

Improving Performance of Virtual Team: Lessons Learned from Online Game Players

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Abstract—With the advantage of bridging over geographical and time restriction, virtual team has been utilized by companies to make the best use of talents from different domains and areas to accomplish various objectives. However, it is always a challenging task to build up a perfect condition for virtual teams to generate outstanding performance.

The current study collected data from online game players, which are considered a special type of virtual team, to understand the operational issues during the process of achieving goals. The major objective is to figure out relationships among different factors that are supposed to affect the performance of virtual teams. The results are: (1) The trust among virtual team members has positive influences on team cooperation; (2) The cohesion of virtual team has positive influences on team cooperation; (3) Team cooperation of virtual team has positive influences on team performance; (4) Communication among virtual team members would decrease the influence of team cooperation on team performance. Managerial implication and future direction are provided at the end of the current study.

I. BACKGROUND

The emergence and evolvement of the information technology have transformed the role of computer from an assistant to a medium of communication and cooperation with others. The idea of establishing virtual teams (distributed teams) is to make the best use of the information technology to cross the temporal as well as spatial boundaries for accomplishing tasks. By utilizing virtual teams, companies would not be limited by the location of the offices or buildings and could gain competitive advantage by improving flexibility and adaptively.

Recently, both academia and practitioners have paid lots of attention to the development of massive multiplayer online role play games (MMORPGs) because, during the process of accomplishing tasks and objectives of MMORPGs, players must actively participate in cooperation with other players; it is thought to be quite similar to the process of accomplishing tasks through virtual teams. Moreover, the value generated by the players for the online game industry and the implications derived from thoroughly understand the behaviors performed by the players are considered fruitful for the development of other MMORPGs and for the completeness of understanding virtual team [5][20][61].

Actually, cooperating with others located in different areas for accomplishing various tasks is quite common in modern days. The advancement of information technology has formed a solid foundation for cooperation; however, in the context of team cooperation, the performance of virtual teams might still be jeopardized without a proper leadership

model, an unhindered two-way communication, a trustworthy atmosphere, and the cohesiveness among team members. As virtual team becomes a common practice for companies to conduct daily operations, its quite urgent for academia as well as practitioners to further understand the mechanism that might improve the productivity of virtual team.

The first research question, and the major purpose of the current study, is to figure out the effects of trust, cohesiveness, and team cooperation on team performance. The second research question is to understand the role played by team communication on team performance. In the following sections, literature about virtual team, team trust, cohesiveness, and communication will be provided, followed by hypotheses proposed by the current study and methods for conducting this study; results, implications, suggestions, and limitations will be discussed at the end of this article.

II. LITERATURE REVIEW

A. Virtual Team

Members of traditional teams come from the same organization; they used to cooperate in a face-to-face manner. However, facing the pressure of globalization, the competition from rivals, and the limitation of precious resources, the concept and the practice of virtual teams is considered as a powerful weapon for beating rivals from around the world.

Unlike traditional teams, members of virtual teams might come from different continents or different time zones; without the chance to have face-to-face communication with other team members, Internet and information technology are then critical for building up a channel for communication and discussion and to accomplish different tasks. As mentioned by [28] and [18], the emergence of virtual teams not only drastically changed the operational pattern of organizations but also blurred the boundaries among organizations. However, it should be noted that virtual teams cannot be considered as a magic pill for dealing with every challenge confronted by modern organizations, the advantages brought by utilizing virtual teams are considered strategically important and indispensable in the global marketplace [2]. Recently, virtual team has played an essential role in the daily operations of different organizations; it's also a hot topic for scholars in the area of sociology and organizational psychology [3] [41].

From the literature, two kinds of definition of virtual team could be found: (1) members of a virtual team might come from different organizations or from the same organization; they utilize information technology for crossing the

boundaries of organizations, and for overcoming temporal and spatial limitations [28] [29] [21]; (2) members of a virtual team might come from different countries (distributed locations); they might not be able to see each other face to face; cultural differences are quite common among different virtual team members [4] [22] [33].

