



UCEM Institutional Research Repository

Title	Impact of Trust in Virtual Project Teams: Structural Equation Modeling (SEM) approach.
Author(s)	Sukhwant S.K Sagar, Mohammed Arif, O Oladinrin, Amit Kaushik and Rubina Islam
ORCID	
Type	Article
Publication title	Construction Innovation
Publisher	Emerald
ISSN/ ISBN	1471-4175
Publication Date	27 July 2023
Version	Accepted Version
DOI	
Repository link	https://ucem.repository.guildhe.ac.uk/id/eprint/93/
Link to publication	

Copyright:

UCEM aims to make research outputs available to a broader audience via its digital [Repository](#). Where copyright permits, full text material held in the Repository is made freely available. URLs from GuildHE Research Repositories may be freely distributed and linked to. Please refer to each manuscript for any further copyright restrictions.

Reuse:

Copies of full items can be used for personal research or study, educational, or not-for-profit purposes without prior permission or charge provided that the authors, title and full bibliographic details are credited, a hyperlink and/or URL is given for the original metadata page, and the content is not changed in any way.



**Impact of Trust in Virtual Project Teams: Structural
Equation Modeling (SEM) approach**

Journal:	<i>Construction Innovation: Information, Process, Management</i>
Manuscript ID	CI-03-2023-0039.R1
Manuscript Type:	Research Article
Keywords:	Team Working, Team performance, Trust, Virtual project team, Structural Equation Modelling, Organisation

SCHOLARONE™
Manuscripts

Impact of Trust in Virtual Project Teams: Structural Equation Modeling approach

Abstract

This study focuses on model development to analyse key factors affecting trust in Virtual Project Teams (VPTs). A questionnaire survey was conducted on construction professionals participating in virtual teams. Structural Equation Modelling (SEM) technique was performed to establish the effect of relevant factors on trust-building in VPTs. Team performance is highly affected by trust among the team members. Trust building can be enhanced by improving the quality of team communication, organisation culture, team bonding, and team members' characteristics. The model developed in this study would benefit team productivity and team members' learning in VPTs.

Introduction

Organisations are expanding their dependence on virtual project teams (VPTs) to produce commercial value (Sagar et al., 2022), as well as gather diverse knowledge banks, time and financial savings, and identify economical solutions for collaboration (Gibson & Gibbs, 2006). VPTs have gained significant traction and usage by many major corporations, from a 60% estimate in 2003 (Gibson & Gibbs, 2006; Martins et al., 2004), to 85% in 2016 (Hacker et al., 2019). A major study spanning 100 countries surveyed 3000 managers; it outlines that 40% of the workers were using VPTs for 50% of their work time (Hoch & Dulebohn, 2017). VPTs have been researched consistently and often in information systems, Human Resource Management (HRM), and other disciplines (including the construction domain) for two decades due to significant and growing dependence on information technology (Hacker et al., 2019). However, increased dependence on VPTs has its management issues (Jimenez et al., 2017; Lukić & Vračar, 2018). These issues have not been sufficiently addressed in the current VPTs research and remain unresolved (Hacker et al., 2019). Research also indicates that challenges in trust building directly affect virtual team failure (Kimble, 2011). It has also outlined that trust is a complex experience

1
2
3 for internal and external team members due to various interconnected and dependent
4 participants in VPTs.
5

6 The building sector has reported low levels of productivity and performance due to trust
7 between the client, design team and construction team (Nathaniel & Anthony, 2012). Trust
8 significantly impacts the team's confidence in knowledge sharing within traditional
9 settings and among VPTs (Arif et al., 2015; Sagar et al., 2021). Although a growing body
10 of research addresses virtual teams and the function of trust (Bhat et al., 2017; Sagar et al.,
11 2022), literature on the different variables impacting trust as a single entity in the
12 construction industry is limited. Only a few publications in the past dealt with this issue
13 and were limited to the education, information technology, or manufacturing sector in the
14 United States or Europe. There is a great uptake of VPTs in the construction sector.
15 However, significant challenges need to be explored and addressed due to the infancy of
16 VPTs application in the construction industry. The Middle East attracts professionals from
17 across the globe, making it a multicultural region with professionals from varied countries
18 and backgrounds. The issue of trust in the context of VPTs is a major issue in the Middle
19 East (Zakaria & Yusof, 2020). Therefore, it is crucial to understand trust in virtual project
20 teams (VPTs) from professionals who work across different cultures. The current literature
21 and knowledge on trust in virtual teams within the construction sector is limited (Kaur,
22 2017; Lau & Rowlinson, 2009). As a result, this study aimed to pinpoint the crucial
23 elements contributing to trust in virtual project teams (VPTs) and examine the impact of
24 different factors on trust within virtual teams. The researchers created an analytical trust
25 model to offer practical guidance for managing VPTs in the construction industry.
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43

44 **Literature review**

45 **Trust in VPTs – Construction industry**

46 The construction industry in the United Arab Emirates is worth billions of dollars and
47 accounts for approximately 8% of the country's GDP (Ailabouni, Painting, & Ashton,
48 2009). The delivery of construction projects increasingly relies on virtual teams
49 (Henderson, 2008; Ramalingam et al., 2014; Kaur, 2017; Sagar et al., 2021). It is a
50 combined result of globalisation and multinational teams of consultants working on
51
52
53
54
55
56
57
58
59
60

1
2
3 different construction projects. Research outlines that successful implementation of VPTs
4 requires a comprehensive awareness and outlining of diverse, interlinked and complex
5 challenges that are not otherwise experienced in traditional project teams setup (Hosseini
6 & Chileshe, 2013). While there are multiple challenges in VPTs, trust is the most critical
7 factor influencing the team's performance and productivity (Brahm & Kunze, 2012).
8
9

10
11 There are multiple interlinked procedures, activities and stages in a construction project. It
12 includes procurement processes, detailed design and engineering, project estimation,
13 preliminary engineering, construction, and commission (Sagar et al., 2022). Construction
14 projects are designed, developed and constructed using coordinated information at all
15 project stages. Information management, including sharing and amending designs per
16 requirements, is highly dependent on trust among the team members. Trust develops a
17 willingness to collaborate, which leads to an obligation to share knowledge (Staples &
18 Webster, 2008; Sagar et al., 2021). This obligation would result in the effectiveness of a
19 virtual team (Pangil & Chan, 2014).
20
21
22
23
24
25
26

