemaking facilitates team resilience because it encourages the simultaneous acceptance and questioning of assumptions and beliefs (Kendra & Wachtendorf; 2003). Similarly, reflection enables managers to deal with fallible knowledge and, to balance between overconfidence, and overly cautious doubt (Srivastava & Cooperrider, 1998). Moreover, it allows team members to question assumptions that are not relevant and also allow for a reconfiguration of established routines, so as to come up with novel solutions and responses.

The combined use of mental maps, effective communication, and reflection, increase a team's capacity to deal with uncertainty. Shared meanings, purposes, and mental

maps, already exist in the minds of team members (Choo, 2001). These mental maps allow for the selection of pertinent rules and routines. Team sensemaking makes use of shared mental maps, shared knowledge, both new and old, shared language that allows for better communication, and shared reflection in real-time, and hence have a significant relationship with the resilience of a team. Based on the foregoing discussion, it is hypothesized that a positive and direct relationship between team sensemaking can be present.

Hypothesis 1: Team sensemaking will have a positive relationship with team resilience.

4.2.2 Team Sensemaking, Team Bricolage, and Team Resilience

Baker and Nelson (2005) define bricolage as " making do by applying combinations of the resources at hand to new problems and opportunities" (Baker & Nelson, 2005, p. 333). A team that possesses the ability to bricolage is expected to remain creative under pressure, because it is believed that they routinely act in chaotic conditions, and are trained, through experience and guidance, to pull order out of them. Thus, when situations take an unexpected turn, the team proceeds with whatever materials are on hand (Weick, 1993).

Team sensemaking helps a team to register and interpret relevant cues from their environment (Weick, 2005). This prompts the team members to recombine action, and resources to concoct a suitable solution with whatever resources there are at their disposal. In the absence of team sensemaking, teams may overlook novel recombination of resources. Seeking multiple points of view, and debating alternate possible solutions in times of stress may sound counterproductive, as compared to confident intervention. However, ongoing debate and reflection buffer against the safest interpretation (Weick,

2010) because the safest interpretation might not necessarily be the best interpretation of the crisis at hand. Team sensemaking, thereby, allows teams to transfer their existing capabilities to more complex situations or those which have not been experienced before. Mental models, codifying situations as routine or novel, effective communication, and reflection, allows teams to draw information from a vast store of knowledge, especially when dealing with standard problem-solving situations. In case of team setback, team members work *interdependently* to make sense of the given situation (Stoverink et al., 2019).

Central to team sensemaking is respectfully voicing thoughts and ideas, which not only offers a better understanding of the current predicament but it also leads to generating more response alternatives (Weick 1993; Stoverink et al., 2019). In fact, the honest sharing of thoughts and observations can help to create an accurate understanding of a given situation among team members. It further permits them to make effective use of their resources at hand (*team bricolage*) to solve problems so that they can handle adverse situations better. Therefore, team bricolage as a retrospective aspect of teams can assist members to reflect on what to do about things that do not work out as per the original plan.

Team bricolage facilitates team members to rely on an already existent set of tools and materials, to consider or reconsider what it contains, and to index the possible answers that the whole set of tools at hand can offer to create an optimal solution to deal with adverse situation (Yanow and Tsoukas, 2009). This improvisatory act of team bricolage through existing tools in response to usual provocation can be an important intermediary mechanism to achieve team resilience. Once adversity is detected then the resilient teams shift into sensemaking through team bricolage to move seamlessly from determining what

is happening to what needs to be done to bounce back from the adverse situation (Weick et al., 2005). Team sensemaking allows teams to draw information from the collective source of knowledge, most commonly in the face of standard problems. Furthermore, it may also allow the teams to use this information in novel situations, or even transfer it to a different domain, such as when solving a problem via an analogy. Hence, team sensemaking can lead to team bricolage.

While examining the case of Mann Gulch, Weick (1993) identified bricolage as one of the key sources of resilience. Effective organizations (and teams) have the capability to recombine resources at their disposal, in order to come up with out-of-the-box solutions (Boin, 2009). Through a refusal to endorse the standard use, and subsequently the limitations pertaining to the known, existing resources, (Phillips & Tracey, 2007), bricoleur teams aim to, and are able to repackage, and recombine the same resources in ways for which they were not originally designed for (Baker & Nelson, 2005). According to Wildavsky (1991), the ultimate form of resilience is for a team to be prepared to learn, and to act in the moment, without having any prior notification about the situation they would potentially come face to face with, or the appropriate action that would be required at that very time. Bricolage improves a team's capability to expect, and effectively deal with the unexpected (Duckek, 2014; Huynh & Patton, 2017).

The primary reason as to why team bricolage can potentially facilitate the link between team sensemaking, and team resilience, is that bricoleur teams tend to hold a bias for action. Teams that engage in bricolage quickly respond to any adverse circumstances, rather than waiting for the right resources to become available (Senyard, Baker & Davidson, 2009). According to Weick (1993), bricolage enables the team to overcome

adverse situations by developing an ability to take decisive actions and to search for solutions in unusual situations with the use of typical, available, limited resources. In other words, engagement in bricolage helps avoid a paralyzing effect in the face of an unusual situation and simultaneously helps search for a workable solution to the problem. Team sensemaking provides diverse, timely and relevant information about a situation. As a result, team bricolage helps devise the solutions that are then adapted to the immediate context (Davison & Ou, 2015), with the given limited resources which are used to facilitate team resilience, by maintaining the team's capacity to act (Duymedjian & Rüling, 2010).

Another possible explanation for this facilitating role of team bricolage is provided by the COR theory. According to the COR theory, the factors that are considered the primary building blocks of resilience, are the resources available to the teams (for example team sensemaking, and team bricolage), and the fit of these resources to situational factors (for example task interdependence) (Chen, Westman & Hobfoll, 2015). The COR theory argues about the loss, and gain spirals of the resources, and how, especially the loss of resources, can make individuals more defensive and irrational (Hobfoll et al., 2018). While the primary principle is that, initial gains beget future gains, and initial losses beget future losses, an important corollary is that resource gain tends to become more salient when resource loss has been high or chronic for sometimes (Hobfoll et al., 2018). This is a paradoxical principle, as although the COR theory places the greatest weight on the loss of resources, yet this principle asserts a key role of the resource gain in order to facilitate the process of team resilience. In fact, resource gains may have little impact on people who are not experiencing the loss, or loss cycles.

On the other hand, small gains won through team bricolage become potent where major or sustained loss of resources has been experienced, and thereby, this cycle facilitates the resilience (Eisenhardt & Tabrizi, 1995; Duchek, 2014; Duymedjian & Ruling, 2010). As per the cycle of resource loss and gain of the COR theory, it is argued that team sensemaking will eventually lead to team bricolage, and team bricolage aids in fostering team resilience (Hobfoll et al., 2018, p.106). In the following hypothesis, it is proposed that team bricolage can mediate the influence of team sensemaking on team resilience, that is to say that, team sensemaking can influence team bricolage, which in turn can positively influence team resilience.

Hypothesis 2: Team Bricolage mediates the relationship between team sensemaking and team resilience.

4.2.3 The Relevance of Task Interdependence

The importance of task interdependence has long been realized (Saavedra, Earley & Van Dyne, 1993; Kirkman, Rosen, Tesluk & Gibson, 2004; Langfred, 2005; Chen, Kirkman, Kanfer, Allen & Rosen, 2007). Task interdependence can be defined as the coordination requirements needed among team members, in order to achieve efficacious performance outcomes. It can be viewed as the degree to which the level of interaction and coordination of team members is required, for them to complete the assigned tasks (Guzzo & Shea, 1992). As the level of task interdependence increases in a team's decision-making situation, so does the dependence of the team members upon each other.