In essence, several characteristics of virtual teams are recognized as follows: the main purpose to establish a virtual team is to rapidly integrate resourced distributed in different areas, members of a virtual get together temporally for accomplishing specific tasks, members of a virtual team communicate with each other through digital medium, and cultural diversity is not only quite common among members of a virtual team but also considered as critical assets for the virtual team [27] [55].

B. Team Cooperation

For surviving in the environment of high complexity and rapid changes, independent workers have to cooperate with others to complete different tasks; sometimes it is necessary to cross temporal and spacial boundaries for delivering positive outcomes [38]. The establishment of teams with flexibility and adaptivity is therefore considered essential for sustaining competitive in the global marketplace. Team cooperation is defined as the process of two or more team members, by utilizing resources, knowledge, and information technology, to pursue shared goals, tasks, and benefits [54]. Actually, team cooperation is a set of behaviors performed by members of a specific team; those task-dependent members integrate their domain knowledge and coordinate with one another to achieve a common goal [32]. Team cooperation is a critical process to improve team effectiveness [7], and to ensure the team could perform properly [59].

Planning and communication are considered as two basic mechanisms for team cooperation; those mechanisms make sure the team could accomplish tasks in a steady and predictable manner and help team members to generate positive outcomes in both formal and informal ways [25] [49]. Setting proper goals is also quite important [4]; as shared goals and shared benefits being recognized and accepted by team members, cooperation would then become viable for accomplishing those goals. Task dependent and outcome dependent are proved to increase the willingness to cooperate and to encourage communication among team members [22][53].

Team cooperation is promising but not without drawbacks. Groupthink might restrain the creativity of the team and end up with a compromise instead of an optimal solution [10]; moreover, team cooperation might decrease the motivation of some members and trigger social loafing behaviors [23]. However, from the holistic point of view, even with those flaws, the benefits of team cooperation are still worth pursuing. As the emergence of norms and patterns for cooperation, team members will become more capable of handling specific tasks [13]; it is also less time-consuming and effortless for experienced teams to accomplish difficult

jobs [15]. Actually, the establishment of cooperative norms would have positive effects on team performance because, during the process of achieve goals, team members could easily predict responses as well as reactions of others, reduce the uncertainty, increase the productivity, and minimize the anxiety [7].

However, it is not easy for virtual team members to cooperate with others; different techniques and activities were proposed to increase the cooperation among virtual team member, such as organizing regular face-to-face meetings [33], applying information technologies [57], and minimizing perceptual gaps among team members [34] [50]. It is also well-recognized that the utilization and adaptation of information technology would affect team cooperation and the performance of virtual teams [30] [31]. In the current study, team cooperation is considered as the cooperative relationship among partners to utilize resources at hand, knowledge from different domains, and information technology to pursue common goals, complete various missions, and share benefits.

C. Cohesiveness

Cohesiveness is the desire of individuals to maintain their membership in a group; cohesiveness is considered as a dynamic process for team members to establish a tight relationship and work together for achieving common goals and completing various missions [11]. In other words, team cohesiveness is the mutual recognition of the relationship among members, and the collective believe of common goals and values as well [44]. It's generally recognized that team members with high cohesiveness would pay more efforts to accomplish missions, depend more on other members, and be more willingly to exchange information with others that would then improve the performance of the team [57]. A previous study also indicates that team members with high cohesiveness would be more satisfied about the team and be more willingly to achieve team goals by sparing no efforts [46]. Working in a more dynamic and competitive work sphere, cohesiveness among virtual team members could be considered one of the most important drives for success [51] [52].

The concept of cohesiveness could be divided into two dimensions: task cohesiveness and interpersonal cohesiveness [16]; the former concerns about team members' commitment to pay more efforts to missions and tasks, and the later focus on eliminating communication obstacles and team coordinations. To further elaborate the importance of cohesiveness, researchers propose a positive relationship between team cohesiveness and team effectiveness [63][64]. Moreover, team cohesiveness is closely related to team members' satisfaction, attendance of team members, and the turnover rate of the team; previous study concludes that teams with high cohesiveness could not only achieve goals with lower communication and cooperation costs, but also gain competitive advantage by high efficiency and flexibility [36]. Based on the literature mentioned before, the current

study defines team cohesiveness as the recognition among team members to complete missions, achieve goals, and to maintain a close relationship with other members [12][44].

