



All for one, one for all: Coopetition and virtual team performance

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ABSTRACT

This study establishes a model of knowledge sharing theory to explain the formation of team performance in virtual teams. We tested the model in information technology (IT) organizations, and found applicability of coopetition in influencing team performance and knowledge sharing. Knowledge sharing is indirectly influenced by team politics and social capital (i.e., trust, social interaction and shared vision) via the mediation of cooperation and competition, while team performance is indirectly affected by team politics and social capital via the mediation of cooperation, team emotional intelligence and team competence.

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knowledge sharing
within team or across
teams?

1. Introduction

Virtual teams represent interdependent groups of individuals who work across space, time, and geographical boundaries with communication links that are heavily dependent upon advanced information technologies [1]. Virtual teams have become basic units in business organizations, and their activities are ubiquitous and have received considerable attention from social and organizational psychologists [2,3]. Specifically, team performance and knowledge sharing remain perennial and important issues for interpersonal relationships within virtual teams [4]. Whereas team performance is defined as the extent to which a team accomplishes its goals or mission [5], knowledge sharing is defined as individuals' sharing organizationally relevant experiences and information with one another, increasing the resources of a team (or an organization) and reducing time wasted in trial-and-error [6].

The interpersonal relationships within a team or virtual team are comprised of two elements: cooperation and competition. If both the elements co-exist, then the relationship between the members is considered coopetition [7]. Many organizations use teaming arrangements to push team members to both compete and cooperate with each other, leading to a major challenge for organizations that seek to manage their team workflows and performance [8]. The basic philosophy underlying cooperative relationships in teams is that all teaming activities should aim for the establishment of a beneficial partnership with one another in the team, including the coworkers who may be considered as a competitor [9]. The question posed in this study is concerned with whether cooperation and competition represent a trade-off for team outcomes such as team performance and team knowledge sharing.

In addition to coopetition, team emotional intelligence (EQ) and team competence (IQ) are critical in influencing team outcomes such as knowledge sharing and team performance (e.g., Margerison [10]). Team EQ includes the abilities to perceive and regulate emotions in oneself and in others, to understand emotions and to possess emotional knowledge [11–13]. Team IQ indicates team competence which is regarded as the sum of the professional knowledge and skills of a team. Previous research indicates that EQ and IQ are likely to complement each other and are important for explaining “success” when taken together

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[12]. This suggests that team emotional intelligence and team competence are positively related to teaming consequences such as knowledge sharing and team performance.

This study differs from previous research in certain important ways. First, a majority of previous research related to interactions among team members focuses on either competition or cooperation, which often resulted in a one-sided understanding of team members and their team outcomes. The cooperative relationship between team members is worth studying to avoid managerial misunderstanding because **simultaneous cooperation and competition among the members substantially complicate teaming and its outcomes**. This study examining the team outcomes based on coopetition generates further in-depth understanding regarding critical determinants in the context of coopetition.

Second, many previous studies of cooperation or competition (i.e., coopetition) emphasize face-to-face interaction styles among team members without taking the contexts of communication technology into consideration (e.g., Kent et al. [14]; Thomas and Bostrom [15]; Townsend et al. [16,17]). **Virtual teams** work collaboratively in geographically dispersed locations but still share the same interests, goals, needs and practices that define face-to-face teams (e.g., Chiu, Hsu, and Wang [18]). Due to advances in information technology facilitating communication and information sharing, more companies are moving towards using virtual teams. Regrettably, few theoretical attempts to integrate the coopetition literature in the settings of virtual teams have emerged. For that reason, examining the **applicability of coopetition among virtual team members** is a necessary and essential complement to previous studies given the abundant research on face-to-face teams.

Third, while some prior empirical studies have examined coopetition at the firm level (e.g., Tiessen and Linton [19]), this study is one of the few to use primary survey data collected from team members to test the determinants and outcomes of coopetition based on teams. Research supports and extends the notion that coopetition is not only important among intra-organizational partners, but also among inter-team parties (or inter-organizational parties) and these interactions are key for a team's or firm's long-term viability [20].

Last, this study pioneers the expansion of coopetition by including **team EQ/IQ as critical variables influencing team outcomes**. Most previous research related to coopetition considers cooperation and competition to the neglect of other factors (e.g., Bouncken and Fredrich [22]; Lin et al. [21]; Luo et al. [20]). This study aims at filling a gap in the literature of coopetition by demonstrating how team EQ/IQ and coopetition jointly influence team outcomes. While previous literature has so far privileged a focus on inter-firm relationships [23], little attention has been paid to intra-team relationships, which is examined by this study.

2. Theory and hypotheses

This study establishes a model based on coopetition to explain the relations among team performance and knowledge sharing across virtual teams. In the proposed model (see Fig. 1), knowledge sharing and team performance are indirectly affected by team politics through the mediation of coopetition and by social capital (i.e., trust, social interaction and shared vision) via the mediation of coopetition, team emotional intelligence and team competence. The rationale and justification about the proposed model and its figure are provided in the following section.