27 The effectiveness of a virtual project team (VPT) is highly dependent on the competence
28 of its members in delivering work as promised, which is a crucial factor for success and
29 efficiency. The ability of team members to deliver work is also influenced by their level of
30 commitment to the team, which is, in turn, influenced by the level of trust within the team.
31 Trust is also essential for timely and quality information exchange among team members
32 (Jarvenpaa et al., 1998). Therefore, it has become imperative to explore trust within the
33 context of the construction industry and business literature. The successful delivery of
34 construction projects using VPTs depends on the trust, identity and cohesiveness of the
35 team, and they need to be sternly appraised for the effectiveness of VPTs (Sagar et al.,
36 2022; Kaur, 2017).
37
38
39
40
41
42
43
44
45

46 Trust is a major challenge faced by virtual teams (Morrison-Smith & Ruiz, 2020). A large
47 amount of literature emphasizes the significance of trust in virtual team performance
48 (Henttonen & Blomqvist, 2005; Khan, 2012; Malhotra et al., 2007). It is pivotal to team
49 productivity and performance (Kanawattanachai & Yoo, 2002). Trust building to develop
50 and successful and efficient team is also one of the most complex and challenging in
51 multiple dimensions (Kaur, 2017, Sagar et al., 2022). Virtual communication and
52
53
54
55
56
57
58
59
60

1
2
3 international partnerships in a project set-up require trust to be earned by a collaborative
4 approach for teams to perform efficiently (Lurey & Raisingham, 2001). Research indicates
5 that trust and positive relationships between team members result in higher creativity,
6 critical thinking and a productive environment (Reina & Reina, 1999). It also helps to
7 produce higher-quality work (Nemiro et al., 2008).
8
9
10
11

12
13 Kaur (2017) identified five challenges that must be addressed for the effective management
14 of VPTs: (1) Trust (2) Team cohesiveness (3) Communication (4) Team diversity and (5)
15 Leadership. However, trust is crucial for Virtual Project Team managers to deal with
16 challenges since it is core to the VPT function and operation (Lukić & Vračar, 2018). Trust
17 is an essential element that influences VPT's productivity and performance. Different
18 social and physical factors such as face-to-face conversation, cultural diversity, and long
19 distance between project team members deter trust building. Studies have highlighted that
20 trust is a foundation of positive relationships between construction teams and other
21 stakeholders (Kaur, 2017; Hacker et al., 2019). Much literature outlines the importance of
22 trust in relationships between clients, general contractors, subcontractors and suppliers in
23 the construction sector. However, a lack of literature focuses on trust in VPTs (Pinto et al.,
24 2009; Hosseini & Chileshe, 2013). Trust plays a significant role in the performance of
25 virtual team members, as shown in studies by Khan (2012) and Lukić and Vračar (2018),
26 and is crucial for the productivity and efficiency of a team's processes (Lukić & Vračar,
27 2018). The success of virtual project teams in the construction industry depends heavily on
28 building trust, team identity, and cohesiveness, as emphasized by Chen and Messner (2010)
29 and Kaur et al. (2015). Trust serves as the foundation of cross-disciplinary teams' work
30 setups (Zolin et al., 2004). The lack of trust in team members is the main resistance to
31 effective teamwork (Kaur et al., 2015). An extensive analysis of the literature suggests that
32 most of the research on trust focuses on industry, and there is a lack of literature on the
33 construction sector. There isn't convincing literature on VPTs in the construction sector
34 (Kadefors, 2004; Lau & Rowlinson, 2009; Pinto et al., 2009). However, there is compelling
35 work in other sectors, such as I.T sector (Ho & Richardson, 2013) and online societies (Lee
36 et al., 2014). The study aims to focus on this situation and lack of literature in the
37 construction sector.
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Methodology

Research Model and proposed hypotheses

This section describes the literature review, which was extensively done to identify the factors included in the research framework. Research articles from reputed peer-reviewed journals were identified after a broad search based on appropriate keywords. Some existing relevant models helped the researchers to understand the role of trust in the performance of virtual project teams. Subsequently, those models helped provide the different indicators affecting trust in virtual project teams. The indicators have been cited in various research articles, and many researchers have commented on their importance in building trust in a virtual project team, as discussed in the following subsections.

Organizational Culture and Trust in virtual project teams

Project team members' understanding of project objectives and processes is crucial for achieving the organisations' goals (Sagar et al., 2022). Doney et al. (1998) outlined that lack of clarity among team members on project objectives and degree of trust building within an organisation poses a high risk to the team and its members. Thus, trust among team members and a clear understanding of team goals is crucial for successful team planning and delivery (Brahm & Kunze, 2012). Furst et al. (1999) suggested that establishing clear and transparent goals in a project can reduce uncertainty in team performance. They also emphasized that the team selection process and outcome are important factors in a team's success. Amah, Nwuche, & Chukuigwe (2013) pointed out that professionals are members of an organization before becoming team members. Hence, selection criteria govern the character and description of team members. Bell & Kozlowski (2002) suggested that the suitability of people towards a project should manage the organisations and selection of a VPT. Lack of suitability of team members could result in distrust in a team member and their capability. Barkhi et al. (2004) investigated the effect of rewarding team members based on their contribution to team's decision outcomes. They concluded that rewards scheme positively impacted the team members' trust towards the organization.

1
2
3
4
5 Bryant et al. (2009) also recommended that reward and incentive schemes at team and
6 manager levels have a direct and compelling positive effect on the outcome and attitudes
7 of team members in VPTs. Evaluation of a team includes analysing the transparency of
8 outcomes, transparency and honesty in the availability of information and decision-making
9 procedures, and clarity and fairness in team members' treatment at the interpersonal level
10 (Bryant et al., 2009). An honest and impartial team analysis strongly affects team members'
11 confidence in team evaluation, thus increasing their trust in team operation, governance
12 and evaluation. Cohesion acts as a connection agent among team members, and the close
13 operation and communication among the team members highly influence the probability
14 of team success. It also contributes in team building a team. Also, any conflict between
15 team members on task execution and distribution, and process contributes to range of
16 equivalent solutions. It contributes to the efficient achievement of project and
17 organisational goals. Based on this analysis, following hypothesis are proposed:
18
19
20
21
22
23
24
25
26

27 *H1: A positive relationship exists between organisational culture and trust in virtual*
28 *project teams.*
29

30 *H2: Conflict mediates the positive effect of organisational culture on trust.*
31

32 *H3: Cohesion increases the positive effect of organisational culture on trust.*
33
34
35

36 ***Team diversity and trust among virtual project team members.***

37 A team's diversity encompasses diversity in functions, culture, and different problem-
38 solving approaches. Peters and Karren (2009) argued that diversity among team members
39 in virtual projects could result in differences in attitudes, values, and performance, leading
40 to conflicts. Virtual teams with members from diverse backgrounds and cultures are more
41 likely to experience these conflicts than homogenous teams (Jehn, 1995).
42
43
44
45