The interactive perspective suggests that team performance is a reflection of a multitude of factors (Courtright et al., 2015). Therefore, it can be further argued that the team sensemaking-bricolage-resilience linkage would be stronger when the task interdependence is high. Previous research has shown that when a team enjoys a high level

of task interdependence, the team members are more likely to cooperate, communicate (Bachrach et al.,2006) share knowledge with others (Crawford & Haaland, 1972), and display more organizational citizenship (Bachrach et al.,2006). In the case of team bricolage, and team resilience, the existing literature suggests that the differences in task interdependences would draw a distinction between effective, and ineffective team resilience. Teams undertaking highly interdependent tasks are more likely to adopt team bricolage in delivering their organizational goals (Vera & Crossan, 2005). Highly interdependent teams might be more likely to adopt bricolage, as task interdependence will facilitate information exchange, because interdependent working tasks require employees to exchange information, and communicate on work issues (De Dreu,2007). Also, the team bricolage can lead towards more creativity and improvisation, for increased team resilience (Stoverink, Kirkman, Mistry & Rosen, 2018). In fact, higher task interdependence can compel team members to engage in team bricolage, by investing resources in order to gain more resources for increased team resilience (Hobfoll et al., 2018).

In the pursuit of team bricolage, members of more interdependent teams tend to interact more closely with each other, and have interaction and coordination, already in place. High task interdependent teams can be more aware of problems, such as social loafing (Sicotte & Langley, 2000), compared to teams with a lower level of task interdependence. As compared to their superiors at higher levels in the management hierarchy, a highly interdependent team may reprimand uncooperative team members with stricter and harsher mechanisms, so as to eliminate any further problems. Additionally, task interdependence is likely to foster the formation of shared leadership, which in turn allows team members to share influence, and have a certain sense of power when it comes to

communicating and speaking up (Bachrach et al.,2006; Owens & Hekman, 2016). In brief, team interdependence can galvanize the efforts towards team bricolage, for effective resource generation, and making the team more resilient.

Based on the above statements, it is likely that the presence of task interdependence can lead to an increase in team bricolage. Taking these findings into consideration, it is proposed that the influence of team bricolage on team resilience will be stronger when task interdependence is high. In other words, it is argued that when groups of individuals, working on an interdependent task, face an unexpected situation, their collective effort can become a powerful tool to persevere in the execution of the given task at hand. As tasks become more interdependent on another team member, then team sensemaking is also likely to have a more significant positive influence on resilience through team bricolage. Simultaneously, teams that have a low level of task interdependence might experience process losses, since they would have to spend additional time in planning, coordinating and decision making. Additionally, under low task interdependence, reliance on other team members, and the expectations of reciprocation are low (Staples & Webster, 2008). When task interdependence is low, team members feel comfortable withdrawing help to their team members (Van der Vegt & Van de Vlier, 2005). In the context of the argument above, it can be proposed that the level of task interdependence can moderate the link between team bricolage and team resilience, as proposed in the following hypothesis.

Hypothesis 3: Task interdependence moderates the relationship between team bricolage and team resilience, such that the positive effect is enhanced when task interdependence is high, and the positive effect is mitigated when task interdependence is low.

4.2.4 Research Model

This research aims to examine the relationship between team sensemaking and team resilience by examining the pertinent conditions under which the relationship between the two variables is the strongest. In so doing, the study first examines the impact of team sensemaking on team bricolage and subsequently on team resilience. Furthermore, the study investigates whether task interdependence as a boundary condition moderates the mediating effect of team bricolage for the direct relationship between team sensemaking and team resilience. The mediating effect of team bricolage indicates *how* the relationship between team sensemaking and team resilience is facilitated especially *when* the task interdependence is high. Based on the above arguments, the theoretical framework of the study is represented in Figure 4.1.

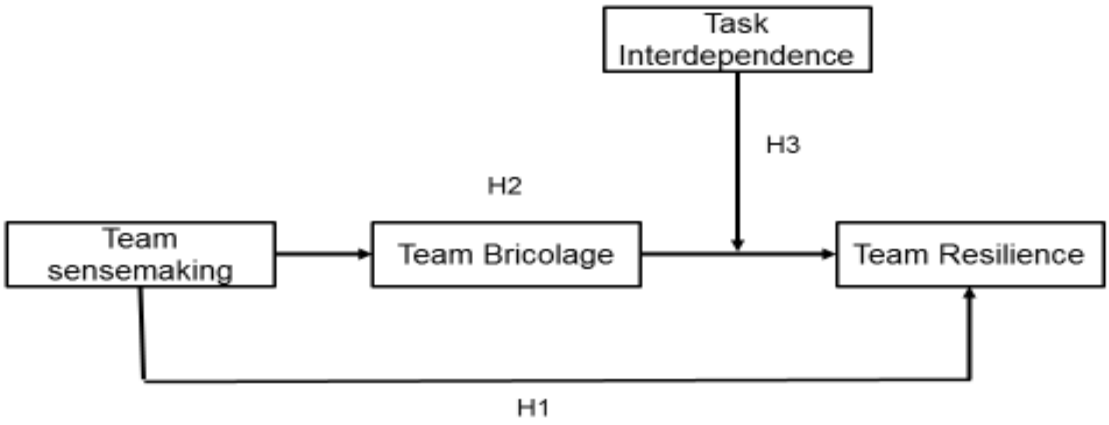

Figure 4-1: Conceptual model of team sensemaking, team bricolage, and team resilience: a moderated mediation model

4.3 Methodology

4.3.1 Sample and data collection

The ICT industry is suitable for the purpose of our study because the work is usually done in teams and there is an ongoing need to make "sense" of the client preferences. Pakistan Software Houses Association for IT and ITES, (P@SHA), is a leading representative body of Pakistan's software industry. It has 290 members listed in their membership directory. This list served as the sampling frame. Teams from 87 firms agreed to participate in the survey. A total of 304 usable responses were used to analyze the data.

Key persons within software houses were contacted via e-mail and telephone to explain the academic nature of the study. It was explained that the confidentiality of the data would be maintained and the data collected would only be used for academic purposes. It was indicated that a report of study findings could be shared with the ICT firms.

Following the example of Mainemelis (2010) and Ratzmann, Pesch, Bouncken and Martínez (2018), the final restriction for inclusion in the sample was that the team must feel constrained for resources. Bricolage by definition is "making do with current resources, and creating new forms, and order from tools and materials at hand" (Baker, Miner & Eesley, 2003). The need for it arises when the resources the organization provides, for the elaboration of new ideas, are not sufficient. The corresponding binary question in the survey reads: "Team members often feel constrained by the organization resources, in pursuing their ideas". Keeping only those respondents, who often felt this constraint, reduced the original sample of 304 to approximately 213 observations. To rule out potential systematic bias, the reduced sample was compared with the sample. This comparision to did not find any significant difference in terms of any variables that later used in the regressions. Notably, by disqualifying respondents, i.e., teams with unlimited resources,

this study excluded several respondents who would not need to engage in bricolage in the first place.

4.3.2 Operationilzation of variables

To design the measure instrument, existing measurement items were adopted. Measurements items for resilience were adapted from Sinclair and Wallston (2004), while the measurement items for bricolage were adppted from Senyard, Baker & Steffins (2010). Team sensemaking was conceptualized as a third-order construct, with three subdimensions: social cognition, communication, and reflection. Social cognition was further represented by three sub-dimensions: confirmatory encoding, representation shifting, and team situation models. Items to measure each sub-dimension were adapted from the existing literature (Neill et al., 2007; Gray et al., 2015; Akgün, Lynn, & Dogan, 2012; and Ortel & Antoni, 2014). Following Rosenauer, Homan, Horstmeier & Voelpel (2016) task interdependence was used measuring a single item" 'Team colleagues have to work together in order to get team tasks done'. A five-point Likert scale was used to measure all items, where a value of 1 denoted "strongly disagree", and a value of 5 was equal to "strongly agree".

4.3.3 Data Analysis

The hypotheses were tested in three interlinked steps. First, a simple regression model (Hypothesis 1) was examined in AMOS version 25. Second, the mediation was examined via PROCESS macro (Hypothesis 2). Third, this study introduced the proposed moderator variable into the model, and empirically investigated the overall moderated mediation hypothesis (Hypothesis 3).