2.1. **Coopetition and knowledge sharing**

Knowledge sharing across team members can be both competitive and cooperative in nature [20], resulting in an interesting paradox. The competitive nature often happens since the acquisition of knowledge can generate private gains for individuals,

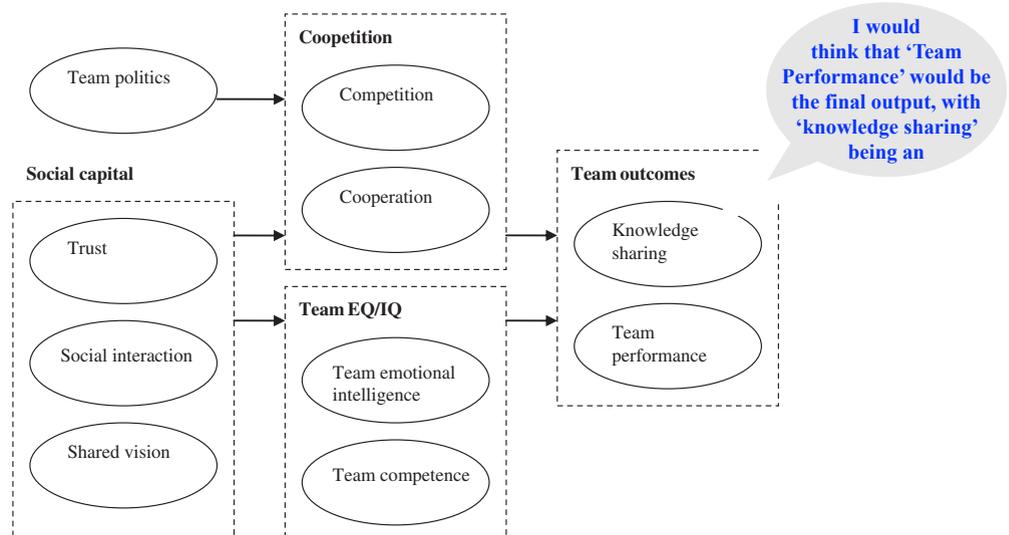


Fig. 1. Research model.

allowing them to outperform their counterparts [20]. To obtain new knowledge for successfully accomplishing their tasks in a team, team members have to cooperate with each other so as to learn from each other [10]. At the same time, knowledge sharing among team members can be cooperative in nature since individuals must collaborate with one another in knowledge sharing in the common interests of the team members. Meanwhile, these members compete with each other in many aspects of their teamwork because they are compared on the basis of their ability to achieve rewards [10], discouraging the members' willingness to share their knowledge with each other. Individuals whose exchanged knowledge may also be used by others for future competition against themselves [6] will discourage his or her knowledge sharing.

2.2. Coopetition and team performance

Research shows the **superiority of team decision making over that of even the brightest individual in the team, except when the team lacks harmony or the ability to cooperate** [24], suggesting the key role of coopetition in teamwork. The first critical factor in the strategic process of coopetition is the **cooperation** that enables employees to work closely within their team [25]. Cooperation represents individuals' like or dislike for the process of working or acting together with their colleagues (e.g., Wageman and Baker [26]). Cooperation entails inducements to the participating parties in their team, because cooperation with others has a positive effect on coordination of product lines, technological diversity, and consequently performance of particular business activities [27].

The second factor in the strategic process of coopetition is **competition**, because individual self-interest may not favor cooperation even if all the members would benefit from this cooperation (e.g., Tsai [10]). Competition represents a perceived state of discord due to a rivalry between team members for benefits, resources or territory (e.g., Campbell and Furrer [28]; Fletcher, Major, and Davis [29]; Jehn and Bezrukova [30]). Intense competition between many parties is detrimental to teamwork and generates negative effects on team performance. Due to the rewards (or limited resources) for individuals with high performance in a team, some members place their own performance targets above those of the team, and the performance achieved by one are often obtained at the expense of another [31].

2.3. Team EQ/IQ and knowledge sharing

The understanding and regulation of one's emotions as well as those of others' emotions (i.e., emotional intelligence, EQ) are the core factors influencing interpersonal relations [15]. Having employees with **high emotional intelligence in a team ensures the success of knowledge sharing** [32] because a team with high emotional intelligence produces identification and mutual understanding among team members, which encourage the members to distribute their knowledge to each other (e.g., Decker, Land-aeta, and Kotnour [33]). Previous empirical findings show that there are noteworthy relationships between emotional intelligence and the use of specific methods of knowledge transfer within a project team (e.g., Decker et al. [33]). Knowledge sharing is likely increased if team members have the ability to perceive emotions, reflectively regulate emotions and consequently promote emotional and intellectual growth [34].

Team competence (i.e., team IQ) is positively related to knowledge sharing because professional knowledge can be successfully shared only if team members have the ability to do so (e.g., Constanzo and Tzoumpa, 2008; Currie et al., 2008; Currie and Ker-rin, 2003; Scarbrough et al., 2004). A team or an organization that successfully shares knowledge and learning is constructed from several components including **core competence, cooperation, motivation and communication** [35]. Among these components, competence is a starting point for effective knowledge exchange in business groups or organizations [36]. For that reason, previous research states that competence building is the first step in knowledge sharing [35].

2.4. Team EQ/IQ and team performance

A number of studies have pointed out the relationship between team emotional intelligence and team performance (e.g., Rhee [37]; Van Kleef, Homan, Beersma, van Knippenberg, van Knippenberg, and Damen [38]) because emotional intelligence itself represents of the ability to use emotions to facilitate performance [13]. Emotional intelligence predicts performance of teams at both the initial and later stages [39,40] and helps predict problem solving and consequently contributes to team performance [41]. Specifically, high emotional intelligence that facilitates emotional understanding, regulation, and utilization tends to help cultivate positive social exchanges, social support or advice (e.g., Law et al. [13]), and to increase team performance [13,15,42]. Employees with high emotional intelligence should be more adept at regulating their own emotions and managing others' emotions to foster more positive relationships, which could contribute to better performance [43].

Team competence also known as team IQ, is positively related to team performance. For example, management team competence indirectly fosters a firm's financial performance [44]. Kakabadse [45] provides evidence of a primary link between the competence of team members and team performance, indicating that team competency is a key to team performance [12]. Further, the assertion is made that employees who possess and deploy this competence produce superior job performance [46].

