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Virtual Team Effectiveness: An Empirical Study Using SEM

Swati Kaul Bhat [a*], Neerja Pande [b], Vandana Ahuja [a]

[a] *Jaypee Business School, Noida, 201301, India*
[b] *Indian Institute of Management Lucknow, Noida Campus, 201307, India*

Abstract

Advances in communication and information technology create new opportunities for organizations to build and manage virtual teams. Such teams are composed of employees from different genders, experiences, back grounds and geographic locations. Virtual teams have become a norm for organizations whose members work across disparate geographical locations, relying primarily or exclusively, on the usage of Information and Communication Technology (ICT) for the completion of common goals. This paper attempts to explain the role of vital elements like trust, information sharing and communication, in building virtual teams. This study strives towards developing a set of factors using SEM that can be used by managers of virtual teams for establishing an efficacious relationship amongst the members.

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Keywords: Virtual Teams, Trust, Team Effectiveness, Information Sharing, Communication, SEM, Information Technology

1. Introduction

With the rapid development and extensive application of information and communication technology, the virtual team offers opportunities for collaboration across time, space and organizational boundaries and has become an important component of the organizational fabric as it enables companies to cope with the accelerated market change. In many countries across the world, the internet has helped in shrinking barriers between teams located across diverse locations, and this has been possible because of what is termed as 'virtual teams'-teams which are connected with each other in cyberspace. The virtual team, with advantages such as including diverse staff, broad organizational boundaries, flexible organizational structure and innovation resources allocation, etc., has been widely adopted in many fields including Service Outsourcing, IT and Innovation, Research and Development, etc.[1]. Research shows that organizations need to bring the right people together at the right time for the execution of specific tasks [2].Both academicians and practitioners have suggested that virtual teams (VTs)

* Corresponding author.
E-mail address: swatikaul46@gmail.com

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allow organizations to address the challenges of increasingly complex and dynamic environments [3]. With the right strategies, processes, planning, actions and tools, organizations can benefit greatly from this new age trend of virtual teams. This format of teams allows organizations to attract and retain individuals across the world because of workplace flexibility which is the prime factor of job satisfaction for many employees [4].

This study explores factors that drive perceived effectiveness within virtual teams. The study focuses on the identification of dimensional factors that are to be considered at an early stage, during the virtual team creation process as they are critical to impacting team effectiveness. Team effectiveness is a function of development of a climate of trust amongst the members of virtual teams [5]. Awareness of surroundings, flexibility, cultural intelligence, communication and interpersonal skills are key competencies that need to be developed for building trust [6]. Assembling a virtual team is like grouping people from dispersed locations, time and/or organizational boundaries. When effectively managed, global virtual teams amplify the benefits of teamwork and possess greater innovation potential than traditional, face-to-face teams.

2. Literature Review

2.1 Virtual Teams

The four key characteristics of the virtual teams [7] identified are:

- Temporary: Virtual teams are organized for a particular task and tenure. Virtual teams open up to the new possibilities of working in a global environment which gives access to a variety of people who best fit the desired talent and skills.
- Culturally diverse: Members of the team have different countries of birth, nationality and languages and this gives a competitive advantage to the team. It is this diversity which helps in generating ideas to accomplish the common task assigned to the team.
- Geographically dispersed: Virtual teams give an add-on benefit to people to work from remote locations. Virtual teams are common across various industries and IT sectors, and their members often span national, geographic, and other boundaries.
- Communicates electronically: A geographically dispersed work team uses information technologies for the purpose of communication. Team members connect with each other across time, space, and boundaries using computer-mediated technology.

2.2 Trust in virtual teams

Trust is a fragile item [8] in team building and should be dealt carefully when teams are located at diverse sites. The virtual teams are formed by bringing together talent from different functions, locations, and organizations [9]. This difference generally leads to trust deficit. Research suggests that trust acts as an integral and important component for the efficacious working of the team. Even though trust is reflected as a multidimensional construct [10], but Mayer, Davis, and Schoorman's model of trust, which treats trust as a unidimensional construct [11] is mostly appreciated and referred to, in literature. Mutual trust and shared understanding is required for the growth of team members [12] .Since members of virtual teams know that they have to interact for a limited tenure; they can change their attitude towards developing trust in the other members of a team [13]. Mayer in his research explained that trustworthiness factors are "conditions that lead to trust".

