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NPD Team Conflicts and Team Learning: The Mediating Effect of the Transactive Memory System

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ABSTRACT:
Some studies demonstrate that team conflicts are important sources for team learning especially in the new product development teams, however, yet, limited studies have explored whether and how different types of conflicts affect team learning. Drawing on the knowledge-based view (KBV), this study differentiates three dimensions of conflicts and explores how transactive memory systems mediate the relationship between team conflicts and team learning. 315 new product development team leaders from Chinese high-tech new ventures were surveyed. Structural equation modeling was used to examine this relationship. The results indicate that task conflict is beneficial for teams' TMS development, but relationship conflict and process conflict have negative effects on teams' TMS. Additionally, TMS can enhance team learning. Theoretical and practical implications are discussed.
Keywords: *Team Conflict, Transactive Memory Systems, Team Learning, Knowledge-Based View, New Product Development*

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I. INTRODUCTION:

New product development (NPD) is a corporate entrepreneurship activity, a complicated trial-and-error activity that is dependent on knowledge and learning. High-tech ventures keep launching new products frequently to maintain a competitive edge and this is why NPD is recognized as a key competence (Harmsen, Gruner, and Bove, 2000). To develop this competence, teams have to develop a learning phenomenon since team learning is crucial for NPD success (Harmsen, Gruner, and Bove, 2000; Lyn, Skov, and Abel, 1999).

Learning is important to organizations in general, and especially critical for NPD teams because innovation spans many functional areas including engineering, marketing, manufacturing, finance, etc. (Lyn, Skov, and Abel, 1999; Kush, Aven, and Argote, 2024), and new product development teams usually are composed of individuals from different backgrounds and perspectives. Development of a new product is a team effort; therefore, for NPD the issue is not how organizations learn, but rather how new product teams learn (Lyn, Skov, and Abel, 1999). Thus, promoting NPD team learning is a crucial research question. Prior research demonstrates that constructively managing conflicts in teams is one of the keys to enhancing individuals' learning from peers and other team members, and thus achieving effective team learning (Wang, Lai, and Lu, 2020; Chen et al., 2017). However, the underlying mechanism is not clear.

NPD is a knowledge-intensive activity that requires extensive approaches to transfer knowledge (Goffin and Koners, 2011). According to the knowledge-based view (KBV), a firm's existing knowledge base delimits its scope and capacity to comprehend and apply novel knowledge to innovation activities (Hill and Rothaermel, 2003; Zhou and Li, 2012). *Transactive memory system* (TMS) is defined as the sum of the individual knowledge and shared understanding of the location of expertise among team members (a shared sense of who knows what) (Lewis, 2003). According to transactive memory theory, a team's transactive memory system represents a key resource or competence in terms of integrating team member's knowledge, skills, and other resources (Zheng, 2011) and can provide individuals with a flow of intangible knowledge relating to NPD to make up the shortage of the specific knowledge for their decision-making. In addition, a transactive memory system enables knowledge assimilated and transferred in a more organized manner, reducing the cognitive resource demand for the entire team. Thus, TMS can be a crucial team-level factor that matters to team learning, but there is little research addressing such a relationship.

Some research has explored antecedents to team transactive memory system development. For example, Akgün et al. (2005) find that team stability, team member familiarity, and interpersonal trust have a positive impact on the transactive memory system. Zhang et al. (2007) find that team characteristics such as task interdependence, cooperative goal interdependence, and support for innovation were also related to higher transactive memory systems in teams. Other research investigating the antecedents of a team transactive memory system has demonstrated the important role of team member familiarity (Lewis, 2004; Chión, Charles, and Vásquez Luna, 2023) and communication volume and frequency (Kackson and Moreland, 2009; Kanawattanachai and Yoo, 2007), but little empirical research has been done about the role of team conflicts on TMS.

Usually, new product teams are of individuals from different expertise backgrounds and perspectives and they own diverse prior knowledge and/or technology/market knowledge about the NPD project, thus interrelationship is not so close in such NPD teams since it takes a long time to develop mature familiarity and trust. On the contrary, conflict is a common occurrence during the NPD process. Conflict is an awareness on the part of parties involved of discrepancies, incompatible wishes, or irreconcilable desires (Boulding, 1963; Jehn and Mannix, 2001). Scholars agree that not all conflict is harmful since conflict is necessary to refine knowledge for effective problem-solving and performance (Donate, Guadamillas, González-Mohíno, 2023; Griffith and Margaret, 2001). How will different types of conflicts affect team TMS building, which is beneficial to team outcomes, i.e., team learning?