2.5. The role of social capital

A key driver of team outcomes is social capital, which is defined as the features of social organizations such as networks, norms, and social trust, which facilitate coopetition and team EQ/IQ for mutual benefit (e.g., Putnam [47], p.67), ultimately

boosting knowledge sharing and team performance (e.g., Andrews [48]). Over the last decade or so, the concept of social capital has captured the attention of sociologists (e.g., Coleman [49]; Putnam [47]) and organizational theorists (e.g., Nahapiet and Ghoshal [50]) as a way of understanding why people in social communities, teams or organizations perform well or share knowledge, even when there is no legal obligation or expectation of personal gain from doing so. However, most previous research ignores critical mediators of the relationship between social capital and team outcomes (i.e., performance, knowledge sharing). For that reason, this study underscores three key factors of social capital: (1) trust (within the team), or the strength of social reliance developed among peers in the network; (2) social interaction, or the structural interactions or connections between individuals in a social network; and (3) shared vision, which refers to shared resources, such as language, interpretations, and mindset that facilitate effective communication.

In general, social capital facilitates cooperation and curbs competition, effectively reducing transactions costs such as negotiation and enforcement, imperfect information and layers of unnecessary team bureaucracy [51]. To sum up, social capital promotes greater cooperation (or team IQ/EQ) among individuals and between departments [51].

2.6. Social capital and cooperation

2.6.1. Trust and cooperation

Trust is defined as the actions that increase the vulnerability and reliance between team members (i.e., trust within team) and between team leaders and members (i.e., leader-member trust). Trust has been recognized to have a variety of positive effects [52–55] including improving team communication, organizational citizenship behavior, group performance, and job satisfaction [56].

Individuals aim to practice cooperation with other team members when they perceive the members to be trustworthy [57]. The cooperation that captures the level of collective actions between team members in their efforts to achieve beneficial outcomes cannot be realized without trust [58]. Trust is negatively related to various phenomena of competitive conflict such as distracted collaboration, distributive efforts, and value claiming [19]. Trust is necessary for cooperation, because trust dominates team members' thinking about whether they should cooperate with or compete against other team members to survive dramatic changes [59]. Trust is considered control mechanisms that dissuade individuals from behaving opportunistically against their co-workers, reducing team competitive conflict [60]. Team members with a high level of trust are unlikely to raise competitive conflicts that hurt their esprit de corps. Collectively, trust facilitates team outcomes (i.e., knowledge sharing and team performance) via cooperation and competition.

2.6.2. Social interaction and cooperation

Social interaction is the way team members talk to and act with each other in a team. Previous research indicates that social interaction among team members boosts voluntary and personal modes of cooperation and restrains deliberate competition (e.g., Tsai [10]). As social interaction provides channels that promote horizontal communications and informal interaction among different members (e.g., Tsai [10]), it is effective in positively affecting integrative processes within organizational units [61,62], including cooperation and competition.

Social interaction blurs the boundaries among team members and stimulates the formation of common interests that, in turn, support the building of cooperative relationships [63]. Social interaction is a critical element of social capital that can facilitate team outcomes (i.e., knowledge sharing and team performance) among team members via cooperation and competition.

Perhaps the most salient factor in a class project

2.6.3. Shared vision and cooperation

Considered the heart of a team's strategy [64], a shared vision represents the overarching objective or mission among team members [65], suggesting that each member possesses something of value that the other members want [11]. Shared vision may overcome the pragmatic boundaries between different parties by creating a common goal or mutual understanding, and facilitating coordination of team knowledge [66]. Developing a shared vision strategically among team members is critical to increased cooperation [67] and decreased competition, because a shared vision reflects an important agreement on beliefs and values that consequently brings about internal stability and harmony in team cooperation (e.g., Henderson and Sifonis [68]). Shared vision enhances the willingness of team members to consider and incorporate opposing views [66]. To sum up, shared vision allows team members to coordinate activities [66] and represents a photograph of the team's future among team members, setting the priorities for their team planning [69] and reducing competition. Bearing in mind the potential relationship between cooperation and knowledge sharing (e.g., Loebbecke, 1998) and the effects of trust, social interaction and shared vision on cooperation (e.g., Lin et al. [21]), the hypotheses based on our preceding rationales are provided as below.

H1. Social capital is positively related to team knowledge sharing, and this relationship is mediated via competition.

H2. Social capital is positively related to knowledge sharing, and this relationship is mediated via cooperation.

H3. Social capital is positively related to team performance, and this relationship is mediated via competition.

H4. Social capital is positively related to team performance, and this relationship is mediated via cooperation.

2.7. Social capital and team IQ/EQ

2.7.1. Trust and team IQ/EQ

A team's social capital (e.g., trust) and human resources act as a surrogate indicator of its competence (i.e., team IQ) and credibility [70] and of its emotional intelligence (i.e., team EQ) [51]. Previous research indicates that **businesses with high levels of trust are significantly more creative, capable and ultimately more profitable than organizations that experience low levels of trust [71]. Scholars have seen trust as an essential ingredient in the healthy personality [72],** as a base of interpersonal relationship (e.g., Rempel, Holmes, and Zanna [73]) and as a foundation for multiple intelligences such as EQ and IQ (e.g., Yamagashi [74]). Levels of trust or mistrust are reflected in a team member's actions and, in turn, may be reciprocated by other members [75]. When employees do not perceive their team members as trustworthy (e.g., because of their dishonesty), they may develop emotionally negative thinking about the workplace and suffer emotion-related problems. Goyal and Akhilesh proposed a strong relationship between social capital (e.g., trust) and emotional intelligence, which jointly influencing team innovativeness [76].