46 Shachaf (2008) argued that cultural diversity within virtual teams could present additional
47 challenges for leaders and members, including language barriers that can lead to
48 communication difficulties and conflicts. Additionally, Curşeu & Schrujier (2010)
49 presented that, according to the similarity-attraction hypothesis, diversity within a team
50 may lead to an increase in conflict, but can have a negative impact on the development of
51 trust.
52
53
54
55
56
57
58
59
60

Diversity within a team may lead to increased conflict and decreased trust. Research has also shown that team members may view those who share their culture as more trustworthy and feel a stronger sense of belonging with them compared to those who do not share their culture (Zolin *et al.*, 2004). Tsui *et al.* (1992) discovered that psychological attachment among group members is negatively related to diversity within a work unit. Based on these findings, it can be inferred that diversity within a team may obstruct the interactions required for team members to fully invest in the team and each other. As a result, the researchers propose the following hypotheses:

H4: A negative relationship exists between the diversity of team members and trust in virtual project teams.

Communication and trust among virtual project team members

Effective communication is crucial in building trust among team members, especially in virtual project teams where members may be geographically dispersed and have different time zones and holidays (Sagar *et al.*, 2021). The communication process may involve various tools and techniques, and training may be required to ensure that team members can communicate and collaborate effectively. According to Amah *et al.* (2013), it is recommended that managers provide training opportunities to their employees to acquire the necessary skills and experiences to become effective team players. Effective communication, particularly during the early stages of team development, is critical for establishing and sustaining trust, as Anderson *et al.* (2007) emphasised.

The global character of virtual teams can make communication a persistent challenge, resulting in diminished mutual understanding within the team (McDonough, Kahn & Barczak, 2001). This can be exacerbated when team members do not have a shared language and when only some are co-located while others are geographically dispersed (Crampton, 2001). The researchers are proposing the following hypotheses as a result:

H5: A positive relationship exists between communication between team members and trust in virtual project teams.

Team member's characteristics and trust in virtual project teams

1
2
3 Kramer and Lewicki (2010) suggest that initial trust in a relationship may be established
4 based on fundamental factors, but as the relationship develops and team members become
5 more acquainted with each other, trust may depend on the personal attributes of team
6 members. As people gain a deeper understanding of their colleagues, they may form trust
7 or distrust based on their perceived traits. The trust of team members can be influenced by
8 several characteristics, such as their cognitive elements, ability, integrity, and benevolence.
9 These attributes were described by Jarvenpaa et al. (1998) as dyadic trust attributes, which
10 include the trustee's perceived benevolence, integrity, and ability. Benevolence refers to
11 one party's willingness to benefit another, while ability represents the trustor's belief in the
12 trustee's skills to fulfil their obligations as expected.

13 Sagar et al. (2021) argue that capability, honesty, and good intentions are the essential
14 components of trust in virtual teams, which are crucial for different phases of virtual team
15 formation and operation. Similarly, Jarvenpaa et al. (1998) emphasize the importance of
16 team members' abilities, honesty, and good intentions for trust. According to Mukherjee et
17 al. (2012), trustors in virtual teams evaluate the trustee's ability to make positive
18 contributions to the team. In a dynamic and uncertain environment where the ability to
19 respond quickly and adapt is crucial for seizing market opportunities, the trustor must have
20 faith in the trustee's positive intentions towards the relationship, even without a formal
21 agreement or prior commitment.

22 According to Kasper-Fuehrer and Ashkanasy (2001), the absence of formal contracts in
23 virtual teams highlights the significance of benevolence in establishing "organizational
24 trustworthiness." Business ethics and integrity are also crucial in virtual settings to convey
25 trustworthiness. Trust among virtual project team members may be formed cognitively
26 after evaluating their teammates' ability, benevolence, and integrity (Mukherjee et al.,
27 2012). As a result of the strong bond between team members, their traits and characteristics
28 may have a greater impact on the development of trust. The trust level among team
29 members may be higher when they are more competent and have high levels of
30 benevolence and integrity. Based on this, the researchers suggest the following hypotheses:

31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
H6: A positive relationship exists between team member characteristics and trust in virtual project teams.

H7: Cohesion increases the positive effect of team member characteristics on trust.

Conflict on Cohesion relevance on the team in virtual projects

According to Dafoulas and Macaulay (2002) and Kaur (2017), virtual teams may require greater trust to succeed and avoid conflicts compared to traditional, co-located teams. Conflicts within a team can negatively affect both the relationships within the team and task performance (Sagar et al., 2021). Jehn (1995) suggests that differences in personal preferences, values, ideology, and political views among team members can result in relationship conflicts and generate tension, animosity, and annoyance. This, in turn, can decrease the overall cohesion of the team. Conflict based on emotional or interpersonal problems can greatly hinder a team's performance. In teams where the members are highly dependent on each other, this type of conflict is likely to significantly hinder the formation of trust. Amason (1996) suggested that relationship conflict can negatively impact decision-making, team unity, commitment, and decision acceptance. Additionally, it can lead to division, diminished trust, and weakened team relationships. Based on this, the researchers put forward a hypothesis:

H8: The more conflict among virtual team members, the less cohesion among them.

Impact of experience on diversity and communication in virtual projects

Experience is used as a moderating factor. This refers to the time an individual has spent working in virtual project teams and the number of virtual projects they have completed. This is significant because the more time a team spends together, the greater opportunity its members have to interact and form positive relationships, which can positively impact the team's performance (Kaur, 2017). Experience with virtual teams can play a role in reducing conflicts, particularly when team members have diverse backgrounds. This could be because more experienced team members can foster better team cohesion due to their maturity. Furthermore, senior members of the team, who typically possess extensive experience in their field and are responsible for teamwork, are more likely to provide dependable, objective, and trustworthy information (Hwang, 2012).