Our research attempts to add to the literature by examining how team conflict affects TMS and thus promotes team learning in NPD teams. Our research aims to provide a more complete picture of the determinants of team learning. We make three contributions to existing literature and theories: first, we extend KBV by shedding light on the important and differentiated role of three types of conflicts in TMS evolvement. Second, we test a linear relationship, rather than an inverted U-shaped relationship, between conflicts and TMS. Third, our findings contribute to the research stream on team learning by testing the "TMS-learning" relationship, which has been implied but not empirically tested.

II. THEORETICAL FRAMEWORK AND HYPOTHESES

2.1 Team Conflicts and TMS

Transactive memory is the shared division of cognitive labor concerning the encoding, storage, retrieval, and communication of information from different knowledge domains, which often develops in groups and can lead to greater efficiency and effectiveness (Brandon and Hollingshead, 2004). Wegner (1987), who observed that long-term team members tend to rely on one another to obtain, process, and communicate information from distinct knowledge and information domains, first termed a system of cognitive interdependence a transactive memory system (TMS). Afterward, scholars define a transactive memory system as the sum of individual knowledge and shared understanding of the location of the expertise among team members (Lewis, 2003; Moreland and Myaskovsky, 2000). A transactive memory system can be regarded as a key resource or competence in terms of integrating team member's knowledge, skills, and other resources (Zheng, 2012) and describes the active use of transactive memory by two or more team members to store, retrieve, and communicate information cooperatively (Lewis, 2003). Liang et al. (1995) extend the TMS concept to the team level and identify three indicators of teams with the established transactive memory system, which respectively named specialization referring to the level of memory differentiation within a team, credibility referring to team members' beliefs about the reliability of other members' knowledge, and coordination referring to the ability of team members to work together efficiently (Lewis, 2003; Moreland and Myaskovsky, 2000). Some research has explored antecedents to team transactive memory system development, such as team stability, team member familiarity, and interpersonal trust (Akgün et al., 2005; Lewis, 2004), communication volume and frequency (Jackson and Moreland, 2009; Kanawattanachai and Yoo, 2007; Lewis, 2004; Peltokorpi and Manka, 2008), and team characteristics such as task interdependence, cooperative goal interdependence (Zhang et al., 2007).

2.1.1 Task Conflict and TMS

Task conflict is an awareness of differences in viewpoints and opinions about a group task (Griffith and Margaret, 2001). Task conflict is generally task-oriented and is focused on judgmental differences on the best solution to achieve organizational objectives (Panteli and Sockalingam, 2005; Amason, 1996; Cosier and Rose, 1977; Jehn, 1995). It is a condition in which individuals disagree about task issues including goals, key decision areas, and the appropriate choice for action (Pelle, Eisenhardt, Xin, 1999).

It is true that task conflict is a specific kind of team conflict and is usually regarded as a liability (Jehn and Mannix, 2001). Research shows that task conflict elicits divergent thinking, which facilitates multiple perspectives being brought to bear on decision-making and the consideration of diverse aspects of the issue under debate (Nemeth, 1995; De Dreu and De Vries, 1993; Nemeth and Kwan, 1987; Nemeth, Mayseless and Sherman, 1990). Thus, we propose that in NPD teams, task conflict may promote team TMS. As it is noted in the book *The Hard Thing About Hard Things*:

First, task conflict facilitates value-adding knowledge sharing, development of common contextual understanding, learning, and knowledge creation (Donate, Guadamillas, González-Mohíno, 2023; Sockalingam, 2000; de Wit, Greer, and Jehn, 2012; O'Neill, Allen and Hastings, 2013). This is achieved through critical,

focused, creative, and investigative (Cosier and Rose, 1977; Amason, Thompson, and Hochwarter, 1995) interaction, which is aided by frank communication of varied perspectives, and open discussion and challenge of viewpoints and traditional paradigms, without threat, anger, resentment or retribution (Amason, Thompson and Hochwarter, 1995) as it is the merit of ideas that drive decision making. Second, task conflict also leads to better scanning of the environment, greater flexibility, and higher responsiveness to external change. Besides, it is a valuable mechanism for strengthening relationships, trust, and affective closeness (Amason, 1996). Third, Moreland and Myaskovsky (2000) demonstrate that team members would jointly recall a greater volume of task-relevant knowledge and information through a debate against a task-related issue (Lewis, 2003).
Thus, we propose that,
H1: Task conflict is positively associated with TMS.