4.3.3.1 Tests of Mediation

Hypothesis 2, suggests an indirect effects model, whereby the relationship between team sensemaking, and team resilience is mediated by teams' bricolage. The test of mediation was conducted by the application of bootstrapped confidence intervals (CI), via AMOS version 25. The bootstrapping method has several advantages over the multistep approach proposed by Baron and Kenny (1986), and Sobel test (1982).

4.3.3.2 Tests of Moderated Mediation

Concerning Hypothesis 3, it was hypothesized that the indirect effect of team sensemaking on team resilience, via team bricolage, is conditional on the value of the moderator, i.e., task interdependence. Such effects are termed conditional indirect effects (alternatively known as moderated mediation) (Preacher, Rucker, & Hayes, 2007). Preacher and his colleagues (2007) developed an SPSS macro that provides a method for probing the significance of conditional indirect effects, at different values of the moderator variable, by the implementation of the bootstrapping method.

4.4 Results

4.4.1 Descriptive Statistics

Table 4.1 presents means, standard deviation and Pearson correlation coefficients among all variables. As expected, team sensemaking and team bricolage were positively correlated to team resilience. Pearson's correlation coefficient for team sensemaking with team resilience was 0.513 ($p<0.01$), and with team resilience was 0.360 ($p<0.01$) and the correlation for team resilience with team bricolage was 0.586 ($p<0.01$).

Table 4-1: Means, standard deviations and correlations of latent variables

Factors	Mean	SD	Team sensemaking	Team resilience	Team bricolage
Team sensemaking	1.96	0.45	(0.80)		
Team resilience	1.81	0.66	.513**	(0.73)	
Team bricolage	1.69	0.56	.360**	.586**	(0.81)

Note: Diagonal values in parenthesis are valus of square root of AVE(s)
*p < 0.05, **p < 0.01, ***p < 0.001.

4.4.2 Measurement Model Results

Before testing the hypothesis, the measurement model was assessed for responses obtained from the team members. A three-factor model was then estimated with team sensemaking, team resilience, and team bricolage. The results indicated a good fit (Normed Chi square=1.98, RMSEA=0.07, CFI=0.91, TLI=0.88).

Next, the composite reliability of the instrument was analyzed. All scales fulfilled the minimum recommended values of 0.7 (Shook et al., 2004). The composite reliability for team sensemaking was 0.84, for team resilience, 0.766, and for team bricolage 0.85. Hence, all constructs exhibited composite reliability. Two types of validity measures were tested namely convergent validity and discriminant validity. The convergent validity was tested using the average variance extracted (AVE). Convergent validity holds if the AVE is greater than 0.5 (Hair et al., 2006). The value of AVE for team sensemaking, 0.64, for

team resilience, 0.53, and for team bricolage 0.65. Hence, all constructs met the criteria for convergent validity. Discriminant validity was tested by comparing value of AVE with the value of squared correlations (Fornel & Larcker, 1981).

Table 4-2: Confirmatory Factor Analysis

Variable	Items	Factor loading	CR	AVE	Model Fit
		(> 0.40)	(>0.70)	(> 0.50)	
Team Sensemaking			0.841	0.64	Normed Chi square=
Social Cognition					1.98
Confirmatory Encoding	CE1	0.741			CFI= 0.905
	CE2	0.773			TLI= 0.879
	CE3	0.627			RMSEA=0.068
Representation Shifting	RS1	0.678			
	RS2	0.728			
	RS3	0.816			
Team Situation Models	TSM1	0.765			
	TSM2	0.853			
	TSM3	0.699			
Communication	Com1	0.619			
	Com2	0.773			
	Com3	0.724			
Reflection	Ref1	0.752			
	Ref2	0.875			
	Ref3	0.652			
Team Bricolage	Bric1	0.518	0.766	0.532	
	Bric2	0.762			
	Bric3	0.864			
Team Resilience	Res1	0.859	0.845	0.646	
	Res2	0.767			
	Res3	0.782			

4.4.3 Hypotheses Testing

Hypothesis 1 predicted that team sensemaking would have a significant, positive impact on team resilience. Hypothesis 2 predicted a mediating effect of team bricolage between team sensemaking, and team resilience. The bootstrapping method was employed for the purpose of testing for the presence of indirect effects. Bootstrapping has become the preferred, inferential method for testing indirect effects. Moreover, it allows empirical estimation of the sampling distribution of the indirect effects, and generate a confidence interval. If zero is not included in the confidence interval, it can be inferred that the indirect effect is different from zero.

The standardized effect of team sensemaking on team bricolage is 0 .446. That is, due to the effect of team sensemaking on team bricolage, when team sensemaking increases by a single unit, team bricolage increases by 0.446 units. The standardized total effect of team sensemaking on team resilience is significantly different from zero at the 0.01 level of significance.

The standardized effect of team bricolage on team resilience is 0.582. That is, due to the effect of team bricolage on team resilience, when team bricolage increases by a single unit, team resilience increases by 0.582 units. The standardized total (direct and indirect) effect of team bricolage on team resilience is significantly different zero at the 0.01 level of significance.

The standardized total (direct and indirect) effect of team sensemaking on team bricolage is 0.663. That is, due to both direct (unmediated) and indirect (mediated) effects of team sensemaking on team bricolage, when team sensemaking increases by a single unit, team bricolage increases by 0.663 units. The standardized total (direct and indirect) effect

of team sensemaking on team bricolage is significantly different from zero at the 0.01 level of significance. The standardized direct (unmediated) effect of team sensemaking on team resilience is 0.403. That is, due to the direct (unmediated) effect of team sensemaking on team resilience, when team sensemaking increases by a single unit, team resilience increases by 0.403 units (p<.01). This is in addition to any indirect (mediated) effect that team sensemaking may have on team resilience. The standardized indirect (mediated) effect of team sensemaking on team resilience is 0.260 (p=.000). That is, due to the indirect (mediated) effect of team sensemaking on team resilience, when team sensemaking increases by a single unit, team resilience increases by 0.26 units Both hypotheses were supported. There is a significant direct relationship between team sensemaking and team resilience. It was also found that team bricolage mediates the relationship between team sensemaking and team resilience.

Table 4-3: Summary of Mediation Results

Bootstrapping			Direct Effect		Indirect Effect		Decision Rule
	Mediator	DV	β	p-value	β	p-value	
Tam sensemaking	Team bricolage	Team resilience			0.260***	0.000	Mediation Present
Team sensemaking		Team bricolage	0.446***	0.000			
Team sensemaking		Team resilience	0.403***	0.000			
Team bricolage		Team resilience	0.582***	0.000			

Note: N=213. ** p<.05. ***p<0.01
Bootstrap sample=5000

In order to test Hypothesis 3, moderated mediation analysis (Edwards & Lambert, 2007) was conducted, using the PROCESS macro (Hayes 2012). Model 14 was specified, with a bootstrapping sample of 5000. The index of moderated mediation is significant at a significance level of 0 .05. Table 4.4 reports the result of the analysis.

Table 4-4: Results of Moderated-Mediation Analysis Predicting Team Resilience

Moderator: Task Interdependence				
Value of Moderator	Effect	SE	LLCI	ULCI
Low(-1SD)	-0.045	0.055	-0.170	0.050
Moderate (Mean)	0.073	0.036	0.011	0.156
High(+1SD)	0.191	0.055	0.096	0.312
Mediator: Team bricolage				
Index of moderated mediation	0.146	0.051	0.062	0.266

Note: N=213, Bootstrapping sample=5000
CI= Confidence Interval, LLCI=Lower Limit of CI, UCLI= Upper limit of CI

The estimated conditional indirect effects, represent the indirect effect of team bricolage on team resilience. As the results in Table 4.4 reveal, the overall indirect effect of bricolage, on team resilience is non-significant (β =0.05, 95% CI from -0.17 to 0.05), when task interdependence is low. In contrast, team bricolage has a significant positive, indirect effect on team performance, through team bricolage, when task interdependence is moderate (β =0.07, 95% CI from 0.01 to 0.16), and high (β =0.19, 95% CI from 0.06 to 0.26). As the degree of task interdependence increases, so does the mediated effect of team bricolage on team resilience, hence the mediating effect of team bricolage on the

relationship between team sensemaking and team resilience is moderated by the degree of task interdependence.