Trust: Theoretical model

1
2
3 Based on the reviewed literature and proposed hypotheses, it is suggested that positive team
4 traits, communication, diversity, and a favorable organizational culture can enhance trust
5 within virtual project teams in the construction industry. The role of two mediators, conflict
6 and cohesion, and how they affect trust are also considered. The theoretical research model
7 of trust, shown in Figure 1, includes variables that represent the main factors directly
8 influencing trust, with the addition of a moderating variable that was be introduced in the
9 analysis. The main task is to test whether the variables influence trust as hypothesized (H1
10 – H8). Given the inherently complex nature of virtual project teams in the construction
11 sector, the researchers proposed that trust in virtual project teams, as a dependent variable,
12 will increase with the development of positive organizational culture (H1) +ve, team
13 member characteristics (H6) +ve, and degree of communication (H5) +ve. It has been
14 observed that trust is negatively affected by the diversity of team members (H4) -ve. There
15 are two mediators – conflict in the team and cohesion of the team, which should positively
16 influence trust building if properly managed. A careful review of the model led the
17 researcher to identify one prime moderator experience (age) in virtual project teams.
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

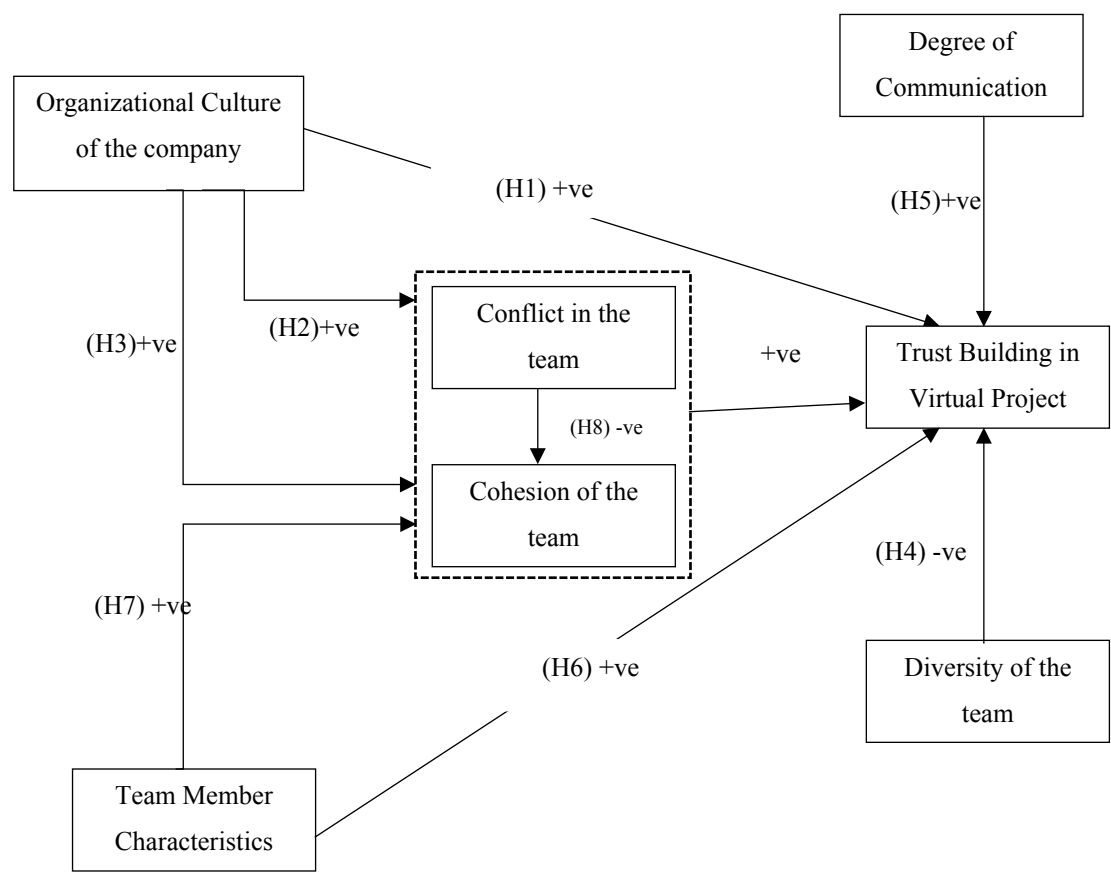


Figure 1: Trust building model in VPTs

(Note: H represent 'hypothesis', +ve – positive relationship, -ve – negative relationship)

Questionnaire Survey

In this study, a survey questionnaire was developed based on a theoretical model incorporating factors identified in previous literature by Kaur (2017). The questionnaire was then pre-tested with seven construction professionals to ensure content validity, following the guidelines by Bhatia and Awasthi (2018), and was subsequently modified based on their feedback. The survey questionnaire, which comprised 25 items across seven constructs, was finalized and is detailed in Table 1. The survey was aimed at professionals who work as either team members or project managers in different construction companies. The email addresses for virtual project team communities were sourced from online directories of construction companies, and the participants were provided with a link to an online questionnaire. The survey was conducted online.

The study recruited virtual project professionals from various construction companies through online directories, such as project managers or team members. These participants were then sent a link to an online survey, which mostly contained closed-ended questions

that required them to choose from predetermined options. The responses were measured using a 5-point Likert scale that ranged from “strongly disagree” to “strongly agree”. Additionally, there were some open-ended questions to gather further information about the participant’s background and job description. The survey was conducted through an online platform. Additionally, online surveys provide a convenient and accessible platform for participants to respond from the comfort of their location without travelling or scheduling appointments (Yun & Trumbo, 2000). Moreover, the anonymity of the respondents in online surveys can also increase their willingness to provide honest and complete answers, potentially leading to higher-quality data (Philbrick et al., 2010).

Table 1: Factors and measurement variables of the research study

<i>Factor name</i>	<i>Variables/ items</i>
Organizational Culture	OrgC1: Clear Objectives and Goals
	OrgC2: Recruitment Strategy
	OrgC3: Rewards
	OrgC4: Team Evaluation
	OrgC5: Availability of Mentor
	OrgC6: Task Interdependence in the organisation
Conflict within the team	Conf1: Conflict in the execution of Task
	Conf2: Conflict in delegation of task
	Conf3: Relationship conflict
	Conf4: Lack of Employee Satisfaction
Characteristics of team members	Char1: Integrity of the team member
	Char2: Benevolence of the team member
	Char3: Propensity to trust
	Char4: Functional diversity of the team
Trust within the team members	Tru1: Relying on the information provided by team
	Tru2: Accepting procedural suggestions from team
Diversity of the team	Div1: Cultural Diversity
	Div2: Differ in Problem Solving Approach

	Div3: Time difference and holidays
Communication of the team	Comm1: Training on core technical skills
	Comm2: Training on personal development and conflict resolution.
Cohesion in the team	Coh1: Cognitive ability of the team
	Coh2: Mutual Respect within the team
	Coh3: Affective (Caring) elements within the team
	Coh4: Technical ability of the team

Data analysis techniques

The main characteristics of the collected data were identified through descriptive statistics, and after cleaning and removing extreme values, 323 responses out of 403 participants were included in the final analysis. Confirmatory factor analysis (CFA) was used instead of exploratory factor analysis (EFA) as the measurement variables had been previously established in research and were expected to align with their respective construct. The reason for this approach was explained by Bhatia and Awasthi (2018), who stated that this method is more appropriate when the measurement variables have already been chosen from a well-established body of literature. Therefore, the researchers used a Structural Equation Modeling (SEM) approach to evaluate the relationship between trust-building and other factors in virtual teams. This method allows for the examination of both latent and observable variables through statistical analysis. A theoretical model must be developed to understand the connection between the key variables involved in trust-building in a virtual team environment to utilise SEM. This required identifying the key factors contributing to trust-building in such a setting. Thus, the initial creation of a theoretical model shows constructs of factors affecting trust-building. SEM is a statistical method that was utilized to test the hypothesis and examine the relationship between trust-building and other variables in a virtual team setting. The approach was previously employed in a study by De Campos et al. (2019). The theoretical model was tested by analyzing the entire system of variables simultaneously to determine the degree of consistency between the hypothesised model and the collected data.