This study assessed the indirect effect of trust on knowledge sharing and team performance via the mediation of team EQ/IQ. This study assumes that the trust in others is a sign of a healthy personality (e.g., Jain and Sinha [75]), strengthening team EQ/IQ and consequently improving team outcomes. It is theoretically justifiable because, when team members trust each other, the sharing of concerns and emotions are done more freely [71], substantially boosting team EQ/IQ.

2.7.2. Social interaction and team IQ/EQ

Sociability is associated with emotionality (e.g., Argyle and Lu [77]). For example, employees attenuate both their positive and their negative moods when they are expecting a social interaction [78]. Previous research indicates that social interaction skills positively affect social and emotional learning [79], suggesting a positive relationship between social interaction and emotional intelligence. Particularly, frequent social interaction helps employees learn to monitor their own and others' feelings and emotions, which guide their subsequent thinking and actions.

Social interaction is related to various competencies such as communicative competence, social competence and intellectual competence [80,81]. Individuals enhance their competence via social interaction with a multitude of different team members. Thus, social interaction is a critical element of social capital that can facilitate performance outcomes (i.e., knowledge sharing and team performance) among team members via team EQ/IQ.

2.7.3. Shared vision and team IQ/EQ

Establishing shared vision is important for bringing people together particularly in cooperation contexts and for fostering team power to a shared future [82–84] because shared vision provides team members with a common direction by which they can navigate, and a focus for learning (e.g., knowledge sharing) among the members [84]. According to Senge [84], talented individuals do not ensure the creation of talented teams if they do not have shared vision [83].

Shared vision is positively related to team outcomes via the mediation of team emotional intelligence and team competence. First, through shared vision that facilitates mutual understanding, team members become more capable of dealing with their emotions and others' feelings (i.e., team emotional intelligence) than those members without shared vision. Under shared vision condition, it is less likely for misunderstanding and irritation to occur among team members, and thus team members' emotional intelligence can be improved. In other words, a shared vision can help team members overcome their negative out-group feelings, a common phenomenon in organizations, including those in collectivistic societies [85]. Building shared vision helps reduce ambiguity, uncertainty, conflict, confusion, and communication misunderstanding [86], consequently facilitating emotion-sharing process and positive social interaction among employees [87].

Second, shared vision is associated with team competence (or learning) since it is a factor influencing knowledge acquisition and knowledge dissemination activities [88]. A shared vision is intended to generate a clear team (or organizational) purpose and promote the necessary changes in the team so that it can achieve its desired team competence or outcomes [88]. Without shared vision, team members are unlikely to understand what their team needs from them and thus their motivation to enhance their team competence is weakened, implying a positive relationship between shared vision and team competence.

Based on the preceding justified effects of trust, social interaction and shared vision on emotional intelligence and competence (e.g., Lin et al. [21]), which in turn drive knowledge sharing [89], our hypotheses can be summarize and stated as below.

- H5.** Social capital is positively related to knowledge sharing, and this relationship is mediated via team emotional intelligence.
- H6.** Social capital is positively related to knowledge sharing, and this relationship is mediated via team competence.
- H7.** Social capital is positively related to team performance, and this relationship is mediated via team emotional intelligence.
- H8.** Social capital is positively related to team performance, and this relationship is mediated via team competence.

2.8. Team politics and competition

Team politics refers to the complex mixture of power, influence, and interest-seeking behaviors that dominate individuals' activity in a work team (e.g., Vigoda [90]). Team politics is a social-influence process in which behavior is designed to maximize

short-term or long-term self-interest in a team [91], substantially affecting teaming outcomes (e.g., Vigoda [90]). Less attention has been paid to examine the possibility that political behavior in an organization leads to mediating competition impacts on the teamwork, lessening team performance [92] and knowledge sharing [93].

Gilmore, Ferris, Dulebohn, and Harrell-Cook [94] proposed organizational politics as one source of conflict in the work environment with the potential for dysfunctional outcomes at both the individual and the team level. Organizational politics often includes undercovert/covert activities, ambiguity, uncertainty [90] and leading to undesirable outcomes [95], like increased competition against others and decreased cooperation with others. To complement previous literature focusing on the negative effects of organizational politics on job outcomes (e.g., Byrne [96]), this study examines the mediating mechanism of competition on the negative relationship between team politics and knowledge sharing (e.g., Becker-Ritterspach and Dörrenbächer [97]; Hackney et al. [98]; Hansen et al. [99]) and between team politics and team performance (e.g., Ahearn et al. [100]; Randall et al. [101]), leading to the following hypotheses.

H9. Team politics are negatively related to knowledge sharing, and this relationship is mediated via competition.

H10. Team politics are negatively related to knowledge sharing, and this relationship is mediated via cooperation.

H11. Team politics are negatively related to team performance, and this relationship is mediated via competition.

H12. Team politics are negatively related to team performance, and this relationship is mediated via cooperation.

3. Methods

3.1. Subjects and procedures

The research hypotheses described above were empirically tested using a survey of IT firm professionals working in virtual teams in Taiwan. Most previous studies of cooperation emphasize face-to-face team members as opposed to virtual team members. Virtual teams work collaboratively in geographically dispersed locations but still share the same interests, goals, needs and practices that define face-to-face teams (e.g., Chiu et al. [18]). Only few theoretical attempts in previous literature have been made to examine if the cooperation works well within virtual teams. For that reason, examining the applicability of cooperation within virtual team members in this study can be a necessary and essential complement to previous studies given the abundant research on face-to-face teams.