4.5 Discussion

The current study is a valuable addition to emerging research about team resilience that investigates how and when teams succeed in face of significant adversity (Lawrence & Maitlis, 2012; Meneghel, Martinez, & Salanova, 2016; Stuart & Moore, 2017). Very recently, it has been conceptually argued that team resilience is an under-researched meso-level construct that is distinctive from individual and organizational resiliencies (Luthans et al., 2015; Gucciardi et al., 2018: 730; Stoverink et al, 2019). This research and its findings are particularly important regarding the pervasiveness of teams in contemporary organizations. Work teams inevitably face adversity while operating in the current business environment (King, Newman, & Luthans, 2015). Hence, it is important to better understand the boundary conditions that can assist teams to operate resiliently while coping with inevitable adversities (West et al., 2009). Takeda, Jones, and Helms (2017); Lengnick-Hall & Beck (2009), and Beunza and Stark (2004) examined the sensemaking-resilience linkage in volatile contexts. The current study found that the same relationship exists in less extreme, day to day business activities. Interestingly, evidence converged in support of team sensemaking, as an antecedent of team resilience.

Another key objective of this study was to examine the role of team bricolage, as an underlying mechanism, through which team sensemaking can impact team resilience. Baker and Nelson (2005) proposed that, when organizational actors are confronted with environments that present new challenges, without providing the access to new resources then they may have three options: (1) to seek additional resources; (2) to remain inert; and

(3) to enact bricolage by configuring combinations of the available resources to new problems and opportunities. The concept of sensemaking outlines how the resource environment becomes idiosyncratic according to what the organizational actors can, and want to make of it (Weick, 2001; 2005). This leads to differences in how teams interpret their environment, and in their ability to survive, and prosper, given ostensibly similar challenges. This study, enriches the existing literature on team resilience, by showing that team bricolage can facilitate team resilience, by focusing on action, and harvesting gain spirals.

This study provides an interesting insight into how the teams of knowledge-intensive industries can be facilitated for better sensemaking through the use of team bricolage to achieve team resilience. Team bricolage helps team in circumventing constraints and limitations of resources so that team members can utilize team sensemaking to bounce back from the adverse situations (Turturea, Jansen & Verheul, 2014). According to Levi-Strauss (1966), bricolage as a form of reasoning is fundamentally different from scientific way of thinking in which the end product decides what means should be used. Team bricolage, on the other hand, begins by assessing what means are available and how these tools can be improvised for an optimal outcome. Indeed, a team can holistically attack a problem to reach the optimal solutions by employing team bricolage (Innes & Booher, 1999; Booher &Innes, 2010; Laine, Helamaa, Kuoppa & Alatalo, 2018). The inclusion of team bricolage as an underlying mechanism (mediator) has enabled us to better explicate how team sensemaking influences the way in which teams manage their resources, which in turn affects their ability to bounce back from the adverse situations.

It is imperative to state that most of the previous studies have explored the direct relationship between sensemaking practices, and team resilience (Takeda, Jones, & Helms, 2017; Lengnick-Hall & Beck, 2009; Grøtan, Størseth & Skjerve, 2008; Beunza & Stark, 2004). A few studies have focused on identifying the intermediary mechanisms that can facilitate the impact of team sensemaking, on team resilience. These factors mainly include leadership and redundancy (Kendra & Wachtendorf, 2003; Kuhlicke, 2013; Baran & Scott, 2010; Lundberg, Törnqvist, & Nadjm–Tehrani, 2012). However, there has been very limited research, with respect to the relevance of team bricolage, on how it can influence the direct relationship between team sensemaking, and team resilience. Indeed, earlier studies have only hinted towards the mediating role of team bricolage, in the relationship between team sensemaking, and team resilience (Lengnick-Hall and Beck, 2009; Beunza & Stark, 2004; Grøtan, Størseth & Skjerve, 2008). In the context of this research, this study has empirically tested the influence of team bricolage which pertains to the link between team sensemaking and team resilience.

In addition to the influence of team bricolage, with respect to the relationship between team sensemaking, and team resilience, this study has examined the role of task interdependence and its relationship with the mediating role of team bricolage. In fact, the current study argues that the mediation of team bricolage is dependent on the degree of task interdependence. The literature on task independence has also, indirectly indicated the possibility of the influence of task interdependence on this linkage. This study has extended the literature by delving on the interactionism theory, and tests for the conditional effect of task interdependence, on the relationship between team bricolage, and team resilience.The empirical results suggest that the task interdependence makes a difference in the ability of

the teams to deploy bricolage, and be more resilient in the face of uncertainty, and business environment adversity. This finding is consistent with the previous research which reveals that task interdependence encourages resource exchange, and information sharing (Cabrera & Cabrera, 2005). Task interdependence creates a setting that facilitates cognitive (for example team sensemaking), and motivational states (for example team bricolage), that are necessary for team resilience (Bossche, Gijselaers, Segers, & Kirschner, 2006). In a recent meta-analysis, it has been found that the trust-performance relationship in teams, is dependent upon the level of task interdependence (Jong, Dirks & Gillespie, 2016). It is imperative to mention that task interdependence had been used as a moderator in this meta-analysis. Indeed, task interdependence necessitates the employees working collaboratively, and therefore acts as an important boundary condition for the team resilience (Runhaar, Bednall, Sanders & Yang, 2016).

The promotion of resilience in teams enables organizations to appropriately respond to unanticipated events, that potentially threaten performance and survival (Amaral, Fernandes & Varajão, 2015). Comprehensive findings of these studies have critical management implications. First, this study suggests that team sensemaking plays an important role in fostering resilience. In fact, organizations can train employees for better situational awareness, communication, and reflection. Team sensemaking improves, out of increased interaction, on-going dialogues among team members. Second, managers can devise such interventions, which can assist team members to engender team bricolage, for improved team resilience. When managers face new business challenges, then management should encourage teams to make use of existing resources, and reconfigure to improvise for better team resilience (Yang, 2018).

These findings indicate that, team bricolage mediates the relationship between team sensemaking, and team resilience. This finding indicates that the team should develop management practices to engender team bricolage, which in turn will inspire team resilience. When facing new business challenges, rather than immediately seeking new resources, management should encourage teams to use existing resources, and recombine these resources for new uses (Yang, 2018). The findings of the current study underscore the importance of putting time, and effort in bricolage activities, rather than look for additional resources to overcome challenges, and to foster resilience.

In addition to team sensemaking and team bricolage, this study has examined the relevance of task interdependence as a moderating factor for team resilience. This study provides evidence that the link between team sensemaking, and team resilience, is highly complex. The research findings clearly imply that under the conditions of higher task interdependence among the team members, the teams can become more resilient. The results suggest that the human resource managers need to pursue alignment between micro-contextual inputs (such as task interdependence, and low munificence), to achieve desirable team outcomes (Cordery, Morrison, Wrights & Wall, 2010). The team's task interdependence needs to be sufficiently high for them to effectively bricolage in the face of adversity. By including bricolage as a possible mediating path and by understanding the boundary conditions under which such mediation will be successful, managers can gain a better understanding of how and when team sensemaking influences team resilience. Managers can design job descriptions of team members in a manner that encourages higher task interdependence and in fact, under the conditions of higher task interdependence, team members can engage in sensemaking and deploy bricolage for making teams more resilient.

4.6 Limitations and Future Research Directions

Although findings of the current study yielded some noteworthy conclusions, the study methods suffered from limitations that should be addressed in future research. The current study relies on a single informant and employs the cross sectional design. Future researches can further improve the research design by separately measuring team resilience through objective measures, instead of survey responses.

The current study indicates that team bricolage mediates the relationship between team sensemaking, and team resilience. Various other factors, such as, for example, the virtual role system, can also possibly mediate the relationship between team sensemaking and team resilience. Further examination of other mediating variables may provide a more comprehensive picture of how team sensemaking promotes team resilience.