2.3 Information sharing in virtual teams:

Virtual teams give individuals a chance to plug and play, cooperate and strive, share knowledge, information and work [14]. The degree of interaction and interdependence between the team members is the first dimension

on which definitions of virtual teams may differ [15]. As information sharing is a vital part of a team's success, organizations often exchange persons within virtual teams to minimize the effects of loss of technical or non-technical information [16].It is vital for organizations to encourage individuals within the organization to share information with other members[17].Information sharing happens once individuals who share a mutual purpose and experience, come together to exchange ideas [18].The process of information sharing among individuals involve the conversion of the knowledge held by an individual into a form that can be understood, absorbed, and used by other individuals [19]. An interruption or breakdown happens when an individual of the team withholds the information from another [20]. Sharing information becomes a tough job when teams are spread out in distant geographical locations [21]. Hence, it becomes essential to develop mechanisms in virtual environments, through which knowledge and information can be transferred from one individual to another. In fact, sharing information amongst team members has been shown to enhance the performance of the teams [22]. However, effective knowledge sharing between members is more difficult in virtual teams than in traditional forms of teams [23].

2.4 Role of communication in virtual teams:

Due to the fact that virtual team member's work across geographically dispersed locations, communication becomes a critically important factor in virtual team functioning [24].Their interaction methods could include telephone, teleconference, messaging, email, skype, etc. All the computer-mediated communication technologies face the same drawback due to the lack of verbal and nonverbal cues, compared to traditional face-to-face communication. The verbal cues (i.e. tone of voice, verbal hesitation, volume) and non-verbal cues (i.e. facial expression, body movement, emotion) are however important sources to process information from team members for tasks [24]. Compared with face-to-face teams, virtual teams face problems such as "decreased social interaction, communication, and emotional expression". The human and technology aspects need to be managed so that virtual teams with attributes like high performance, high commitment, and high cooperation and communication. Our findings from our previous studies suggest that individuals in the virtual settings suffer because of absence of informal meetings and many respondents feel that cross-border knowledge must be used as a potential source of competitive advantage [25].

3. Gaps Identified

In this mobile-first, cloud-first world, organizations are trying hard to use the power of information technology to transform the way they work. Increased competition in the market, progress in field of information and communication technologies and globalization of work has changed the entire outlook of the organizations. Appropriate plans and approaches need be developed to keep these different individuals together. Members in this situation can only perform well when they trust one-another, share their knowledge and information well in time. In literature, trust is considered to be a crucial and challenging factor for the success of virtual teams. Although there is a mounting number of publications addressing virtual teams and role of trust in virtual teams but literature related to trust, information sharing and communication as single entity in IT industry is scarce: only a few publications in the past have dealt with this topic but were restricted to education or manufacturing industry in USA or Europe only. Most of the studies focus on development of trust, stages of trust formation, team design, interpersonal relations, culture, conflicts, knowledge sharing in virtual teams ,awards and recognitions. We have tried to explore parameters on which relationships are formed and further sustained by the individuals who are separated by time, space and boundary? Our study is an attempt to recognize those factors of virtual teams that according to modern era are identified as the most critical for them.

4. Research Problem

Even though a large repository of literature is available on virtual teams and trust, some questions are still unanswered. In this study, we try to investigate the implications and importance of the previously identified factors of Trust, Information Sharing and Communication, in the context of virtual teams. The study focuses on the significance of the dimensions of trust, information sharing and communication in virtual team effectiveness. It also develops and tests the model for virtual team effectiveness using second order CFA.