1
2
3 Structural Equation Modelling (SEM) is a statistical method used to analyze the
4 relationships between multiple variables, including both observed and underlying (latent)
5 variables. One advantage of SEM is its ability to account for measurement errors, which
6 can improve the accuracy of the analysis. This study employed SEM to determine if the
7 proposed theoretical model aligns with the collected data, thereby establishing its validity.
8 The trust model's validity and reliability were assessed through various tests, which
9 provided valuable insights. The Comparative Fit Index (CFI) and Non-Normed Fit Index
10 (NNFI) were used to evaluate how well the theoretical model aligned with the collected
11 data. On the other hand, the Root Mean Square Error of Approximation (RMSEA)
12 measured the level of error present in the model's fit. These evaluations were crucial in
13 determining the effectiveness of the proposed trust model and how it accurately represents
14 the relationships between variables in the real world.

15
16 The validity of the proposed trust model was analyzed using SEM. The SEM was used to
17 evaluate the measurement and structural models. The model's accuracy was verified by
18 comparing the Average Variance Extracted (AVE) of each component with the variance
19 due to measurement error. To ensure validity, the model required an AVE greater than 0.50
20 (Fornell & Larcker, 1981) and a comparison between the square root of the AVE and
21 correlations with other constructs in the model to confirm discriminant validity (Fornell &
22 Larcker, 1981).

23 24 **Results and discussion of findings**

25 26 **Descriptive statistics**

27 According to the survey results, the majority of respondents were team members,
28 comprising 73.7% of the total, while the remaining 26.3% were team leaders. A large
29 proportion of participants had higher education, with 60.1% holding a Bachelor's degree,
30 31.6% holding a Master's degree, and only 8.4% having a diploma. Furthermore, the
31 respondents had considerable experience working in virtual project teams, with an average
32 of 6.9 years.

33 34 **Measurement Model**

35 The measurement model's validity was evaluated through three methods: reliability,
36 convergent validity, and discriminant validity. Composite reliability values were used to
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

measure reliability, with a minimum threshold of 0.7 considered acceptable, according to Fornell and Larcker (1981). The results presented in Table 2 demonstrated that all composite reliability values ranged from 0.716 to 0.795, indicating that they are higher than the minimum acceptable threshold. To evaluate discriminant validity, the study used Fornell and Larcker's (1981) approach of comparing each construct's square root of the Average Variance Extracted (AVE) with the correlations between that construct and other constructs in the model. The results in Table 2 indicated that the square root of AVE for each construct was greater than the correlation values between that construct and other constructs in the model. This suggests that the discriminant validity was acceptable for all constructs.

Table 2: Validity and Reliability Values

	CR	Communication	OrgCul	Conflict	TeamMember Char	Trust	Diversity	Cohesion
Communication	0.795	0.818						
OrgCul	0.743	0.571	0.752					
Conflict	0.731	0.179	0.304	0.751				
Team member Char	0.758	0.148	0.135	0.063	0.742			
Trust	0.783	0.346	0.383	0.425	0.285	0.721		
Diversity	0.716	0.038	0.059	-0.043	0.298	0.200	0.767	
Cohesion	0.726	0.448	0.677	0.558	0.398	0.570	0.144	0.756

In order to ensure that the scales were measuring the same concept accurately and reliably, it was important to establish their convergent validity. This was done by checking that the Average Variance Extracted (AVE) value for each construct was greater than the measurement error variance for that particular construct. This was done by comparing the AVE to a benchmark of 0.50. The results in Table 3 showed that the AVE for each of the constructs ranged from 0.52 to 0.67, indicating that convergent validity was established. The results of the analysis support the convergent validity of the scales. The standardised

factor loadings of the items were examined to verify the convergent validity of the measurement variables. This process helps to confirm that the measurement variables are measuring the intended concept and not some other related or unrelated concept. Ensuring convergent validity is crucial because it confirms that the measurement variables accurately measure the same concept with reliability. The standardised loading value of each measurement variable was evaluated to ensure quality, requiring a value equal to or greater than 0.5, according to Kock (2014). All of the statistical results were significant, and any items that did not meet the required statistical standards, including OrgC6, Conf2, Conf4, Div3, and Coh4, were removed from the analysis. The Cronbach alpha (α) value was used to assess the reliability of each construct, and all of the Cronbach alpha values exceeded the 0.7 threshold value established by Nunnally (1978).

Table 3: Loading values, cronbach alpha (α), and AVE values

Construct	Standardized Loadings	Cronbach Alpha (α)	Average Variance Extracted (AVE)
Organizational Culture			
OrgC1	0.64	0.753	0.567
OrgC2	0.59		
OrgC3	0.63		
OrgC4	0.61		
OrgC5	0.55		
Conflict within the team		0.713	0.564
Conf1	0.60		
Conf3	0.75		
Team member characteristics		0.766	0.551
Char1	0.89		
Char2	0.67		
Char3	0.53		
Char4	0.54		
Trust		0.703	0.520
Tru1	0.69		
Tru2	0.76		
Diversity		0.700	0.588
Div1	0.98		
Div2	0.50		
Communication		0.757	0.669
Comm1	0.63		
Comm2	0.97		
Cohesion		0.757	0.573
Coh1	0.80		
Coh2	0.63		

Coh3	0.62		
------	------	--	--

Structural Model

The adequacy of a structural model is determined by its fit indices, which determine whether the model is acceptable or not. In this study, the model is deemed a good fit since all the goodness-of-fit indices meet the recommended thresholds. For instance, CMIN/DF (Minimum discrepancy) value, which should range from 3 to 1 (Carmines & McIver, 1981), is 1.882. Also, the Goodness of fit Index (GFI) is 0.904 (Hu & Bentler, 1995), Root Mean Square Error of Approximation (RMSEA) records 0.052 (MacCallum et al. 1996), Comparative Fit Index (CFI) is 0.913 (Raykov, 2005), which are all indications of good fit. It is possible to infer that the findings of this study were stable. As a result, the SEM model suited the data well, and the conceptual framework discussed in the previous section was validated. The final SEM model is presented in Figure 2. The justification for this paradigm is described in the section that follows.