The generalizability of the findings is limited, as this research was conducted only in the ICT sector of Pakistan. Future studies should attempt to extend these conclusions in other contexts to generalize the findings that team sensemaking positively impacts team resilience, and that team bricolage mediates this relationship, and also that this mediation effect is stronger, when task interdependence is high in a team.

Chapter 5: Conclusions and Implications

5.1 Introduction

The primary motivation of this research is to conceptualize and measure the antecedents and consequences of team sensemaking. In the past decade, there has been a rapid theoretical development of collective sensemaking but there has been a dearth of empirical investigation (Maitlis & Christianson, 2014; Maitlis & Powell, 2015; Pohl & Haider,2017; Sandberg & Tsoukas, 2014). The present research was motivated by the following three research questions: *1) What is the influence of transactive memory systems (TMS) on team sensemaking in the presence of relevant boundary conditions namely, task conflict and reward interdependence? 2) What is the relevance of team sensemaking as a facilitatory mechanism for the relationship of social-environment factors (team autonomy and cognitive diversity of team) with team creativity? 3) How and when does team sensemaking impact team resilience?*

The research design was primary data collection using surveys. The ICT firms listed on P@SHA were considered as the sampling frame for this study. Managers were emailed the questionnaires. After several reminder emails, a total sample of 304 questionnaires was collected and was used in the final data set for the analysis of the results. The results of Chapter Two shows that TMS is a strong predictor of team sensemaking, especially when task conflict is low to moderate and reward interdependence is high. In Chapter Three, socio-cognitive factors (team autonomy and cognitive diversity) predicted team sensemaking. Also, the team sensemaking had a positive impact on team creativity and more importantly, it had mediated the relationship between team autonomy and team

creativity as well as between cognitive diversity of team and team creativity. In Chapter Four, the impact of team sensemaking on team resilience was found to be mediated by team bricolage such that the mediation of team bricolage was moderated by task interdependence.

5.2 Key Findings

This research investigated the important issue of team sensemaking in the ICT sector of Pakistan. Using the lens of sensemaking theory, this study found that TMS can predict team sensemaking. Interestingly, the relationship between team sensemaking and TMS was influenced by the dual presence of task conflict and reward interdependence. Two important social-environment factors namely, cognitive diversity and team autonomy were found as the enablers of team sensemaking. Likewise, team sensemaking was found to influence team resilience both directly and through the underlying mechanisms of team bricolage when level of task interdependence was higher.

Chapter Two examines the direct impact of TMS on team sensemaking. It also directs attention to understand *when* TMS is most useful for enhancing team sensemaking. Role specialization spurs sensemaking (Bechky, 2006; Meyerson, Weick, & Kramer, 1996; Termeer & Bruinsma, 2016), especially when both task conflict and reward interdependence are high. Task conflict provides the impetus to teams to look for novel situations and TMS provides the necessary tools, such as augmented memory (Clowes, 2017; Guchait, Tews, & Simons, 2014) and deep expertise (Kotlarsky, van den Hooff & Houtman; 2015). Interestingly, the benefit of interaction among TMS, task conflict and reward interdependence for team sensemaking is only realized when low reward interdependence does not constrain the free exchange of ideas.

The findings of Chapter Three shows that team sensemaking can help turn cognitive diversity and autonomy into drivers of team creativity. As per the past literature, mixed findings have been reported concerning the impact of cognitive diversity and autonomy on team outcomes such as team creativity. In addition to the investigation of these direct relationships, Chapter Three findings indicate that team sensemaking as an underlying mechanism fosters the above mentioned relationships thereby facilitating the link between social-environment factors and team performance – team creativity.

Taking this discussion further, the findings of empirical study in Chapter Four explain *how* team bricolage facilitates the link between team sensemaking and team resilience in the presence of task interdependence as a contextual factor. Also, this study found evidence that team bricolage mediates the relationship between team sensemaking and team resilience when task interdependence is high or moderate but there is no evidence of mediation when task interdependence is low. These findings demonstrated that when team members work under conditions of low task interdependence then they are less able to achieve team synergies.

Team sensemaking has been the focal area of interest of this thesis and the key findings have established its relevance for the teams of contemporary organizations. For instance, the study in Chapter Two has demonstrated the relevance of TMS as an important predictor of team sensemaking, a relationship not previously investigated. The study does not only find evidence of the direct influence of TMS on team sensemaking but it also emphasizes the pertinence of task conflict and reward interdependence in determining the strength of this relationship. Likewise, the study of Chapter Three has exhibited the relevance of team sensemaking as a facilitatory mechanism for the relationship of key

social environment factors (team autonomy and cognitive diversity) with team creativity. Lastly, Chapter Four has demonstrated the positive relationship between team sensemaking and team resilience as proposed by Weick (1995). Furthermore, the findings have emphasized that team bricolage facilitates this relationship when task interdependence is high and ascertain the importance of team processes (team bricolage) and conditions (task interdependence) as these auxiliary factors enable team sensemaking for influencing team resilience.

5.3 Theoretical Implications

Grounded in the sensemaking theory, team sensemaking can be viewed as a mechanism by which a team a team synchronizes its attempts to clarify and impose meaning on the current situation under uncertain circumstances (Klein, Wiggins & Dominguez, 2010). There have been calls for research to better understand sensemaking and heedful interrelating (Weick et al., 2005).

This research thesis identifies TMS as an antecedent of team sensemaking. The TMS theory states that transactive memory is a team-level shared encoding, storage and retrieval scheme distributed among teammembers (Wegner, 1995; Wegner, Giuliano, & Hertel, 1985). Each team member utilized the other team members as an external memory aid. Each team member must also comprehend where the expertise lies; and submit new information to the relevant team members and request information from other appropriate team members (Mohammed & Dumville, 2001). Consequently, individual memory becomes more specialized and makes transactive memory more cognitively efficient (Austin, 2003). The cognitive load on each individual decreases, because individuals can tap into the collective memory of a team (Kozlowski and Bell, 2008). This study examines

the direct impact of TMS on team sensemaking and it also examines *when* TMS is most useful for enhancing team sensemaking.

There has been scant empirical research on the facilitating role of team sensemaking on other team outcomes despite the fact that theoretical arguments have been made that a principal function of team sensemaking is to synthesize distributed information to come up with plausible solutions (Nambisan, Lyytinen , Majchrzak & Song, 2017). In this thesis, the focus on team sensemaking as an intermediary process has assisted to demonstrate the influence of team level social-environment factors on team creativity. The results validate the intermediary role of team sensemaking in the relationship between team autonomy and team creativity. It is plausible that if team members do not build shared mental models, effectively seek and contribute information, and mindfully update information on ongoing tasks, the benefits of cognitive diversity and autonomy will remain unrealized and therefore, team sensemaking plays the role of a facilitator.

A key motivation of this study was to examine how team bricolage in the presence of task interdependence as an underlying mechanism facilitates the link between team sensemaking and team resilience. In the face of new challenges, organizational actors can remain inert or enact bricolage (Baker and Nelson; 2005). Enacting sense allows teams to survive and prosper. This study enriches existing literature on team resilience by proposing and testing the role of team bricolage in facilitating team resilience by focusing on action and harvesting gain spirals. This study further extends the literature by delving on interactionist perspective and tested for the conditional effect of task interdependence on the relationship between team bricolage and team resilience.

5.4 Practical Implications

The findings of this thesis have great value for human resource managers to understand the conditions under which team sensemaking occurs and be beneficial for their organizations. This study suggests that knowledge of team members is a valuable resource (Gardner, Gino & Stats, 2012; Nonaka and Takeuchi 1995). To reap synergies, human resource managers should avoid disrupting team structures or assigning new members to a team or rotating team members very frequently. Moreover, the benefits of TMS are fully realized when both task conflict and reward interdependence are high. If a team is experiencing high task conflict, one way to make sure that the conflict remains constructive is to increase reward interdependence. Reward interdependence incentivizes attention on teamwork, thereby stimulating cooperation among team members (van Vijfeijken, 2004).