Professionals from IT firms were recruited for this study, because this population represents one of the largest user groups of online technologies. Initially, we invited ten executive MBA students working professionally in IT firms to help with data collection. A total of 42 large IT firms that utilize virtual teams in two well-known science parks in Taipei and Hsinchu were targeted. It was confirmed in advance by the firms that their virtual teams met the criteria that the communication and coordination among team members were predominantly based on electronic communication media (e-mail, fax, chat tools, online conferencing, instant messaging, phone, etc.) (e.g., Hertel et al. [102]; Lin [103]). We surveyed five persons on each team, including four team members and a team leader (or team supervisor). In case a leader supervised more than one team, we only surveyed one of his or her teams to avoid any confusion to the leader.

To avoid the threat of common method bias we collected our data from two different sources (i.e., managers and subordinates). Reliance on a single source of data can cause the methodological problem of common method variance [104–106]. While employing the Harman's one-factor test [105] would have provided certain testing against it, using separate sources of data is much robust option (see Spector [107]).

Of the 800 questionnaires distributed of the members of 160 teams (four for the members and one for the leader each team), 759 usable questionnaires from 152 teams were returned, a high response rate of 94.88%, partially due to gift voucher incentive of NTD100 (about USD3.09/person) that was provided. This high level of response rate (cf Baruch and Holtom [108]) in our survey was also achieved in part due to the strong support of our sample firms in which their personnel departments first helped distribute the questionnaires to the employees, expressing their voluntariness and then traced the status of returned questionnaires. Only one team returned four questionnaires (one from the leader and three from the members), while the remainder of the teams completed all five questionnaires. Our sample contained 480 males (63.24%) and 279 females (36.76%). Roughly 95% (722) of the participants held a bachelor's degree or higher and almost 88% of the participants (667) worked in their firm for a year or more.

3.2. Measures

The constructs in this study are measured using 5-point Likert scales drawn and modified from the existing literature. Four steps are employed in choosing measurement items. First, the items from the existing literature are translated into Chinese from English. Second, the items in Chinese were then substantially modified by a focus group of five people familiar with organizational behavior, including three graduate students and two professors. Our focus group repeatedly examined both our English version questionnaire as well as its Chinese counterpart. A high degree of correspondence between the two questionnaires indicated that the translation process did not substantially introduce artificial translation biases. Third, three pilot studies were conducted prior to the actual survey to assess the quality of our measures and to improve item readability and clarity. Respondents for these studies were drawn from the student population at an evening college, who worked professionally during the day in the information technology industry. They were asked to complete the survey questionnaire and point out any confusing items.

Sample sizes for the three pilot studies were 64, 66 and 58 respondents respectively. These respondents did not overlap with the respondents in the actual survey. Some inappropriate items were repeatedly reworded or removed from our survey questionnaire after the pilot tests. Data from the three pilots were analyzed using exploratory factor analysis, employing the principal components technique with varimax rotation. Due to our limited pilot samples and a large number of research factors, we divide our factors into three groups and ran exploratory factor analysis for each group. A total of 10 factors emerged from the analysis with eigenvalues greater than 1.0, corresponding to the hypothesized factor structure. Furthermore, reliability analysis found that each of our 10 constructs had a Cronbach alpha of 0.8 or higher, providing clear evidence of reliability. The final items are summarized in the [Appendix A](#).

Finally, in our actual survey, we collected data for empirically testing our hypotheses from 152 teams. Similar to the procedures in our pilot tests mentioned above, we have again performed exploratory factor analysis using our team-level data. The results along with Cronbach's alphas are provided in [Appendices B and C](#).

4. Results

Structural equation modeling would not be appropriate to employ in our study due to the sample size that is relatively small for our large model. Thus, we used multiple regression analysis to reflect the proposed associations in our hypotheses at a team-level (see [Table 1](#)) after aggregation of individual responses to team-level measures had been justified (see [Appendix D](#)). In step 1, we first included four demographic control variables and four independent variables (i.e., team politics, trust, social interaction and shared vision). Our four demographic control variables are the ratio of members' difference in gender, the ratio of members' difference in age, the ratio of members with higher education and the ratio of expatriate members. The test results show that team politics are positively related to competition and negatively related to cooperation. Trust is negatively related to competition while trust, social interaction and shared vision are positively related to cooperation. Meanwhile, trust, social interaction and shared vision are positively related to both team emotional intelligence and team competence (i.e., team EQ/IQ).

In step 2, we tested the relationship between our mediators (i.e., cooperation and team EQ/IQ) and outcomes (i.e., knowledge sharing and team performance). The test results at this stage show that knowledge sharing is affected negatively by competition and positively by cooperation while knowledge sharing is neither related to team emotional intelligence nor team competence. Accordingly, team performance is positively affected by cooperation, team emotional intelligence and team competence, whereas team performance is not related to competition.

Finally, to test if cooperation, team emotional intelligence and team competence are full mediators or partial mediators, we conducted further tests by adding direct links from our four antecedents to our two team outcomes. The test results presented in [Table 1](#) show that all the significant paths in above-mentioned Step 2 remain unchanged. Only an exceptional path between trust and knowledge sharing being significant, suggesting that full mediations of cooperation, team EQ/IQ do exist between our antecedents and team outcomes to a large extent. The unexpected exception might occur due in part to cultural differences across teams, and this should be further investigated in future research.

Based the results reported in [Table 2](#), we depict all the significant model paths in [Fig. 2](#) and present the actual data in [Tables 3 and 4](#), showing the final results of our hypotheses. Of our 12 hypotheses, we have 7 supported, 1 partially supported and 4 unsupported.

Table 1
Test results of regression models.