5. Research Methodology

A research instrument (questionnaire), comprising of 45 questions was prepared by analyzing the available literature. Structural Equation Modelling (SEM) technique with the help of AMOS 23.0 was used to test the research question of the study. SEM provides the most efficient and appropriate estimation technique. The reason for choosing SEM over other techniques (e.g. multiple regressions) was due to its capacity to discriminate between direct and indirect relationships between variables and to study relationships among latent variables without random error. Hair in 2010, has categorized SEM in two basic components- Measurement model and Structural model. A measurement model shows that the different variables are truly different constructs predicted by their particular set of items. Structural models are path models which relate dependent to independent variables. To identify which independent variable predicts the dependent variable, the researcher needs theoretical support from past studies. The responses of respondents were collected on a Likert scale and were further analyzed and summarized using Amos 23.0 in the current paper.

5.1 Data and Sample

To acquire the data sample, members who work in virtual teams in the IT industry were identified. Snowball sampling was used to target individuals who work in virtual settings. The data was collected by sending emails to virtual team members and the sampling frame was developed for the pilot study. Questionnaire once drafted was sent across to the respondents to collect the information. After conducting the pilot study, some of the items which were found to be inappropriate were dropped and a new draft of the questionnaire was created consisting of 45 questions, 15 items for each construct.700 questionnaires were sent out, out of which 550 respondents responded. Out of these, 520 were found appropriate. Our previous research study "Factors Impacting Effectiveness in virtual teams" helped us to identify the factors that impact trust, information sharing and communication in virtual teams. The demographic characteristics of respondents are shown below.

Table 1: Demographics

Details	N	Percentage	
Gender	520	• Male	66
		• Female	34
Designation	520	• Manager	45
		• Team Lead	23
		• S/W dev.	32
Age	520	• 25-35	91
		• 36-45	9
		• 46-55	-
		• Above 55	-
Duration of working as a virtual team member	520	• <1 year	36
		• 1–5 years	49
		• 6–10 years	13
		• Over 10 years	2

Duration of working in your current virtual team	520	• < 1 year • 1-5 years • 6-10 years • Over 10 year	51 38 8 3
Number of members in team	520	• < 10 • 10-25 • 25-50 • Above 50	53 29 10 8

6. Analysis

Factors impacting effectiveness in virtual teams found in previous study:In our previous study, we have identified the factors that impact effectiveness of virtual teams. The study was conducted by preparing a set of 45 questions from the available literature. The questionnaire contained 15 items related to each variable (trust, information sharing and communication). Respondents were asked to fill the questionnaire on the scale of 1 (strongly agree) to 5 (strongly disagree). Factor analysis was then conducted on the responses obtained. From this survey we have obtained the set of 8 factors that impact effectiveness of virtual team.

To analyze the data in the current study, two step data analysis technique was used: (i) Confirmatory Factor Analysis (CFA), (ii)Structural Equation Modelling (SEM).

7. Results of CFA

7.1 Trust:

Literature on virtual teams indicates that trust is a critical factor for the team whose members are separated by location, culture, and time. Trust building is a challenging and a routine practice for any team, but it becomes comparatively harder in a virtual scenario, where members have limited instances of personal interactions [26].

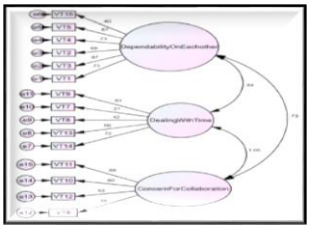

Figure 1: Trust Model

Table 2: Model Fit Indices for Trust

CMIN/df	P value	RMSEA	CFI	TLI
1.544	.000	.043	.982	.979

7.2 Information Sharing

Virtual teams give individuals a chance to plug and play, co-operate and strive, share knowledge and information [27]. Once individuals trust each other and believe that others are willing and able to share their knowledge and information, sense of obligation develops inevitably.

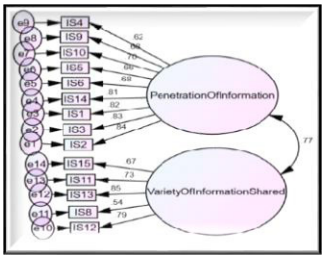

Figure 2: Information Sharing Model

Table 3: Model Fit Indices for Information Sharing

CMIN/df	P value	RMSEA	CFI	TLI
2.792	.000	.059	.966	.960

7.3 Communication:

"Without communication, the boundary spanning among virtual entities is impossible."[28]. Four factors location, culture; nonverbal communication and trust most directly influence the team communication effectiveness and the objective fulfilment [29]. Virtual team members work interdependently with computer-mediated communication technologies to interact with team members and to accomplish shared tasks for the company [30].