The findings provide several practical implications for knowledge-intensive teams as well. For instance, highly autonomous teams enjoy better team creativity. Autonomy allows teams to retain control over the "how" component of the work. Team sensemaking as an intermediary variable provides a useful lens to gain a finer understanding of the relationship between team autonomy and team creativity. While team autonomy represents control and authority over structuring tasks (Ryan & Deci, 2005), team sensemaking provides an understanding of the interaction among team members (Peronard, 2016). Team sensemaking acts as a catalyst by providing enabling extrinsic motivation mechanism to fully leverage the benefits of team autonomy. The second recommendation is to bring together teams with high cognitive diversity and to encourage team sensemaking to take advantage of different perspectives. Cognitive diversity has the ability to have a positive effect on team creativity as it provides non-redundant knowledge sets, however; the relationship between cognitive diversity and team creativity is complex (Jiang & Zhang,

2014). Team sensemaking, as a participative decision-making mechanism, encourages vision and knowledge sharing (Dreu & West, 2001; Dreu 2002) and consideration of divergent viewpoints acts as an intermediary variable between cognitive diversity and team sensemaking.

The findings of the current study suggest that team sensemaking plays an important role in fostering resilience. In fact, the organizations can train employees for better situational awareness, communication and reflection. Team sensemaking improves out of increased interaction based on on-going dialogues among team members. Human resource managers can devise such interventions that can assist team members to engender team bricolage for improved team resilience. Especially, when managers face new business challenges then management should encourage teams to make use of existing resources and reconfigure to improvise for better team resilience (Yang, 2018).

5.5 Limitations and Future Research Directions

Although findings of the current study yielded some important conclusions, the study methods suffered from limitations that can be addressed in future research. The first limitation of this study is its cross-sectional research design. Thus, future researches are strongly encouraged to examine the relationships between the study variables over time, in order to add validity to the findings. In so doing, the future studies can separate data collection of exogenous and endogenous variables with a time lag.

Second, this research is open to the typical criticisms of single-source, self-report data, particularly for the measurement of team performance measure. The common method bias is nonexistent but future researchers could collect data form multiple sources. For example, information about team creativity and team resilience may be collected from the

team leades or elicited from the comments of clients. Future studies can be conducted specifically to elicit team level responses instead of relying on a single informant.

Lastly, the current study was conducted only in the ICT sector of Pakistan. It would be interesting if future studies replicated the findings of the current study in other contexts, both inside Pakistan and outside. Although the theoretical arguments presented were not country-specific, cultural specific variables have the potential to interfere with the conceptual framework. For example, cross-country studies can provide insights into the relative importance of the interaction between task conflict and reward interdependence in determining the relationship between TMS and team sensemaking. Pakistan can be considered an uncertainity avoidant country, and in such a context employees may be more sensitive to the strain that task conflict causes than in other contextss (Hofstede, 2001). Due to these limitations, the findings of this study should be treated with some caution insofar as to extend the generalizability to other settings.

Even though this study identified an important antecedents and consequences of sensemaking, it has some limitations that indicates some directions for future research of team sensemaking. In order to be parsimonious, this research did not examine the moderating effect of relationship conflict and process conflict. Future scholars may thus expand the scope of this work by empirically examining possible moderating factors that impact the relationship between TMS and team sensemaking.

Additionally, the current study examined the outcomes of team sensemaking such as team creativity and team resilience.. There are other important outcomes, such innovation implementation, trust and speed-to-market. Future research might investigate the relationship between team sensemaking and other team outcomes to create a more

comprehensive understanding of the effects of team sensemaking on organizational performance.

In this study, the lower mean values imply future research directions. The existing literature has reported that important cross-cultural divergences exist regarding the socio-cognitive aspects. For instance, Hoegl, Parboteeah & Muethel (2012) and GLOBE study have reported that cultural aspects impact the level of creativity among managers. Especially, the higher levels of power distance are negatively related to creativity and ultimately undermine employee motivation (Baker et al.2005). In the similar vein, Haas (2010) argues that the autonomy and knowledge acquisition in a cross-cultural context are dependent on the culture. The national culture that encourages knowledge hoarding may make it more difficult to identify and secure useful knowledge even within an MNC that operates across the globe. There is also considerable evidence that a country's wealth has a positive impact on its innovation and creativity (Leung & Wang, 2015). In this backdrop, future studies can unravel the underlying principles that can shed light on the role of culture regarding these socio-cognitive facets. Furthermore, .many studies have reported differences in response style based on nationality. Some cultures tend to favor disacquiescence response style, that is the tendency to disagree with an item. When comparing response style across 26 countries, Harzing (2006) found that counties like India and Malaysia tend to exhibit high disacquiescence. It is plausible that such an effect exists for Pakistan.

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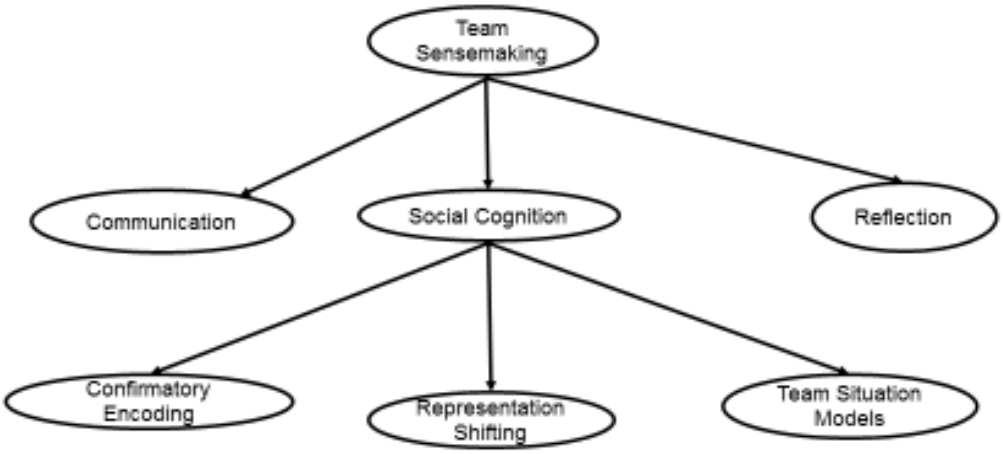
Appendices

A. Conceptual Definitions of dimensions and sub-dimensions of team sensemaking

Team sensemaking dimensions	Description
Confirmatory encoding	"…process whereby individuals seek to organize task information within an existing cognitive representation." Gary, Butler and Sharma (2015, p.2086)
Representation Shifting	"modify their cognitive representations by adding new information categories, splitting categories, or merging categories." Gray, Butler and Sharma (2015, p.2086)
Team Situation Models	"a shared understanding and dynamic mental representation of a team pertaining to a current team functioning situation, including its environment and task, and the team itself"(Haar, Li, Segers, Jehn, Bossche, 2015, p.597)
Communication	"Process by which information is clearly and accurately exchanged among team members." (Salas, Burke and Cannon-Bowers;2000.p.343)
Reflection	"is the critical examination of a process, such that it can be subsequently adjusted according to new data and knowledge." (Edmondson, 2002;p.13)

B. Dimensions of team sensemaking



C. Questionnaire Items

Confirmatory Encoding (Gray, Butler and Sharma; 2015)

- Team members often draw on other team members to fill small gaps in their knowledge
- Team members frequently refer to other team members to understand the finer points of a topic that they already know something about.
- Team members frequently turn to other team members to find the missing piece to a problem that they have a pretty good grasp of.
- Team members often consult other team members to learn more details about something they understand reasonably well.

Representation Shifting (Gray, Butler and Sharma; 2015)

- Team members often consult other team members in order to see a problem or issue from a completely different perspective.
- Team members regularly draw on other team members to reinterpret a problem and make sense of it in a creative way.
- Team members frequently seek out other team members to get a very different point of view on a particular topic.
- Team members frequently refer to other team members to take their understanding of something in a totally new direction.