	Competition	Cooperation	Team emotional intelligence	Team competence	Knowledge sharing	Team performance	Knowledge sharing	Team performance
<i>Step 1:</i>								
Control variables:								
Ratio of members' difference in gender	0.01	0.01	0.01	0.01	0.01	0.00	0.01*	0.00
Ratio of members' difference in age	0.12**	0.00	0.09**	0.03	0.00	−0.03	0.01	−0.03
Ratio of members with higher education	0.01	−0.01	−0.02	0.00	0.01	−0.02	0.00	−0.02
Ratio of expatriate members	0.03	−0.04	−0.02	−0.14**	−0.03	0.01	−0.05	0.01
Independent variables:								
Team politics	0.51**	−0.08*					0.02	−0.07
Trust	−0.25*	0.43**	0.19**	0.22*			0.35**	0.03
Social interaction	−0.21	0.14*	0.19**	0.27*			0.02	−0.06
Shared vision	0.10	0.24**	0.36**	0.26*			0.11	0.05
<i>Step 2:</i>								
Mediators:								
Competition					−0.18**	−0.02	−0.15**	0.03
Cooperation					0.56**	0.35**	0.29**	0.32**
Team emotional intelligence					0.04	0.28**	−0.05	0.25*
Team competence					0.01	0.29**	−0.02	0.28**
<i>Adj R</i> ²	0.56	0.66	0.51	0.32	0.59	0.54	0.66	0.53

* $p < 0.05$.

** $p < 0.01$.

Table 2
Hypotheses of social capital and its outcomes.

Hypotheses	Results
H1: Social capital is positively related to knowledge sharing, and this relationship is mediated via competition.	Partially supported
H2: Social capital is positively related to knowledge sharing, and this relationship is mediated via cooperation.	Supported
H3: Social capital is positively related to team performance, and this relationship is mediated via competition.	Not supported
H4: Social capital is positively related to team performance, and this relationship is mediated via cooperation.	Supported
H5: Social capital is positively related to knowledge sharing, and this relationship is mediated via team emotional intelligence.	Not supported
H6: Social capital is positively related to knowledge sharing, and this relationship is mediated via team competence.	Not supported
H7: Social capital is positively related to team performance, and this relationship is mediated via team emotional intelligence.	Supported
H8: Social capital is positively related to team performance, and this relationship is mediated via team competence.	Supported

4.1. Limitations

The first limitation of this study is its generalizability, due to the nature of the subject sample. The inferences drawn from such a sample may not be fully generalizable to employees from other countries. Given that the team competition may vary widely among cultures, the results of this study would benefit from a validation study in a culture that is substantially different from Taiwan. Another issue is that our participants were all IT professionals who are technologically adept. Other types of organizations use virtual teams, but as they may not be as familiar with the technologies, the relationships we found may not be the same. Confirming our results in different industries would expand our knowledge regarding interactions and performance in virtual teams.

The second limitation is related to the cross-sectional design employed. As team dynamics evolve over time, longitudinal studies would add further validation to our findings. Yet, using different sources tackled the possible impact of common method bias. The third limitation is that other intervening variables may prove significant too. Future studies should cover these issues.

5. Discussion and conclusions

Cooperation has been addressed in the traditional teamwork literature as a trade-off in creating progress towards organizational outcomes, particularly team performance [109,110]. To date, teams acquire dominating roles that provide a potent response to fast changing markets through advanced information technology, where teamwork would have once been impossible [1,54]. We advanced current knowledge by including the influential effects of cooperation and team EQ/IQ into a model to examine their mediating roles for generating team outcomes. Even though previous research has suggested a potential relationship between cooperation, team EQ/IQ and team outcomes individually, few studies have empirically explored the reasons for those relationships (e.g., Luo et al. [20]) by simultaneously taking all the factors into consideration. In terms of the mediating role of cooperation, all of our four antecedents were found to have significant influence on team outcomes via cooperation, empirically supporting the intrinsic need for collaboration across teams.

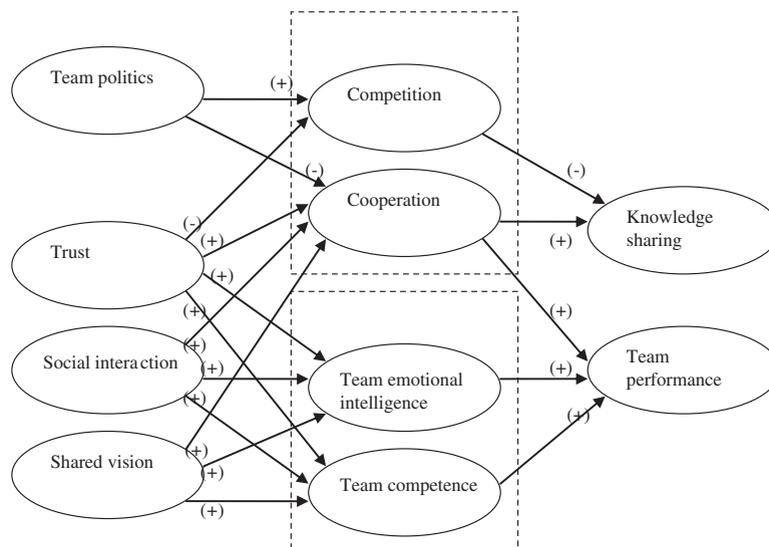


Fig. 2. Test results of research model.

Table 3

Hypotheses of team politics and its outcomes.