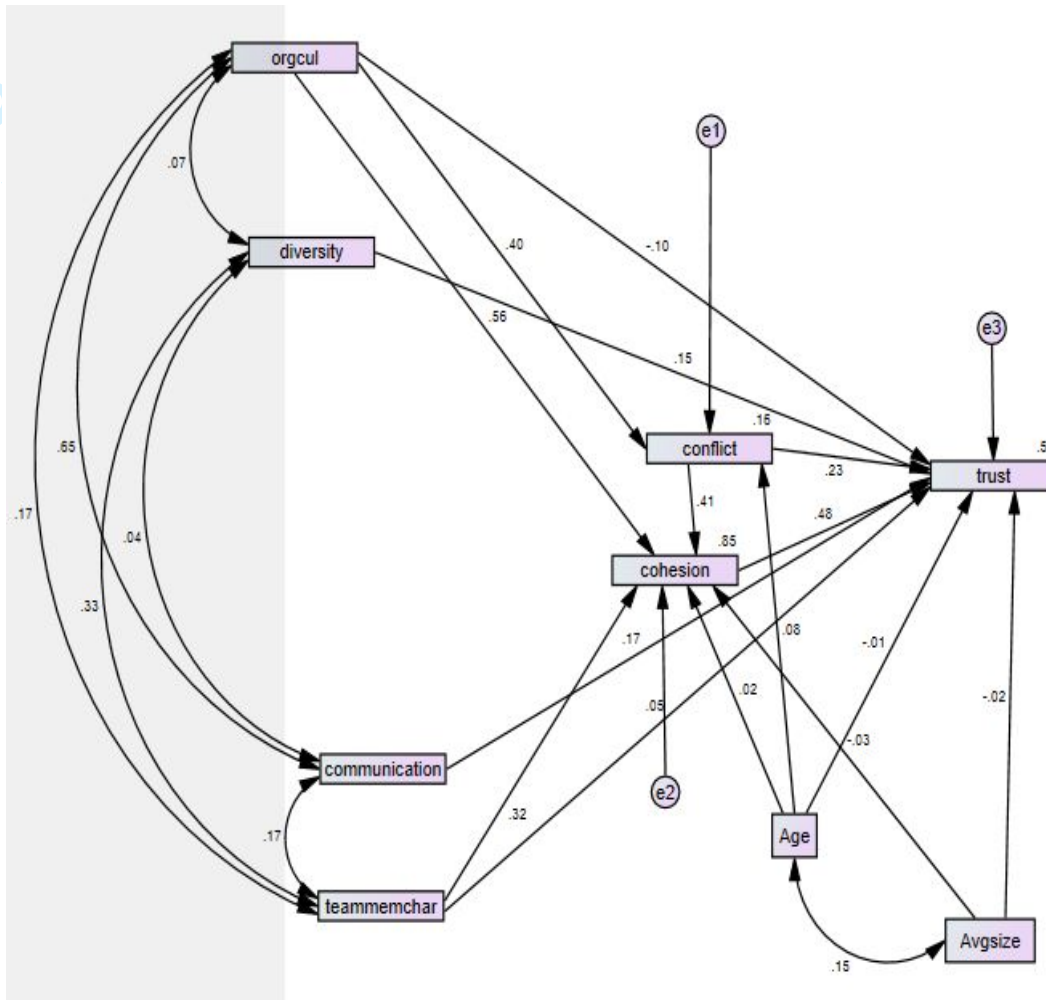


Figure 2: Final SEM Model of Trust

Discussion on Model of Trust and hypothesis testing

The model shown in Figure 2 constitutes various factors affecting trust positively or negatively. As shown in **Table 4**, after the SEM analysis was conducted, 3 out of the 11 hypotheses were rejected. The discussion of the different relationships between the variables was based on the results of the statistical data analysis.

Table 4: Results of the hypothesis test.

Hypothesis Number	Statement of Hypothesis	Coefficient	p-values	Results
H1	A positive relationship exists between organizational culture and trust in virtual project teams.	0.065	0.000	Supported

H2	<i>Conflict increases the positive effect of organizational culture on trust.</i>	0.243	0.001	Supported
H3	<i>Cohesion increases the positive effect of organizational culture on trust.</i>	0.464	0.001	Supported
H4	<i>A negative relationship exists between diversity of team members and trust in virtual project teams.</i>	0.000	0.991	Not supported; came out to be positive relationship
H5	<i>A positive relationship exists between communication of team members and trust in virtual project teams.</i>	0.168	0.004	Supported
H6	<i>A positive relationship exists between characteristics of team member on trust in virtual project teams.</i>	0.149	0.001	Supported
H7	<i>Cohesion increases the positive effect of team member characteristics on trust.</i>	0.149	0.001	Supported, full mediation
H8	<i>The more conflict among virtual team members, the less is the cohesion among them.</i>	0.203	0.001	Supported

The result of hypothesis 1 verification

The company's organisational culture encompasses various components such as setting clear goals and objectives, outlining a recruitment strategy, providing incentives to team members, ensuring unbiased performance appraisals, offering mentorship programs to employees, and the team's level of interdependence of tasks. Research has shown that team members committed to the team's objectives, especially long-term goals critical to the team's overall success, are more likely to pursue the team's objectives actively (Sagar et al., 2021; Kaur, 2017). Thus, it is crucial to establish a clear understanding of the team's objectives and goals during the planning stage to foster trust among team members (Brahm & Kunze, 2012). Choosing team members also holds significant importance in determining

1
2
3 a team's success. Amah et al. (2013) proposed that individuals become members of
4 organizations before they join teams, indicating that the organization's selection criteria
5 can affect the type of individuals who are chosen to be part of the team.
6
7

8 Additionally, Barkhi et al. (2004) discovered in their research that rewarding team
9 members based on the results of their individual or team decisions could improve team
10 members' trust in the organization. It is crucial to have fairness in team evaluations to
11 encourage trust and motivation among team members. When team members perceive that
12 the evaluation process is just and unbiased, they tend to be more dedicated to the team's
13 objectives and less inclined to resist change (Bryant et al., 2009). Mentoring and coaching
14 team members can also increase their skills and improve their performance, leading to a
15 more effective and cohesive team (Sagar et al., 2021).
16
17
18
19
20
21
22