2.1.2 Relationship Conflict and TMS

Relationship conflict, an awareness of interpersonal incompatibilities, includes affective components such as tension and friction (Griffith and Margaret, 2001). Relationship conflict tends to be emotional and focused on inter-personal incompatibilities or disputes (Brehmer, 1976; Cosier and Rose, 1977) and typically provokes hostility, distrust, cynicism, apathy, and other negative emotions (Amason, Thompson, and Hochwarter, 1995; Eisenhardt, Kahwajy, Bourgeois, 1997; Jehn, 1994).

Theory suggests that relationship conflict has negative implications on team and organizational functioning as it can promote inefficiency and ineffectiveness (Panteli and Sockalingam, 2005; de Wit, Greer and Jehn, 2012; O'Neill, Allen and Hastings, 2013), lead to a loss of perspective regarding the task, inhibit individuals' cognitive functioning in assessing new information provided (Pelled, 1996) and processing complex information, encourage stereotype listening and induce the freezing out of bias from important discussions. Moreover, Amason et al. (1995) found that relationship conflict diminished decision creativity and quality, eroded team unity and commitment, and curtailed decision acceptance and support, i.e., forbidding members to coordinate, since such relational conflict may lead to team members' knowledge-hiding behavior and also affect the quality of knowledge shared (Kahar, 2018; Wang, Wang, and Chang, 2019; Chen, Nguyễn, and Ha, 2021). Accordingly, relationship conflict can promote division, diminish trust, and weaken relationships, which in turn curtails open communication, value-adding knowledge sharing, learning, and ultimately knowledge creation. Thus, we propose that,
H2: Relationship conflict is negatively associated with TMS.

2.1.3 Process Conflict and TMS

Process conflict is an awareness of controversies about aspects of how task accomplishment will proceed (Jehn, 1997; Griffith and Margaret, 2001; Jehn and Mannix, 2001). More specifically, process conflict pertains to issues of duty and resource delegation, such as who should do what and how much responsibility it is to complete a specific duty, they are experiencing process conflict.

This form of conflict arises from differences of opinion regarding roles, responsibilities, time schedules, and resource requirements. Unlike task conflict, process conflict tends to be associated with decreased productivity through ineffective task performance (Jehn, Northcraft, and Neale, 1999; de Wit, Greer, and Jehn, 2012; O'Neill, Allen, and Hastings, 2013), and dissatisfaction that can promote a desire amongst members to abandon the team (Jehn and Mannix, 2001). The issues regarding process conflict, such as task or role assignment, often carry personal connotations in terms of implied capabilities or respect (Jehn and Bendersky, 2003; de Wit, Greer, and Jehn, 2012). Hence, members who want to take charge of a task, that was assigned to other mates, would disagree with the task delegation and might think that they are not trusted or not competent with the task (de Wit, Greer, and Jehn, 2012). In this way, process conflict may be highly personal, and may distract team members from task accomplishment (Jehn, 1995) and limit their willingness to contribute ideas and knowledge. Thus, we propose that,
H3: Process conflict is negatively associated with TMS.

2.2 TMS and Team Learning

Argote (1999) defines group (team) learning as a process wherein members share their knowledge, generate new knowledge, and evaluate and combine this knowledge. Prior research has demonstrated a positive relationship between TMS and team consequence, for example, creativity (Rong and Xie, 2021) and team performance (Li and Huang, 2013; He and Hu, 2021; Kim, Kim, and Jo, 2021), since a team with high level of TMS maybe search for fresh knowledge and also knowledge integration approaches beyond the organizational boundary (Zhu, Miao, Jin and Moehler, 2023; Bachrach, Lewis, Kim, Patel and Campion, 2019). TMS indicates a shared sense of who knows what within teams (Lewis, 2003) and facilitates the identification of knowledge, which is a crucial input to learning, by providing a common repository and reducing search costs (Gibson and Vermeulen, 2003). The degree to which a team facilitates codification and tracking of knowledge influences the availability of ideas in the team for team members to acquire and recombine into new knowledge. Learning occurs when team members acquire know-how and subsequently combine and shape it to meet their needs (Anand, Clark, and Zellmer-Bruhn, 2003), it is facilitated by translation and recontextualization (Brannen, 2004); and it rarely occurs without a transformation in the acquired knowledge. Hence, we propose that team TMS promotes team learning. First, TMS provides team members access to knowledge of their teammates, thus facilitating team learning by providing readily available access to expertise, since team members need to be aware of where the required knowledge is located and must be able to acquire it promptly to engage in knowledge learning (Bachrach, Lewis, Kim, Patel and Campion, 2019; Li and Huang, 2013; Lewis, 2003, 2004).