Hypotheses	Results
H9: Team politics are negatively related to knowledge sharing, and this relationship is mediated via competition.	Supported
H10: Team politics are negatively related to knowledge sharing, and this relationship is mediated via cooperation.	Supported
H11: Team politics are negatively related to team performance, and this relationship is mediated via competition.	Not supported
H12: Team politics are negatively related to team performance, and this relationship is mediated via cooperation.	Supported

Social capital is powerful in improving team outcomes via cooperation. Yet, it is surprising that only one of the three social capital factors (i.e., trust) increased knowledge sharing via the mediation of competition, which has no effect on team performance. This finding first suggests that trust within team may be more critical than other social capital factors in virtual settings because such trust simultaneously drove cooperation and competition, making it key in the success of cooperation. Particularly, virtual meeting conducted through 3D avatar-based communication may facilitate “seeing is believing,” thus effectively strengthening the relationship between trust and cooperation and curbing the relationship between trust and competition.

Team politics' significant influence on team outcomes indirectly via the mediation of cooperation suggests management should be careful about politics because team politics obviously yield significant influence through different channels to damage knowledge sharing and team performance. The issue of politics within teams (i.e., team politics) has not received much research attention and we need to learn more about its overall negative effects on competition and cooperation, which ultimately impact knowledge sharing and team performance. If management engages in negative politics as a major tool to make a good deal, the organization will eventually pay a heavy price for this type of manipulation.

Another surprising finding is that team emotional intelligence and team competence only affects team performance rather than knowledge sharing. It may be understandable that team emotional intelligence and team competence both reflect types of team capability that improves performance, but their lack of significant influence on knowledge sharing deserves future research. Nevertheless, it is important to note that team emotional intelligence and team competence are both affected by three social capital factors, making social capital factors unique and powerful ones in boosting team performance. For example, previous literature suggests that virtual worlds allow team members to communicate and foster trust, interaction and shared vision in an interactive, multi-channelled communication environment with a virtual face and identity [111]. Moreover, the social capital factors enhance team performance through three different mediators – cooperation, team emotional intelligence and team competence, suggesting that “all for one, one for all” in social contexts may be a good policy for fostering team performance over the long term.

Our findings indicate that competition is negatively related to knowledge sharing. Yet, such findings do not directly imply that managers should aim to fully eliminate competition in their teams due to two reasons. First, a reasonable level of competition is healthy for organizations to stimulate team spirits [112]. Second, the cooperation becomes more important and valued by employees when competition increases to a certain extent. Thus, managers should aim to reach a balance between cooperation and competition in their team, leading to optimal conditions in terms of various team outcomes, as we demonstrated in our study.

In summary, while existing research and theory on relationships among team members focus on either competitive or cooperative relationships, little research has considered that team members can be involved in both competition and cooperation at the same time, hence both kinds of relationships need to be emphasized simultaneously [9] as we investigated herein. By complementing the previous literature, this study provides important references point for management to benefit from the advantage of virtual teaming as well as to reduce the negative impact of such teaming (e.g., competition). Based on this study regarding the intra-team relationship in the same organization, future research may expand the research scope to the area of inter-team relationship across different organizations to investigate unexplored inter-teaming dynamics.

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Appendix A. Measurement items

Trust (Source: Langfred [113])

- TW1. We trust each other a lot in the team.
- TW2. I know I can count on the other members in the team.
- TW3. The other members in the team know they can count on me.
- TW4. I trust all of the other members in the team.

Shared vision (Source: Burgers et al. [66])

- SV1. There is commonality of purpose in our team.
- SV2. Our team members share the same ideas and vision with one another.
- SV3. All team members are committed to the goals of this team.
- SV4. There is total agreement on our team vision.
- SV5. Our team members try their best to achieve collective goals and mission of the whole team.

Social interaction (Source: Baruch, Bell, and Gray [114])

- SI1. Our members maintain good networking with colleagues.
- SI2. Our members maintain close social relationships with colleagues in our firm.
- SI3. Overall, our team maintains close social relationships with friends or partners.

Team politics (Source: Vigoda [90])

- TP1. The member who gets ahead around here is not determined by merit but by favoritism.
- TP2. There are few members in our team who always get things their way because no one wants to challenge them.
- TP3. Members in our team attempt to build themselves up by tearing others down.
- TP4. I have seen changes made in policies here that only serve the purposes of a few individuals, not our team.
- TP5. Managers prefer yes-men around here: good ideas are rejected when it means disagreeing with superiors.

Cooperation (Source: Wong, Tjosvold, and Liu [115])

- CP1. Our team members 'swim or sink' together.
- CP2. Our team members want each other to succeed.
- CP3. Our team members seek compatible attitude in terms of teamwork.
- CP4. Our teamwork goes smoothly.
- CP5. When our team members work together, we usually seek a solution that is good for the team.

Competition (Source: Wong et al. [115])

- CM1. Our team members structure things in ways that favor their own benefit rather than that of other team members.
- CM2. Our team members have a 'win-lose' relationship.
- CM3. Our team members like to show that they are superior to each other.
- CM4. Our team members' work attitude is incompatible with each other.
- CM5. Our team members give high priority to the things they want to accomplish and low priority to the things other team members want to accomplish.

Team performance (Source: Stewart and Barrick [116])

- TP1. Our quality of work is superior to that of similar teams in other organizations.
- TP2. Our quantity of work is satisfactory.
- TP3. Our resource planning and allocation are superior to those of similar teams in other organizations.
- TP4. Our overall performance is satisfactory.

Knowledge sharing (Source: Lin [6])

- KS1. We share our job experience with each other.
- KS2. We share our expertise at the request of other members.
- KS3. We share our ideas about jobs with one another.
- KS4. We share work reports and official documents with one another.