Team Situation Models (Akgün, Keskin, Lynn, and Dogan; 2012)

- Team members developed a common language during the project.
- The team have a shared understanding of the target market user.
- The team have a shared understanding of the customer's needs and wants.
- The team has a shared understanding of the required product features.
- Our team members have a shared vision during the project.

Communication (Ortel and Antoni; 2015).

- Team members listen carefully to each other
- Team members ask each other questions if something is unclear.
- Team members encourage each other to look at the work from different perspectives
- Team members collectively draw conclusions from the ideas that were discussed.
- Team members elaborate on each other's information and ideas.

Reflection (Ortel and Antoni; 2015)

- We evaluate the results of our actions.
- We check what we can learn from our achievements.
- We consider what we can do about things that didn’t work out as planned.
- We reflect upon how dissatisfying results emerged.

Transactive Memory Systems (Adapted from Lewis, 2004; Choi, Lee & Yoo, 2010)

- Team members have specialized knowledge of some aspects of our task.
- Different team members are responsible for expertise in different areas.
- Our team members are comfortable accepting procedural suggestions from other team members.
- The specialized knowledge of different team members was needed to complete the task.
- Team members have knowledge of who in the team has the expertise in specific areas.
- Our team members trust that other members' knowledge about the project is credible.
- Our team members are confident of relying on the information that other team members bring to the discussion.
- Our team members work together in a well-coordinated fashion.
- Our team members have a very few misunderstandings about what to do
- Our team members have the capability to respond to the task-related problems smoothly and efficiently.

Task Conflict (Jehn & Mannix, 2001)

- There is frequent conflict of ideas in our team.
- Team members have disagreements within the team about the task of the project.
- Team members have conflicting opinions about the task team is working on.

Reward Interdependence (Adapted from Xie, Song, and Stringfellow, 2003; Pee, Kankanhalli & Kim, 2010)

- The evaluation of performance is strongly influenced by how well our team performed.
- The reward for tasks is determined in large part by based on team performance instead of individual performance.
- All team members share equally in the rewards from successful task completion.

Team Resilience (Sinclair and Wallston, 2004)

- We look for creative ways to alter difficult situations.
- Regardless of what happens to us, we can control our reaction to it.
- We can grow in positive ways by dealing with difficult situations.
- We actively look for ways to overcome the challenges we encounter.

Team Bricolage (Salunke, Weerawardena, & McColl-Kennedy, 2013)

- Our team has the ability to combine resources in ways that challenge conventional business practices,
- Our team has the ability to combine resources in a manner that extracts value from under-utilized resources
- Our team combines resources to accomplish new challenges that the resources weren't originally intended to accomplish.

Cognitive Diversity (Van der Vegt's and Janssen, 2003; Shin, Kim, Lee & Bian , 2012)

- Members of the team differ in their way of thinking.
- Members of the team differ in their skills.
- Members of the team differ in how they see the world.
- Members of the team differ in their beliefs about what is right or wrong.

Autonomy (Kirkman, Rosen,Tesluk and Gibson; 2004)

- Our team can select different ways to do the team's work.
- Our team determines as a team how things are done in the team.
- Our team makes its own choices without being told by management.

Team Creativity (Rego, Sousa, Marques and Cunha; 2007)

- Our team members exhibit creativity when given the opportunity to.
- Our team members implement new and innovative ideas.
- Our team members come up with creative solutions to problems.
- Our team members develop adequate plans and schedules for the implementation of new ideas.

Team Psychological Safety (Edmondson, Kramer & Cook, 2004)

- Members of this team are able to bring up problems and tough issues.
- People on this team sometimes reject others for being different.
- It is safe to take a risk on this team.
- No one on this team would deliberately act in a way that undermines my efforts.

Team Co-Location (McDonough , Kahnb, & Barczaka, 2001).

Which statement best describes your team?

Our team is comprised of individuals who work and live in different countries and are culturally diverse.
Our teams is comprised of individuals who have a moderate level of physical proximity and are culturally similar.
Our team is comprised of individuals who work together in the same physical location and are culturally similar.

D. Sampling Frame

Downloaded from the official website of Pakistan Softaware Houses Association (P@SHA) on 15th Oct 2016

1. 110 Solutions
2. 22 FOUR
3. 3sc Technologies pvt.Ltd.
4. 7Vals
5. A2Z Creatorz
6. AbacusConsulting
7. ABM INFO TECH (Private) Limited
8. Access Group
9. Aekpani Networks
10. AGCN Pakistan (Pvt) Ltd
11. AKSA-SDS (Pvt.) Ltd.
12. Algotrek Technology Consulting
13. APEX Consulting Pakistan
14. Application Management Outsourcing Services (AMOS) Global (Pvt.) Ltd.
15. AppsGenii
16. ARBISOFT (PRIVATE) LTD.
17. ARITTEK
18. Arkhitech
19. Arpatech Pvt. Ltd
20. Arwen Tech (Pvt.) Limited
21. Askoli
22. Astica (pvt) Ltd (Sub of Elastica, Inc)
23. AT&T Global Network Services International, Inc. – Pakistan Branch

24. AutoSoft Dynamics (Pvt.) Limited
25. Avanceon
26. Avanza Solutions (Pvt.) Ltd.
27. Averox Pvt Ltd.
28. AZM Computer Services (Pvt.) Ltd.
29. Bahria Enterprise Systems & Technologies (BEST)
30. Bari's Technology Solution
31. Bentley Systems Pakistan (Pvt) Ltd.
32. BestHive Pakistan
33. Binex Solutions (Pvt) Ltd.
34. BITSWITS (PVT.) LIMITED
35. BizSoft Technologies
36. Blue Zorro (Pvt) Ltd
37. Brain Logix
38. C Square Consulting (Pvt.) Ltd.
39. CARE (Center for Advanced Research in Engineering) Pvt. Ltd
40. CATALYST IT Solutions (Pvt) Ltd
41. Centegy Technologies (Private) Limited
42. CIKLUM PAKISTAN (Pvt.) Ltd.
43. Cloud BPO (Private) Limited
44. Code Enterprise
45. Code Informatics
46. Cogilent Solutions (Pvt) Ltd
47. Computer Research (Pvt.) Ltd. (CRPL)
48. COMSATS Internet Services
49. Comstar – Information Systems Associates Ltd.
50. Confiz
51. Conrad Labs
52. Cooperative Computing

53. Corvit Networks
54. Cosmosoft Business Solutions Pvt Ltd.
55. CRYSTALLITE
56. CRYSTALLITE PAKISTAN (PVT) LTD
57. CTO 24/7 Private Limited
58. Cubexs Weatherly (Pvt) Ltd.
59. Cult Productions (Pvt.) Ltd
60. CureMD Healthcare
61. Cybarea Pvt Ltd
62. Cyber System Private Limited
63. DataNet
64. DevelopersINN
65. DGHarbour
66. Digital Research Labs (Pvt.) Ltd.
67. Dikhawa
68. DiscreteLogix (Pvt) Ltd.
69. Dockland Technologies Pakistan Private Limited
70. DPL
71. DSS MEDIA
72. DYS Solutions (Pvt.) Ltd.
73. Dzine Media
74. E-Cart Services Pakistan Pvt. Ltd.
75. Edev Technologies
76. EduSys Pakistan
77. EfroTech Services
78. ELG Inc (eListGuy)
79. Elixir Technologies Pakistan (Pvt) LTD
80. ER Solutions
81. Etilize Pakistan (Pvt.) Ltd
82. EURONET PAKISTAN PVT LIMITED

83. Excellence Delivered ExD (Pvt) Ltd
84. Expert Systems (Pvt.) Ltd.
85. Five Rivers Technologies (Pvt.) Ltd.
86. Folio3
87. FOURGEN Information Systems (Pvt) Ltd
88. FutureNow Technologies (Pvt) Ltd
89. Gaditek
90. GAMEVIEW PAKISTAN (PVT) LTD
91. GCS (Pvt) Ltd.
92. GenITeam
93. Giant Precision (Private) Limited
94. Gillani Inc.
95. GoldbarTech Pvt Ltd
96. Goldtime Pvt. Ltd.
97. GoodCore Software (Pvt) Ltd.
98. GRIPHENS (PRIVATE) LIMITED
99. Hayat Tech
100. HTECH SOlutions Pvt Limited
101. Hussain Chaudhury Consulting
102. i2c
103. i3PATHFINDER Solutions Pvt. Ltd.
104. IBM
105. Ice Animations
106. ICON Consultants (Pvt) Ltd
107. iENGINEERING Pakistan (Private) Limited
108. Ikonami
109. Inbox Business Technologies Pvt. Ltd
110. INCISIVESOFT
111. INFOGISTIC Private Limited
112. InfoTech Private Limited