Second, a high level of TMS indicates a comparatively high degree of trust in other members' expert knowledge. Such trust can help in cultivating a learning environment through frequent knowledge exchange (Bouty, 2000), and can also enhance team members' willingness to exchange and absorb each other's knowledge (Ellis, 2006; Rau, 2005). Such processes are critical for team learning (Zellmer-Bruhn and Gibson, 2006).

Third, TMS constitutes knowledge channels, hence largely reducing the time and cost needed to seek necessary expertise from other teammates (Lewis, 2004). Thus, team members can engage in team learning by identifying and exploiting distributed knowledge (Li and Huang, 2013; Michinov and Michinov, 2009). Thus, we propose that,

H4: TMS is positively associated with team learning.

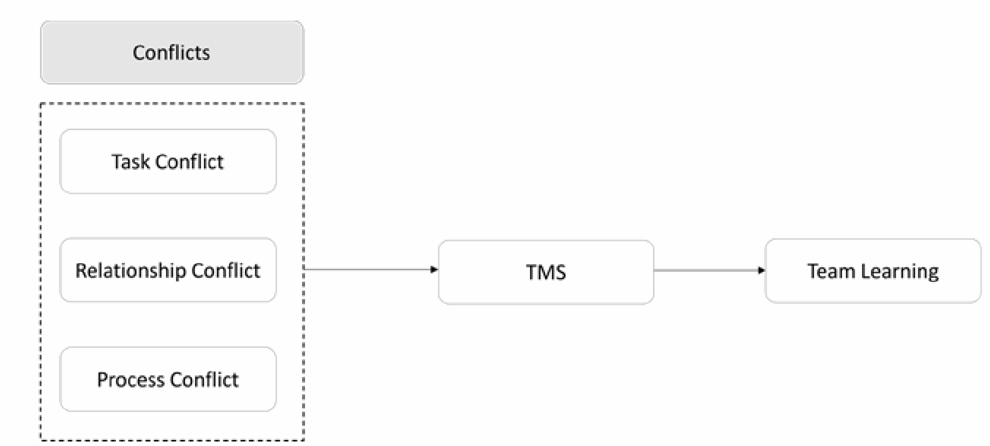

Figure 1 Conceptual Model

III. METHODOLOGY:

3.1 Sample and Data Collection

We randomly select 500 high-technology new ventures that meet three criteria: (1) most of the managers are engineers or scientists; (2) more than 30% of staff are technical staff; and (3) more than 3% of total sales are spent on R&D (Li and Atuahene-Gima, 2001). We developed the original questionnaire in English and utilized previously validated items of our study's constructs to ensure the content validity of our measures, as explained below. With the assistance of two entrepreneurship scholars who are proficient in both English and Mandarin Chinese and with substantial research experience in the subject field in China, we translated the questionnaire into Chinese. We then assured translation equivalence utilizing back-translation (Usunier, 2000) and paid special attention to detecting any significant misunderstandings caused by the translation. We were particularly careful to avoid any cultural biases with certain words and phrases. Before the execution of the survey, a pilot survey was conducted by interviewing 10 CEOs of 5 firms from the identified sample of high-tech firms to determine the face validity, clarity, and relevance of the measures in our research context. These interviewees were not only asked to answer the questionnaire items but also to provide feedback about the design and wording of the survey instrument, thus assisting us in ensuring both content and face validity. These firms were excluded from the final sample of firms examined. The survey promised to protect the identity of each respondent and report only statistics. The final survey was conducted in Chinese.

We finally collected 315 valid responses with a response rate of 63% (315/500). Among the key respondents, 69.5% are male, with 9.8%, 61.6%, and 28.6% having secondary education, bachelors, and post-graduate (26.0% for masters and the rest for Ph.D.) degrees, respectively. 34.6% of the respondents are below 30 years of age, 54.3% are between 31 and 40 years, 9.8% are between 41 and 50 years, and the rest are over 50 years old. A detailed sample profile is attached as Table 1.