D. Communication

Communication is the process of transmitting concepts, attitudes, or messages from the sender to the receiver through a specific channel [48] [53]. The main purposes of communication are transmitting information, expressing emotions, and improving understandings among different participants. To smoothly complete a communication, seven components are suggested to be critical, including: the sender, encoding, the message, the channel, decoding, the receiver, and feedback [43].

As different kinds of technology being invented, the rationale of choosing a specific kind of tool for communication becomes an interesting topic. Comparing to traditional teams, members of virtual teams requires different communication tools to construct trust and cohesiveness [12][17]. A previous study concludes that virtual teams that utilize communication tools would have stronger cohesiveness among team members [18]. It is also believed that, in the context of virtual team, communication tools embedding with richer information could help improve team performance [35]. In the current study, the authors define communication as a process of virtual members to send and receive information from other members; communication could be one-way, two-way, or multi-directional interaction with other team members [18] [39].

E. Trust

Trust is the confidence that an individual would find what is desired from another, rather than what is feared [9]. Psychologists consider "trust" as the belief or expectation from the truster to the trustee. With the existence of trust, team members would like to share information and are more willingly to take risk about information exchange [37]. Trust could also encourage team members to help each other, to actively engage in various tasks, and to transform tacit knowledge into explicit knowledge for practical use [8]. In other words, trust could be considered as the interdependent relationship among different parties to hold positive and optimistic expectation in uncertain contexts [6] [58] [26]. In the context of virtual team, a previous study find out that trust among team members could be considered as a kind of social capital that could lead to cooperative behavior [6] [8][47].

In the current study, trust is defined as believing others from the same virtual team to pursue a common goal and to achieve mutual objectives for the benefits of all members [45] [24].

F. Team Performance

Team performance is a crucial indicator to examine whether a team efficiently and effectively achieves team goals [1] [40]. More specifically, team performance is defined as the degree of satisfying preset criteria achieved by

a team, such as: quality, cost, and completing time [19]. In practice, performance of the results and performance of the process are both critical aspects for measuring team performance [60]. A previous study uses a three-pronged approach to evaluate team performance, include: the degree of achieving team goals, the efficiency of completing tasks, and the relationships among team members [42].

After reviewing studies on virtual teams, the Input-Process-Output structure commonly utilized for measuring traditional team performance is modified for analyzing performance of virtual teams [45], including: Input, Social Emotional Processes, Task Processes, and Outputs. Characteristics and composition of virtual teams are critical input variables; social emotional processes deal with the construction of relationships among virtual team members; cooperation among members of virtual teams is considered a crucial factor for understanding the task process; performance and satisfaction of virtual team members are important output variables.

Based on the review of literature three trends could be found: (1) previous studies utilize the Input-Process-Output Structure to investigate the relationships among team performance and other factors; (2) characteristics of the team, the interaction among team members, and team performance are popular variables in previous studies; (3) most scholars agree that the interaction among team members would affect team performance. In the current study, team performance is defined as the degree of satisfying team objectives such as outputs, time, and cost achieved by a virtual team; objectives, characteristics, cooperation, and the results are critical variables of the Input-Process-Output structure adopted for measuring team performance.

III. RESEARCH METHODS, DATA COLLECTION, AND ANALYSIS

In this section, research framework and hypotheses will firstly be provided, followed by the description of research instrument, the process of collecting data, and the results of data analysis.

A. Research Framework and Hypotheses

Based on the review of literature provided in the previous section, the framework of the current study is depicted as follows:

From the framework, four hypotheses are proposed:

- H1: Trust among virtual team members will positively affect the cooperation of the virtual team.
- H2: Cohesiveness of the virtual team members will positively affect team cooperation.
- H3: Team cooperation will positively affect team performance.
- H4: Communication has a moderating effect on the relationship between team cooperation and team performance.

B. Research Instrument

On-line survey is utilized for collecting data; most of the items are adopted from previous studies with necessary modifications. In total a Six-point Likert scale with 21 items is formulated.

For measuring cohesiveness, four items proposed by [14] are adopted in the current study. Respondents are asked to express their feeling about the belongingness, happiness, and willingness of the virtual team.