23 ***The result of hypotheses 2 and 3 verification***

24 The study's findings align with previous research on the subject and support the idea that
25 team members dedicated to the team and its goals are more likely to cooperate in pursuit
26 of organizational objectives. This positive correlation between trust, collaboration, and
27 goal attainment can be further enhanced when teams work through task-related conflicts
28 constructively and transparently, ultimately contributing to the development of mutual trust
29 among team members.
30
31
32
33
34

35 Researchers have shown that conflicts arising from tasks, processes, and relationships can
36 harm the effectiveness of remote teams (Hinds & Bailey, 2003; Sagar et al., 2021). While
37 some conflicts can be beneficial, it is essential to effectively manage conflicts that have a
38 negative impact on team results and organizational objectives. In virtual teams, active
39 conflict management and early conflict detection may be crucial (Kaur, 2017). Process
40 conflict is a type of conflict that arises from disagreement or differences in opinions about
41 how work should be done. On the other hand, relational conflict is typically caused by a
42 lack of understanding about personal situations or differences among team members
43 (Wakefield, Leidner, & Garrison, 2008). Organizations must address relational and process
44 conflict promptly and effectively to maintain a positive organizational culture and improve
45 team performance. Addressing conflict can help to create a culture of trust, cooperation,
46 and commitment to the organization's objectives, and it can help to foster positive
47 outcomes and achieve the team's objectives.
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3 The study's findings indicate that virtual teams are susceptible to performance and team
4 dynamics challenges, including low cohesion and trust. In traditional teams, high levels of
5 team cohesion, which is the sense of unity and shared purpose among team members, can
6 facilitate cooperation and help teams achieve common goals (Brahm & Kunze, 2012).
7
8 Virtual teams may face challenges in building trust and avoiding misunderstandings due to
9 the lack of face-to-face interaction (Blackburn et al., 2003). To address these issues, virtual
10 teams can use communication and collaboration technologies, like video conferencing and
11 instant messaging, to enhance interpersonal interactions and facilitate regular and
12 transparent communication. Effective communication and cooperation among virtual team
13 members can promote trust and strengthen team cohesion. Strong trust among team
14 members can help reduce the potential negative impacts of limited interaction and virtual
15 communication on team cohesion (Kaur, 2017). A high trust climate can foster a sense of
16 shared identity and purpose, leading to more effective communication and collaboration
17 among team members and, ultimately, better organizational outcomes.
18
19
20
21
22
23
24
25
26
27
28

29 ***The result of Hypothesis 4 verification***

30
31 The data analysis revealed that diversity did not negatively impact trust levels in virtual
32 teams operating in the construction sector. This could be attributed to the fact that these
33 teams may include members from various cultural backgrounds, leading to an environment
34 that encourages trust through enhanced comprehension and respect of differing views and
35 work styles. Additionally, it is possible that the virtual nature of the teams, with its
36 increased focus on communication and collaboration, has helped to mitigate any potential
37 negative effects of diversity on trust. Overall, virtual teams in the construction sector can
38 effectively manage diversity to promote trust and positive outcomes for the organization.
39
40
41
42
43
44

45
46 However, the data collected from experts as part of this research showed that diversity can
47 actually enhance a team's trust. Teams comprising individuals from different backgrounds
48 and with various levels of expertise and experience can benefit from this diversity. Despite
49 this, Peters & Karren (2009) noted that diversity within a team could sometimes result in
50 distrust due to differences in attitudes, values, and performance among team members.
51 Research data suggests that diversity can foster trust among team members. Teams with
52
53
54
55
56
57
58
59
60

1
2
3 members from different backgrounds or cultures can benefit from their varying
4 perspectives, skills, and experiences. Although differences among team members can
5 sometimes cause conflicts, these can be overcome by the team's collective ability to
6 understand and respect each other's differences. On the other hand, people are more likely
7 to trust others who share similar characteristics and values, which is why trust is more
8 prevalent in homogeneous teams. Diversity among team members can provide an
9 opportunity for mutual learning and trust-building through understanding and cooperation,
10 as emphasized by Costa (2003).
11
12
13
14
15
16
17

18 ***The result of Hypothesis 5 verification***

19
20 The findings of the study indicate that establishing and sustaining trust among members of
21 virtual teams is closely linked to effective communication. The relationship between
22 communication and trust-building is statistically significant and underscores the crucial
23 role that efficient and regular communication practices play in virtual team settings. The
24 findings of Sagar et al. (2021) support that improved communication leads to increased
25 trust among virtual team members, further emphasizing communication's critical role in
26 virtual team performance and success. As per the findings of Amah et al. (2013), offering
27 training programs to employees is a useful method for managers to enhance team
28 performance. These training sessions can aid in building the necessary skills required to
29 work collaboratively within a team and create a sense of achievement and contentment
30 among employees. Potential topics for the training program may involve coaching,
31 communication, conflict resolution, negotiation, and problem-solving.
32
33
34
35
36
37
38
39
40
41

42 ***The result of hypothesis 6 verification***

43
44 The analysis of Hypothesis 6 showed that certain team members' characteristics could
45 positively impact trust development in a team. Virtual teams often consist of individuals
46 with diverse qualities, including skill level, honesty, kindness, expertise, dependability, and
47 professional conduct. According to Kramer and Lewicki (2010), trust in virtual teams may
48 start out being based on basic factors. Still, as the relationship develops and team members
49 better understand each other, they may form trust or distrust based on their individual
50 characteristics. Additionally, Kramer & Lewicki (2010) suggest that trust in virtual teams
51
52
53
54
55
56
57
58
59
60

1
2
3 may depend on the competence of team members. Competence refers to a team member's
4 ability to perform tasks effectively and efficiently. Furthermore, the results of Sagar et al.
5 (2021) indicate that reliability, professionalism, and other related characteristics are also
6 important components that can positively impact trust in virtual teams. These findings
7 suggest that team members' characteristics are crucial in developing trust among virtual
8 teams. Trustworthiness is not only based on individual skills but also on personal qualities.
9
10
11
12
13
14

15 ***The result of hypothesis 7 verification***

16 The analysis revealed that Hypothesis 7 was supported, indicating that team cohesion
17 positively affects the association between team member characteristics and trust. The
18 findings suggest that trust is primarily influenced by the cognitive aspects of team member
19 characteristics, such as their competency, professional ethics and constancy, rather than the
20 affective components like care and emotional connection. These findings align with
21 Kanawattanachai and Yoo's (2002) and Sagar et al. (2021) research. According to
22 Nakayama et al. (2006), trust is associated with competency, loyalty, and openness.
23 Besides having favourable qualities in team members, team cohesion also plays a
24 significant role in trust building. When a team has a tight-knit bond and a strong sense of
25 unity, the impact of team member characteristics on building trust is expected to be more
26 potent.
27
28
29
30
31
32
33
34
35
36
37