Table 1 Profiles of Responding Respondents and Organizations (N=315)

Characteristics of Respondents and New Firms	Frequency	Percentage
Gender		
(1) Male	219	69.5
(2) Female	96	30.5
Age of entrepreneur		
(1) < 30	109	34.6
(2) 30-40	171	54.3
(3) 41-50	31	9.8
(4) >50	4	1.3
Education		
(1) Secondary education	31	9.8
(2) Bachelor	194	61.6
(3) Master	82	26.0
(4) Doctor	8	2.6
Firm size		
(1) 1-20	13	4.1
(2) 21-50	25	7.9
(3) 51-200	106	33.7
(4) 201-500	72	22.9
(5) >500	99	31.4
Firm age		
(1) 1-2	38	12.1
(2) 3-4	46	14.6
(3) 5-6	46	14.6
(4) 7-8	53	16.8
(5) >8	132	41.9
Industry		
(1) Electronic information industry	58	18.4
(2) New energy and new materials industry	75	23.8
(3) New pharmaceutical industry	144	45.7
(4) Integrated optical industry and others	38	12.1

3.2 Measurements

3.2.1 Dependent variable

Team learning is the main dependent variable. Learning concerned the extent to which a team created new processes and practices. Following Zellmer-Bruhn and Gibson (2006), we measured team learning with three items. Respondents were asked to rate the extent to which statements about team learning were accurate (1= "strongly disagree", 7="strongly agree"). The items are: 1) If a new way of doing work is introduced, it often comes from within this team, 2) This team comes up with many new ideas about how work should be done, and 3) This team is often the source of ideas copied by other teams.

3.2.2 Independent variables

Team conflict is measured using the established scale along three key dimensions: task conflict, relationship conflict, and process conflict with three items for each dimension (Jehn and Mannix, 2001). Team leaders were asked to respond to each item using a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). Sample item on task conflict stated: “How frequently do you have disagreements within your work team about the task of the project you are working on?” Sample item on relationship conflict stated: “How much relationship tension is there in your work team?” Sample item on process conflict stated: “How often are there disagreements about who should do what in your work team?”

The transactive memory system is measured following Lewis (2003) and Zheng (2012) using five items for each of the three dimensions, using a 7-point Likert-type scale ranging from 1 (strongly disagree) to 7 (strongly agree). One item on coordination stated, “Our team worked together in a well-coordinated fashion”. Following the convention in the transactive memory system literature, we consolidated the three dimensions to a single score to form an overall TMS variable (Lewis, Lange, and Gillis, 2005; Liang, Moreland and Argote, 1995; Zhang, Hempel, Han and Tjosvold, 2007; Zheng, 2012).

3.2.3 Controls

We included several controls in the models: *respondent's age*, *gender*, and *education*. Respondents were asked to “indicate their age”, “indicate their gender (1=male, 2=female)” and “indicate their education level (1=secondary education, 2=bachelor, 3=master, 4=Ph.D).” We controlled for respondents' gender and age as previous research found that gender and age have a certain influence on their innovative work behavior programs (Jung, Chow, and Wu 2003). Education level was controlled due to the probable influence it may have on team members learning behaviors (Carmeli, 2007).

Team size is commonly controlled in group research because larger teams may have more potential for conflicts than smaller ones, but also may face additional process challenges (Zellmer-Bruhn and Gibson, 2006; Farh, Lee and Farh, 2010). Additionally, we also control for teams' *support for innovation*. Previous studies suggest that a climate supporting innovation can enable team members to freely try fresh ideas regarding the working tasks and share resources for the application of such ideas (Zhang et al., 2007). Support for innovation was measured with an 8-item scale following Zhang et al. (2007) and Anderson and West (1998).

IV. ANALYSIS AND RESULTS

4.1 Test for Unidimensionability of Constructs

We conducted confirmatory factor analysis (CFA) using AMOS 19.0 to assess the unidimensionality of each construct in the model (Gerbing and Anderson, 1988). An eight-factor measurement model concludes task conflict, process conflict, process conflict, specialization, credibility, coordination, team learning, and support for innovation. Each item is allowed to load only on its proposed construct. The CFA results in DELTA2=0.906 (Bollen, 1989), CFI=0.905 (Bentler, 1990), TLI=0.895 (Tucker and Lewis, 1973), and RSMEA=0.062 (Steiger and Lind, 1980), $\chi 2$ (541) =1186.544, p=0.000, which indicate acceptable model fit. Our result thus confirms the unidimensionality of each construct in our model.