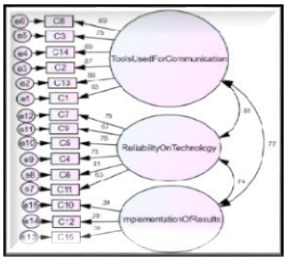

Figure 3: Communication Model

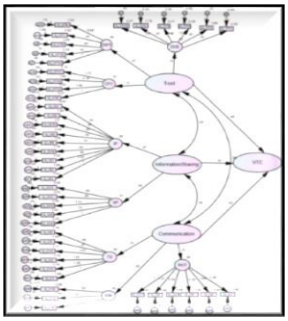

Figure 4: Structural Model for Trust, Information sharing and Communication

Table 4: Model Fit Indices for Communication

CMIN/df	P value	RMSEA	CFI	TLI
2.483	.000	.071	.999	.987

Further, SEM was used to examine this relationship in depth. SEM was applied with the help of AMOS.

Table 5: Direct Path Analysis between Trust, Information Sharing, Communication and Virtual Team Effectiveness

			Estimate
VTE	<----	Trust	0.49
VTE	<----	Information Sharing	0.57
VTE	<----	Communication	0.54

Table 6: Model fit indices of structural model of Trust, Information Sharing, Communication and Virtual Team Effectiveness

CMIN/df	P value	RMSEA	CFI	TLI
1.430	.000	.038	.977	.974

8. Conclusions

Even though there is ample literature pertaining to the topic of managing virtual teams; little has been done to quantify the scope and magnitude of practices within organizations today. The prominent factors on which trust, information sharing and communication are dependent in virtual teams were identified. These factors help member in virtual teams to remain focused for achieving effectiveness and efficiency in their work. The current study adds to researcher efforts by highlighting the importance of factors that impact trust, information sharing and communication in the virtual team of IT industry. The resulting factors of the research- 1[Dependability on Each Other], 2[Dealing with Time], 3[Concern for Collaboration], 4[Information Penetration], 5[Variety of Information], 6[Reliability on Technology], 7[Tools Used for Communication], 8[Implementation of Results], should be considered to create effective virtual teams. The findings and factors provide a useful insight into how virtual team efficacy and ability is determined. This study strives towards developing a set of factors that can be used by managers of virtual teams for establishing an efficacious relationship amongst the members. Since virtual teams enable a set of talented, highly capable and experienced individuals spread across various locations, to work together for the completion of a particular task, without being relocated, these factors can be used by both members and organizations to analyze their teams and their members well. Researchers claim that geographic separation amongst members of teams causes adverse effects on communication, knowledge sharing, and work coordination [30]. In this scenario, our factors provide a holistic approach to make the virtual team and its employees more effective.

9. Limitations

Maintaining a good relationship amongst team members is essential in any of the settings, be it a traditional or geographically dispersed team. But how would associates develop strong relationships when they are separated by time, space and boundary? The framework of virtual teams developed here had made an attempt to identify the relationships between those factors that were seen as the most critical in the literature. The factors such as team design, culture, conflicts, awards and recognition etc. are not included in our framework. Other important contours such as supervisor support, multiple project handling, learning environment, willingness to do the assigned job, work-life balance, health, project planning , scheduling , technical uncertainty mergers and acquisitions etc. have not been studied and can be included in the further studies. The scope of the present study is limited to the IT software sectors, we have not considered IT hardware sector, construction, bio-technology, engineering, research and pharmaceutical industries and others. By adding a couple of new facets a new study can be done. The data collected for the study comprised of IT professionals at the same level. The model hence proposed can be further validated. Few items were found to have lesser correlation values. Despite challenges and forces acting against virtual teams, developing global-minded managers is more important than ever.

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