Four items adopted from [5] are used to measure the condition of communication; relationships, interactions, and closeness of virtual team members, and the frequency of communicating are considered important indicators.

Four items modified from [15] are used to measure the trustworthiness and dependability of virtual team members.

Cooperation is measured by 5 items adopted from [62]; respondents' willingness to share his/her duties, take responsibilities, and jointly search for solutions with other members are key indicators.

Team performance is measured by 5 items designed by [56]. The degree of achieving goals, the completion of tasks, and the fulfillment of mission requirements are critical checkpoints.

Items used in the current study are listed in the following table.

C. Data Collection Process

Although different kinds of virtual teams are commonly used by practitioners, it's not easy to get permission by companies and collect enough data from virtual team members. After a series of consultation with scholars and experts, players of MMORPGs players were then chosen as suitable targets for collecting data. A paper-based pretest of 113 participants (response rate= 91.87%) with experiences of playing MMORPGs is conducted; necessary modification of the items is made after analyzing questionnaires. A formal on-line survey is then developed and announced in several MMORPGs communities for attracting potential respondents to participate the current study. Responses from MMORPGs communication are quite surprising; without any rewards for filling out the questionnaire, 1765 complete questionnaires are received (29 of them are non-usable, 1736 of them are used for verifying hypotheses) in one week.

D. Results of Data Analysis

In addition to 22 items measuring five variables, 8 demographic items are included to get a general idea of the respondents, including: gender, marriage status, age, occupation, educational background, monthly income, daily average time spent online, and seniority of playing MMORPGs. Description of demographic items are provided in the following paragraphs.

TABLE 1. ITEMS USED FOR COLLECTING DATA

Variable	Items	Source
Cohesion	<ol style="list-style-type: none"> 1. I feel that I belong to this team. 2. I am happy to be part of this team. 3. I see myself as part of the team. 4. I am not content to be part of this team. 	Garrison, Kim, Wakefield & Xu [14]
Cooperation	<ol style="list-style-type: none"> 1. Our team members 'swim or sink' together. 2. Our team members want each other to succeed. 3. Our team members seek compatible attitude in terms of teamwork. 4. Our teamwork goes smoothly. 5. When our team members work together, we usually seek a solution that is good for the team 	Yehuda & Chieh-Peng [62]
Communication	<ol style="list-style-type: none"> 1. I maintain close social relationships with some members in the virtual team 2. I spend a lot of time interacting with some members in the virtual team. 3. I know some members in the virtual team on a personal level. 4. I have frequent communication with some members in the virtual team. 	Chiu, Hsu, & Wang [6]
Trust	<ol style="list-style-type: none"> 1. We trust each other a lot in the team. 2. I know I can count on the other members in the team. 3. The other members in the team know they can count on me. 4. I trust all of the other members in the team. 	Garrison, Kim, Wakefield & Xu [14]
Team performance	<ol style="list-style-type: none"> 1. This team achieves its goals. 2. This team accomplishes its objectives. 3. This team meets the requirements set for it. 4. This team serves the purpose it is intended to serve. 5. This team fulfills its mission. 	Taiga & Florian [56]

More than 90 percent of the collected questionnaires are completed by male (N=1577); only 159 female participants are female. Most of the respondents are not married (N=1625); 111 married respondents participate the current study. As expected, a large portion of MMORPGs players are college students; from the collected questionnaire, 1540 respondents are aged under 20 or aged from 20 to 30. 1091 respondents are currently students of different level of educational institute; others are almost equally distributed in different industries. About 60 percent of the respondents have bachelor degrees with various majors, and the monthly income for about 80 percent of the respondents is less than 30000 NTD. Around 85% of the respondents spend more than 2 hours surfing on the Internet every day. Finally, more than 75% of the respondents have experience of playing MMORPGs for more than 5 years.

The test for reliability is also plausible; Cronbach's Alpha for different variables range from 0.889 to 0.962 indicating a fairly high reliability of the instrument used in the current study.

For verifying hypotheses proposed in previous sections, regression analysis is utilized.

H1: Trust among virtual team members will positively affect the cooperation of the virtual team.