4.2 Measurement Reliability

To assess the measures' reliability, we calculate two indicators, namely: (1) coefficient alpha reliability; and (2) the composite reliability indices, calculated across all dimensions. First, we find that all coefficient alpha reliabilities exceeded the accepted 0.7 thresholds (Cronbach, 1951). Zumbo, Gaderman, and Zeisser (2007) suggest that Conbach's alpha coefficient underestimates or overestimates the scale reliability. To complement the results, we calculate composite reliability using Fornell and Larcker's (1981) procedures. Results show that the composite reliabilities for all scales are higher than the minimum threshold of 0.7 (Hair et al., 2006).

4.3 Convergent and Discriminant Validity

To assess convergent validity, we use two methods. First, within the CFA setting, we calculate average variances extracted (AVE) using the Fornell and Larcker (1981) procedures. We can see from Appendix A that the AVE of all the six constructs, task conflict, process conflict, process conflict, team learning, and support for innovation, except for TMS, are greater than the minimum threshold of 0.5 recommended by Fornell and Larcker (1981). Second, we observe that convergent validity is evident as the path coefficients from latent constructs to their corresponding manifest indicators are statistically significant (i.e., $t > 2.0$) (Anderson and Gerbing, 1988). All items load significantly on their corresponding latent construct, with the lowest t-value at 6.494, providing evidence of convergent validity. Skewness and kurtosis for all scale items are within the acceptable -2 and +2 range (Shepherd et al., 2011), indicating that the data are normally distributed.

Discriminant validity is assessed by comparing the squared correlation between pairs of constructs and the AVEs of the constructs. All the squared correlations are lower than the AVEs, indicating sufficient discriminant validity (Fornell and Larcker, 1981).

4.4 Common Method Variance

Following Podsakoff et al. (2003), we integrated both procedural methods and statistical techniques to reduce the potential of common method variance. We assured the respondents that their answers were confidential and that there were no right or wrong answers to the questions in the survey, thus to reduce the respondents' evaluation apprehension and "make them less likely to edit their responses to be more socially desirable, lenient, acquiescent, and consistent with how they think the researcher wants them to respond" (Podsakoff et al., 2003, p. 888). In addition, we note that common method bias is more problematic at the item level than at the construct level. Thus, we used multiple-item constructs, following Harrison, McLaughlin, and Coalter's (1996) suggestion.

We then used Harman's single-factor procedure (Podsakoff and Organ, 1986) to address the concern about common method variance raised by the nature of the measures we employed. The logic underlying this approach is that if method variance is largely responsible for the covariation among the measures, a factor analysis should yield a single factor. Because models having large numbers of variables often fail to find a good fitting model (Bentle and Chou, 1987), we have conducted the confirmatory factor analyses above. Fit indices suggested the six-factor model fit well. In comparison, a one-factor model did not fit the data well (DELTA2=0.820, CFI=0.819, TLI=0.807, RSMEA=0.084, $\chi 2$ (556) =1782.059. The results suggested that common method variance did not pose a serious threat to interpreting our present findings.

V. FINDINGS:

5.1 Correlation Analyses

In the following section, we test the conceptual model and corresponding hypotheses. Table 2 presents the means, standard deviations, and bivariate corrections for the variables.

Table 2 Descriptive Statistics and Correlations Matrix[a]

	1	2	3	4	5	6	7	8	9	10
1.Age	1.000									
2.Gender	-0.147**	1.000								
3.Education	0.180*	-0.101	1.000							
4.Team size	0.077	-0.016	0.111*	1.000						
5.Support for innovation	0.124*	0.076	0.020	0.087	1.000					
6.Task conflict	0.019	-0.094	0.085	-0.044	0.177**	1.000				
7.Relationship conflict	-0.033	-0.010	-0.119*	-0.048	-0.263**	0.267**	1.000			
8.Process conflict	-0.027	-0.126*	-0.012	-0.023	-0.186**	0.488**	0.586**	1.000		
9.TMS	0.045	0.060	0.040	0.111*	0.571**	0.130*	-0.373**	-0.275**	1.000	
10.Team learning	0.124*	0.004	0.035	0.087	0.526**	0.189**	-0.220**	-0.205**	0.613**	1.000
Mean	32.810	1.300	2.210	16.710	5.527	4.511	2.283	2.952	5.664	5.484
SD	6.630	0.461	0.645	19.622	0.868	1.132	1.214	1.411	0.686	0.975

SD, standard deviation
** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

5.2 Structural Equation Modeling Analysis and Results

We employ structural equation modeling using AMOS 19.0 to test hypotheses. Table 3 presents the results of the SEM analysis. We can see from the results that a positive relationship exists between task conflict and TMS (H1: $\beta = 0.569$, $p = 0.000$), thus supporting H1, which proposes that task conflict is positively associated with TMS. The results also show that negative relationships exist between relationship conflict and TMS (H2: $\beta = - 0.354$, $p = 0.000$) and process conflict and TMS (H3: $\beta = - 0.414$, $p = 0.000$), thus supporting H2, which proposes that relationship conflict is negatively associated with TMS, and H3, which proposes that process conflict is negatively associated with TMS. H4 proposes that TMS is positively associated with team learning. The result shows that there is a positive relationship between TMS and team learning (H4: $\beta = 0.554$, $p = 0.000$), thereby H4 is supported.