113. IngenicoTribe
114. Innokat (PVT) Ltd
115. Innovarge
116. Innovative Integration Pvt Ltd
117. Innovision I.T. Consultancy & Solutions
118. Intagleo Systems Pvt Ltd
119. Integrated Systems Research Private Limited
120. Integrated Units Pvt Ltd
121. Intellexal Solutions Private Limited
122. Intelligentsia Software (Pvt.) Ltd.
123. InvoCode Pvt Ltd
124. IT Solution
125. Itim Systems (Pvt.) Ltd.
126. ITMinds Limited
127. Jabs Solutions
128. Jin Technologies (Pvt.) Ltd.
129. JTELEMARKETING
130. Kabot International (Pvt) Ltd
131. KalSoft Limited
132. KalSoft Ltd.
133. KCOMPUTE (PRIVATE) LIMITED
134. Knowledge Platform
135. KOLACHI ADVANCED TECHNOLOGIES
136. KSOFT
137. Kwick High Tech & Solutions (Pvt) Ltd
138. Lakson Business Solutions Limited
139. LMK Resources Pakistan (Pvt.) Ltd.
140. LMKT (Pvt.) Ltd.
141. LumenSoft Technologies Pvt. Ltd.
142. M3 Technologies Pakistan (Pvt.) Limited

143. Magma Consulting Corporation Private Limited
144. Maison Consulting & Solutions
145. Mantaq Systems
146. Marriala Consultants
147. Matech Consulting & Outsourcing
148. Mazars Consulting Pakistan
149. Medical Transcription Billing Company (Pvt.) Limited
150. METICODE (PRIVATE) LIMITED (FORMERLY HI-Q) PRIVATE LIMITED
151. Metis International Pvt Ltd
152. Millennium Software (Pvt.) Ltd.
153. Millennium Systems & Consultants (Pvt.) Ltd.
154. Mindstorm Studios
155. Mixit Technologies
156. Mob Inspire (Pvt) Ltd.
157. Modemetric
158. Moftak Solutions
159. Mojo Solutions & Services (Pvt) Ltd
160. Monet Pvt Ltd
161. MotionCue
162. Multinet Pakistan
163. Naseeb Networks
164. National Consulting for Business and Management Solutions (Private) Limited
165. National Software Developers
166. NetSol
167. Netsolace Information Technology (Pvt) Ltd
168. NexDegree
169. Next Generation Innovations
170. NTES Technologies
171. OA Systems Pvt Ltd
172. Objects

173. Off-Road Studios
174. OPEN-SILICON PAKISTAN (PVT) LTD.
175. Ora-Tech Systems (Pvt.) Ltd.
176. Outsource systems & solutions (Pvt) Limited
177. Ovex Technologies Pakistan (Pvt) Limited
178. Ovex Technologies Pvt. Limited
179. Ozitechnology
180. Pakistan Data Management Services
181. Pakistan Revenue Automation (Pvt.) Ltd.
182. Palmchip Pakistan (Pvt.) Limited
183. Parallel Horizons Technology (Pvt) Limited
184. Penguin Informatics pvt Ltd.
185. Personforce Consulting
186. Pi Labs
187. PIBAS Pakistan Pvt. Ltd.
188. PlanetBeyond Pakistan(Private) Limited
189. Plumsmedia (Pvt) Limited
190. PNC Solutions
191. Premier Software (Pvt.) Ltd.
192. Primatics Financial (Pvt.) Ltd
193. Primero Solutions (Pvt.) Ltd.
194. Pring
195. Probase Applications (Pvt.) Ltd.
196. QC Technologies
197. RCAPPS
198. Ride Services (PVT) Ltd.
199. RIKSOF (Private) Limited
200. Sabri Technologies
201. Sakonent
202. Saremco Tech Pvt. Ltd

203. SecureBeans
204. Sensys Pvt Ltd
205. SERONIC (PVT) LIMITED
206. Server4Sale
207. Server4Sale Systems
208. SEVEN HILLS ENTERPRISES
209. Sharp Image
210. SI GLOBAL SOLUTIONS (PVT.) LTD.
211. Sidat Hyder Morshed Associates (Pvt.) Ltd.
212. SisTech Systems
213. Sitara Infotech Pvt. Ltd.
214. SNL Pakistan (Pvt.) Ltd.
215. Socio Engineering Consultants
216. Sofcom (Private) Limited
217. Sofizar (Pvt.) Ltd.
218. Soft Solutions
219. SOFTBEATS (PVT) LTD
220. Softech Systems (Pvt) Limited
221. Softech Worldwide
222. Softronic Systems (Pvt.) Limited
223. Softronics Systems (Pvt.) Limited
224. Software Labs
225. SoloInsight Inc.
226. SoloTech Corp
227. SOLUTION HUT
228. SPC TEK Pakistan Private Limited
229. Spur Solutions Private Limited
230. Strategic Systems International
231. SYBRID (PRIVATE) LIMITED
232. Synergy Computers Pvt Ltd

233. Synergy-IT
234. Systems Limited
235. Talented Earth Organization (Pvt) Ltd.
236. Target Systems
237. Tech4life Enterprises
238. Techaccess Pakistan Private Limited
239. Techlogix Pakistan (Pvt.) Ltd.
240. Technomics International Ltd
241. Telematics Master Pvt. Ltd
242. Ten Pearls International
243. Teradata Global Consulting Pakistan (Pvt) Ltd
244. TeReSol Pvt Ltd
245. TEXPO Pakistan (Pvt) LTD
246. The Brand Crew Pvt. Ltd.
247. THE FACTS
248. The Game Loop (Pvt.) Ltd.
249. The Resource Group
250. THK Solutions (Pvt.) Ltd.
251. TkXel
252. TMR Consulting (PRIVATE) LIMITED
253. Tohfay.com (T-Shop International)
254. Tohfay.com (Topak International)
255. Touchstone Communications (Pvt.) Ltd
256. TPL TRAKKER
257. TPS Pakistan (Pvt.) Ltd.
258. TradeKey Private Limited
259. Traffic Online
260. TRICAST MEDIA PRIVATE LIMITED
261. Trivor Software
262. TRIOCA software

263. TunaCode Pvt. Ltd.
264. Universal Softech
265 VaporVM
266. VentureDive Pvt Ltd
267 Venture Systems
268. Viftech Solutions (Pvt.) Ltd
269. Viper Technology Pvt Ltd
270. Virtual Base
271. Visionary Computer Solutions (pvt) Ltd.
272. Vizteck Solutions
273. VOPIUM AKTIESELSKAB (Pvt.) Ltd.
274. VOZYE SMC PVT. LTD.
275. Wallsoft
276. Wavetec (Private) Ltd.
277. Webiz Media (Pvt) Ltd
278. Webiz Media Pvt Ltd
279. Webotiks
280. WERPLAY.COM
281. Workforce Software Development Pvt. Ltd.
282. XAVOR PAKISTAN (PVT) LTD
283. Xtreme Solutions PVT (LTD)
284. XYNOPSI PVT Ltd
285. YDA (PVT.) Ltd
286. Zahdan Technologies (Pvt.) Limited
287 Zegatron SMC(Pvt) Ltd
288. Zigron Pakistan Pvt Ltd
289. ZRG International (Private) Ltd
290. sZS(ZealSoft) Business Solutions

E. Counts of firms

	No. of Firms	No.of teams	No. of responses
	02	2	04
	51	3	153
	23	4	92
	11	5	55
Total	87		304