R^2 for H1 is 0.546 with F value equals to 1853.276 ($P < 0.001$) indicates that H1 cannot be rejected. Trust has

a positive effect on team cooperation for virtual teams (Beta=0.739).

H2: Cohesiveness of the virtual team members will positively affect team cooperation.

R^2 for H2 is 0.576 with F value equals to 2093.865 ($P < 0.001$) indicates that H2 cannot be rejected. Cohesiveness has a positive effect on team cooperation for virtual teams (Beta= 0.759).

H3: Team cooperation will positively affect team performance.

R^2 for H3 is 0.259 with F value equals to 541.147 ($P < 0.001$) indicates that H2 cannot be rejected. Cohesiveness has a positive effect on team cooperation for virtual teams (Beta= 0.51).

H4: Communication has a moderating effect on the relationship between team cooperation and team performance.

From the results of regression analysis, the positive effect of team cooperation on team performance is decreased after taking communication into consideration (the Beta value is decreased from .51 to .448, Please see Table 5). The result indicates that communication among virtual team members might jeopardize the cooperative relationship and threaten the performance achieved by the virtual team.

TABLE 2. SUMMARY OF THE REGRESSION ANALYSIS – TRUST ON TEAM COOPERATION

Regression Model	Adjusted R^2	F Value	Standardized Beta	t Value	Sig.
Trust on Team Cooperation	.546	1853.276	.739	43.050	.000

TABLE 3. SUMMARY OF THE REGRESSION ANALYSIS – COHESIVENESS ON TEAM COOPERATION

Regression Model	Adjusted R^2	F Value	Standardized Beta	t Value	Sig.
Cohesiveness on Team Cooperation	.576	2093.865	.759	45.759	.000

TABLE 4. SUMMARY OF THE REGRESSION ANALYSIS – TEAM COOPERATION ON TEAM PERFORMANCE

Regression Model	Adjusted R^2	F Value	Standardized Beta	t Value	Sig.
Team Cooperation on Team Performance	.259	541.147	.510	23.263	.000

TABLE 5. SUMMARY OF THE REGRESSION ANALYSIS – INTERACTION OF COMMUNICATION AND TEAM COOPERATION ON TEAM PERFORMANCE

Regression Model	Adjusted R^2	F Value	Standardized Beta	t Value	Sig.
Interaction of Communication and Team Cooperation on Team Performance	.200	386.494	.448	19.659	.000

IV. CONCLUSION, LIMITATION, AND SUGGESTIONS

Using data collected from players of MMORPGs, the current study proposes four hypotheses to figure out the relationships of different variable with virtual team performance. The results indicate that, by analyzing data collected from an online survey, trust, cohesiveness, and cooperation among virtual team members have positive relationships with virtual team performance. However, it is surprised that communication among virtual team members might decrease the effects of virtual team cooperation on virtual team performance. After interviewing with several participants of the current study, it is concluded that, due to the fact that virtual team members have different backgrounds, communication obstacles and inefficient communication might decrease the willingness for further communication and then affect the performance of the virtual team. Moreover, the characteristic of instantaneity for MMORPGs might trigger emotional responses from members of the same team and decrease the willingness for further cooperation.

Although lots of data were collected for analysis in the current study, several limitations deserve further explanation. First of all, the current study takes a cross-sectional viewpoint; without a longitudinal understanding, critical information might be missing. Secondly, the current study collected data from players of MMORPGs; although MMORPGs and tasks of virtual teams share some common features, a holistic view of virtual teams might be threatened by taking MMORPGs players for investigation. Thirdly, for virtual teams operating in the real world, team members might come from different cultural backgrounds; the diversity of the respondents in the current study might not sufficiently reflect the real situation.

Undoubtedly, adopting virtual team for accomplishing different tasks is the trend for practitioners to strengthen their competitive advantages. In order to make the best use of virtual teams, it is fruitful to thoroughly understand factors that might affect the performance of virtual teams. A plethora of studies on traditional teams have formed a solid foundation for further research; studies on different types of virtual teams, a longitudinal perspective of virtual team study, and the comparison of the effects of critical factors on traditional teams and virtual teams are considered plausible directions for further study.

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