Table 3 Results of Structural Equation Modeling Analysis (N=315)

Parameter	Standardized Regression Weights
Hypothesized paths	
Task conflict → TMS	0.569*** (0.044)
Relationship conflict → TMS	-0.354*** (0.038)
Process conflict → TMS	-0.414*** (0.039)
TMS → Team learning	0.554*** (0.115)
Control measures	
Age → Team learning	0.081 (0.096)

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

VI. DISCUSSIONS:

Our research aims to develop the theoretical reasoning for, and empirically test, the "conflict-TMS-team learning" link in NPD teams. We draw on a knowledge-based view and examine two relationships, namely: (1) the relationship between three types of conflicts and TMS, and (2) the relationship between TMS and team learning. The results indicate that task conflict is beneficial for teams' TMS development, but relationship conflict and process conflict have negative effects on teams' TMS. Additionally, TMS can enhance team learning.

Our research addresses an important yet under-researched question in the conflict and TMS literature. We make three contributions to existing literature and theories. First, our research is the first step toward uncovering the relationship between team conflict and TMS, thus deepening our understanding of knowledge-based theory by demonstrating that conflict, especially task conflict, is a crucial source of team knowledge acquisition. Prior research has focused primarily on the supportive role of some seemingly positive factors, such as team member familiarity (Akgün, Byrne, Keskin, Lynn and Imamoglu, 2005; Lewis, 2004), communication volume and frequency (Jackson and Moreland, 2009; Kanawattanachai and Yoo, 2007; Lewis, 2004; Peltokorpi and Manka, 2008), team stability and interpersonal trust (Akgün, Byrne, Keskin, Lynn and Imamoglu, 2005), little research has explored the important role of team conflict. Our empirical findings show that task conflict is beneficial for teams to develop a high-level TMS, since the debate about the key decision areas, and the appropriate choice for action (Donate, Guadamillas, González-Mohíno, 2023; Pelle, Eisenhardt, Xin, 1999) may facilitate the spread of valuable knowledge, the communication of divergent thinking, and acquisition of creative and innovative ideas (De Dreu and De Vries, 1993; Nemeth, Mayseless and Sherman, 1990). However, consistent with prior research, our findings show that relationship conflict and process conflict can harm the development of TMS. Our research indicates that relationship/process conflict, which focuses on personal feelings/issues of duty or responsibility would largely promote team inefficiency and ineffectiveness (Panteli and Sockalingam, 2005), lead to a loss of perspective regarding the task, inhibit individuals' cognitive functioning in assessing new information provided, and erode team cohesion (Amason et al., 1995), and finally would negatively affect TMS building.

Second, our research also adds knowledge to conflict literature. Our research verifies that three types of conflicts, task conflict, relationship conflict, and process conflict, are functionally diverse (Jehn and Mannix, 2001). On the surface, it appears that our research only replicates a previously discovered "conflict-team outcome" relationship. However, the logic of our research differs substantially from that of previous research. Our finding indicates a linear relationship, rather than an inverted U-shaped relationship. The research findings demonstrate that in NPD teams, which are usually composed of individuals with different expertise backgrounds and perspectives, team member familiarity and trust are limited, thus conflict may be a way to develop TMS: the more task conflict, the more sharing of knowledge and transferring of new ideas (Sockalingam, 2000) which are beneficial for TMS development.

Third, our research also contributes to the team learning literature by testing the relationship that has been implied but not yet tested. Previous research focuses on exploring the relationship between TMS and performance (e.g., Lewis, 2004; Zheng, 2012; He and Hu, 2021; Kim, Kim and Jo, 2021; Bachrach, Lewis, Kim, Patel and Campion, 2019). In the notable exception, Lewis et al (2005) point out that "TMSs help members learn, both individually and collectively", but up to date, little empirical research has been done on the relationship between TMS and team learning (an exception is Li and Huang, 2013). Our research demonstrates that a high level of TMS can encourage team members to share their knowledge, generate new knowledge, and evaluate and combine this knowledge (Lewis et al., 2005).