Team emotional intelligence (Source: Law et al. [13])

- TE1. Our team members have good understanding of our own emotions.
- TE2. Our team members understand what we feel ourselves.
- TE3. Our team members know whether or not we are happy.
- TE4. Our team members always know other members' emotions from their behavior.
- TE5. Our team members are good at observing others' emotions.
- TE6. Our team members have good understanding of the emotions of people around them.
- TE7. Our team members tell ourselves we are competent persons.
- TE8. Our team members are self-motivated persons.
- TE9. Our team members would always encourage ourselves to try our best.
- TE10. Our team members are quite capable of controlling our own emotions.
- TE11. Our team members can calm down quickly when we are very angry.
- TE12. Our team members have good control of our own emotions.

Team competence (Source: Paré and Tremblay [117])

- TC1. Our members' skills are better developed than those of members of other teams
- TC2. Our members can easily rotate jobs to develop their skills.
- TC3. Our members often take professional development activities (e.g., coaching, training) to improve their skills and knowledge.
- TC4. Our members obtain a variety of professional certification or specialized courses.
- TC5. Our members are able to apply new skills in their work.
- TC6. Our members are encouraged to apply their new abilities and skills in the context of the daily work.

Appendix B. Team-Level Factor Matrix (actual survey data)

Items	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
Shared vision 1	0.835	−0.154	−0.087	0.188	0.184	0.167
Shared vision 2	0.759	−0.155	−0.011	0.174	0.274	0.201
Shared vision 3	0.823	−0.144	−0.064	0.354	0.203	0.087
Shared vision 4	0.858	−0.141	−0.010	0.231	0.182	0.081
Shared vision 5	0.784	−0.107	−0.252	0.280	0.154	0.126
Social interaction 1	0.190	−0.188	−0.202	0.230	0.086	0.751
Social interaction 2	0.211	−0.109	−0.137	0.170	0.108	0.876
Social interaction 3	0.092	−0.019	−0.042	0.103	0.165	0.878
Trust 1	0.409	−0.208	−0.221	0.353	0.654	0.146
Trust 2	0.376	−0.170	−0.218	0.334	0.730	0.127
Trust 3	0.377	−0.115	−0.094	0.342	0.655	0.238
Trust 4	0.399	−0.137	−0.199	0.351	0.695	0.177
Team politics 1	−0.138	0.909	0.058	−0.119	−0.080	−0.047
Team politics 2	−0.165	0.839	0.280	−0.206	−0.133	−0.098
Team politics 3	−0.161	0.660	0.505	−0.187	−0.160	−0.081
Team politics 4	−0.145	0.860	0.304	−0.087	−0.085	−0.036
Team politics 5	−0.105	0.807	0.345	−0.136	−0.068	−0.165
Cooperation 1	0.271	−0.316	−0.005	0.694	0.241	0.202
Cooperation 2	0.221	−0.153	−0.270	0.648	0.370	0.239
Cooperation 3	0.381	−0.181	−0.233	0.740	0.208	0.166
Cooperation 4	0.298	−0.207	−0.152	0.767	0.283	0.138
Cooperation 5	0.401	−0.062	−0.168	0.759	0.160	0.135
Competition 1	−0.144	0.556	0.600	−0.165	−0.285	−0.108
Competition 2	−0.078	0.421	0.779	−0.137	−0.005	−0.137
Competition 3	−0.088	0.128	0.904	−0.087	−0.096	−0.051
Competition 4	−0.171	0.416	0.747	−0.210	−0.046	−0.136
Competition 5	0.010	0.224	0.751	−0.104	−0.243	−0.122
Cronbach's alpha	0.94	0.94	0.92	0.92	0.93	0.87

Based on the principal components technique with the varimax rotation.

Legend: Factor 1 = Shared vision; Factor 2 = Team politics; Factor 3 = Competition; Factor 4 = Cooperation; Factor 5 = Trust; Factor 6 = Social interaction.

Appendix C. Team-Level Factor Matrix (actual survey data)

Items	Factor 1	Factor 2
Team EQ1	0.877	0.109
Team EQ2	0.871	0.051
Team EQ3	0.854	0.091
Team EQ4	0.796	0.236
Team EQ5	0.734	0.270
Team EQ6	0.832	0.277
Team EQ7	0.726	0.309
Team EQ8	0.675	0.339
Team EQ9	0.820	0.173
Team EQ10	0.704	0.227
Team EQ11	0.685	0.281
Team EQ12	0.734	0.248
Team competence (IQ1)	0.291	0.668
Team competence (IQ2)	0.127	0.727
Team competence (IQ3)	0.086	0.869
Team competence (IQ4)	0.113	0.837
Team competence (IQ5)	0.352	0.798
Team competence (IQ6)	0.473	0.662
Cronbach's alpha	0.95	0.87
Knowledge sharing 1	0.356	0.799
Knowledge sharing 2	0.253	0.843
Knowledge sharing 3	0.247	0.896
Knowledge sharing 4	0.068	0.803
Team performance 1	0.858	0.297
Team performance 2	0.853	0.301
Team performance 3	0.876	0.044
Team performance 4	0.852	0.297
Cronbach's alpha	0.91	0.89

Note: Based on the principal component technique with the varimax rotation.

Appendix D. Inter-rater reliability

Construct	ICC1	ICC2
Trust	0.3685	0.7445
Shared vision	0.3700	0.7457
Social interaction	0.3705	0.7461
Team politics	0.3421	0.7219
Knowledge sharing	0.3697	0.7455
Team competence	0.3674	0.7436
Team emotional intelligence	0.3712	0.7467
Competition	0.3529	0.7314
Cooperation	0.3702	0.7459
Team performance	0.3669	0.7432

Note 1: The ICC1 values are all larger than the recommended level of 0.12.

Note 1: The ICC2 values are all larger than the recommended level of 0.60.

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