Finally, the practical implications of our research cannot be ignored. NPD team leaders or firms can take at least three lessons from our research. First, not all conflicts should be forbidden. Well-managed task conflict can enhance the teams to share knowledge, and communicate new ideas, and thus promote TMS. Thus, we suggest team leaders encourage task conflict among team members. The team leaders should embrace the attitude that some conflict can be good, and allow ample time for team members to voice up addressing specific task issues. Further, team leaders should monitor the affective level of team members, since relationship conflict and process conflict may cause team members to become frustrated, leaders need to intervene and potentially act as conflict mediators to prevent relationship/process conflict from leading to destructive effects.

VII. LIMITATIONS AND FUTURE DIRECTIONS:

Our research can be improved in several ways. First, prior research has somehow indicated that different types of conflicts may interfere with each other. For example, a high level of task conflict or too many disagreements may sometimes translate into relationship conflict (Farh, Lee, and Farh, 2010). Future research should take such interaction effects into account. Second, we take TMS as a whole variable, but maybe three dimensions of TMS may play different roles in the model. Future research can separately test the different dimensions of TMS. Another concern is that the key findings of our research are drawn from a limited sample of NPD project teams in China. Future studies can investigate whether or not the proposed causal mechanisms hold or vary for large samples or in other contexts.

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Appendix A - Measurement Items and Validity Assessment

Items description summary	**Loading**	**t-value**
Task conflict **(CA=0.800; CR=0.8058; AVE= 0.584)**		
There is much conflict of ideas in your team.	0.803 [a]	
Your team members usually have disagreements within your team about the task of the project you are working on.	0.631	10.860
Your team members usually have conflicting opinions about the project you are working on.	0.842	13.908
Relationship conflict **(CA=0.893; CR=0.8998; AVE=0.7504)**		
There is much relationship tension in your team.	0.801	18.952
Your team members usually get angry while working.	0.941 [a]	
There is much emotional conflict in your team.	0.851	21.150
Process conflict **(CA=0.920; CR=0.9211; AVE=0.7959)**		
Your team members usually disagree about who should do what.	0.861	23.334
There is much conflict in your team about task responsibilities.	0.945 [a]	
Your team members usually disagree about resource allocation.	0.868	23.796
Transactive memory system **(CA=0.761; CR=0.9032; AVE=0.3946)**		
Each team member has specialized knowledge of some aspect of your team task.	0.387	6.553
You have knowledge about an aspect of the task that no other team member has.	0.700 [a]	
Each team member is responsible for expertise in different areas.	0.475	8.018
The specialized knowledge of several different team members was needed to complete the project deliverables.	0.610	10.230
You know which team members have expertise in specific areas.	0.669	11.190
You are comfortable accepting procedural suggestions from other team members.	0.690	11.540
You trust that other members' knowledge about the task was credible.	0.755	12.574
You are confident relying on the information that other members brought to the discussion.	0.816	13.543
When other members gave information, you want to double-check it myself.*	0.772	12.851
You do not have much faith in other members' "expertise."*	0.461	7.786
Your team works together in a well-coordinated fashion.	0.696	11.629
Your team has very few misunderstandings about what to do.	0.632	10.589
Your team needs to backtrack and start over a lot.*	0.660	11.044
You accomplish the task smoothly and efficiently.	0.384	6.494
There are much confusion about how to accomplish task. *	0.496	8.369
Team learning **(CA=0.748; CR=0.7739; AVE=0.5375)**		
If a new way of doing work is introduced, it often comes from within your team.	0.586	9.684
Your team comes up with many new ideas about how work should be done.	0.809	12.759

Your team is often the source of ideas copied by other teams.	0.784 [a]	
Support for innovation **(CA=0.932; CR=0.9322; AVE=0.6329)**		
Your team is always moving toward the development of new answers.	0.832	16.734
Assistance in developing new ideas is available.	0.790	15.596
Your team is open and responsive to change.	0.846	17.108
Your team members are always searching for fresh, new ways of looking at problems.	0.794 [a]	
In your team, you take the time needed to develop new ideas.	0.748	14.543
Your team members cooperate in order to help develop and apply new ideas.	0.776	15.256
Your team members provide and share resources to help in the application of new ideas.	0.842	17.007
Your team members provide practical support for new ideas and their application.	0.728	14.041

[a] Fixed factor loading. Notes: CR = Composite Reliability, AVE = Average Variance Extracted.