38 ***The result of hypothesis 8 verification***

39 The statistical analysis results showed that this hypothesis was supported, and the literature
40 also supports this idea. The findings from the statistical analysis support the hypothesis,
41 which is in line with previous research. Conflicts arise from perceived incompatibilities or
42 disagreements among team members. Dafoulas and Macaulay (2002) and Kaur (2017)
43 have noted that virtual teams require a higher level of trust to operate effectively and
44 prevent delays and conflicts compared to traditional, co-located teams. Team members play
45 a crucial role in a team by contributing through both social interactions and task-related
46 activities. When there are incompatible interpersonal dynamics among team members, it
47 can lead to relationship conflict, which includes tension, animosity, and annoyance. This
48 can negatively impact team cohesion and trust in highly interdependent groups. (Jehn,
49
50
51
52
53
54
55
56
57
58
59
60

1995; Sagar et al., 2021). In teams where conflict is prevalent, there is a risk of reduced trust and cohesion among team members. If such conflicts are not managed appropriately, they can damage relationships and hinder learning, resulting in a lack of trust. The relationship between conflict and cohesion is inverse, indicating that as conflict increases, cohesion decreases. It is essential to effectively address and manage conflicts to sustain positive relationships and maintain team cohesion.

The result of moderating effect of experience

The study's findings support the notion that individuals with more experience working in virtual project teams are better equipped to handle diversity and communication challenges, reducing conflicts' negative impact. This aligns with previous research, which has demonstrated that experience and expertise can assist individuals in navigating the difficulties of virtual work and developing stronger relationships with their team members (Kong et al., 2016; Xiong et al., 2018). These results have significant implications for organizations seeking to establish and manage virtual project teams, as they indicate that prioritizing the recruitment of experienced individuals may be advantageous. Additionally, it appears that increasing experience in virtual teams can lead to increased maturity and improved cohesion among team members. It seems that gaining experience working in or leading virtual teams, culturally diverse ones, can improve cohesion and trust within a team. Developing effective communication practices and sharing experiences and goals can also help build strong team relationships. Azimi et al. (2011) suggest that certain measures can be taken to optimize the contributions of seasoned team members across multiple projects. Cultivating expertise and fostering strong bonds among team members can promote cohesiveness and triumph in virtual teams.

Implications of Model of Trust

The trust model created through Structural Equation Modeling (SEM) has significant implications. Firstly, it highlights the significance of effective communication in building trust within virtual project teams. To enhance communication and trust among virtual team members, it is recommended to use suitable communication tools and strategies, provide

1
2
3 training on conflict resolution and interpersonal skills, and improve problem-solving
4 techniques. Weak communication within a team can lead to a lack of mutual
5 comprehension and hinder overall team understanding.
6
7

8 Second, having diversity among team members can contribute to building trust within the
9 team. This is likely due to the diverse team members bringing different skills and
10 alternative solutions to the tasks. Furthermore, a well-defined and structured organizational
11 culture that communicates objectives and expectations can enhance trust among team
12 members. However, policy ambiguity, unfair evaluation methods, and unstructured reward
13 systems can lead to a lack of trust among team members. Therefore, management needs to
14 establish a structured approach to the company's organizational culture to foster trust
15 among team members. Third, organizations should consider team members' previous
16 experiences and expertise in virtual team settings. Individuals who have previous
17 experience working in virtual teams may be better equipped to handle the challenges that
18 come with virtual collaboration and have a positive influence on team performance.
19 Additionally, a diverse team with varying backgrounds, viewpoints, and abilities can bring
20 new and creative ideas to the project. Still, it is crucial to manage diversity effectively to
21 reduce the potential for conflict. In the end, selecting the appropriate team members and
22 ensuring their effective management and communication can play a crucial role in the
23 success of virtual projects.
24
25
26
27
28
29
30
31
32
33
34
35

36 Fourth, teams consisting of individuals with diverse cultural and functional backgrounds
37 may encounter disputes, particularly regarding their relationships. Such conflicts,
38 stemming from personal ego issues, can diminish the trust shared among team members.
39 Conversely, conflicts arising from the team's tasks can be advantageous, as they foster
40 constructive discussions and encourage examining novel solutions to challenges.
41 Nonetheless, the team must regulate the occurrence of these conflicts to prevent them from
42 becoming excessive and interfering with the team's overall productivity. Fifth, assembling
43 a well-rounded team with a diverse range of individuals is vital. This can facilitate more
44 robust connections and trust between team members. When team members believe in each
45 other's abilities and collaborate effectively, it can lead to enhanced knowledge sharing and
46 prompt project completion. Furthermore, incorporating experienced team members can
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3 decrease conflicts, improve information exchange, and refine team communication,
4 fostering overall team cohesiveness and success.
5
6

7 **Conclusion**

8
9 This study aimed to explore interrelationships between trust and various factors that
10 enhance VPTs in the construction industry. Virtual teams consist of individuals from
11 diverse cultural backgrounds and countries working together on various projects. The
12 research focuses on multidisciplinary VPTs and seeks to comprehend the factors that
13 impact their effectiveness. By examining existing literature, it was discovered that the
14 performance of virtual teams is heavily influenced by the level of trust established among
15 team members. The study identified various factors that can impact the trust level within
16 virtual project teams and introduced a model to evaluate the effect of these factors on trust.
17 The final SEM supports the hypothesized positive interrelationships between trust and
18 organizational culture, team diversity, degree of communication and team members'
19 characteristics. Conflict within the team behaves in two different ways. First, the task
20 conflict brings more discussions and different perspectives to the problem; hence, it helps
21 build trust in team members' capabilities towards achieving the company's goal. Second,
22 if the conflicts result in relationship controversy, it will affect the bonding of the team
23 members as it leads to ego and hence affects trust building. Cohesion of the team helps in
24 building trust among team members. The more bonding the team members are, the less
25 conflicts will occur.
26
27

28
29 The trust model developed in this research, can provide useful guidance to construction
30 management professionals who aim to cultivate trust among members of virtual teams. It
31 underscores essential trust-related themes that senior management and project managers
32 should consider when building and managing virtual project teams.
33
34

35
36 This study's investigation of the critical factors that influence the success or failure of
37 virtual project teams in the construction sector adds to the current understanding of this
38 topic. Previously, such information was not available specifically in the construction
39 industry context. The findings of this study are expected to draw the interest of
40 professionals and policymakers in this field. In particular, project managers can benefit
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3 from these research insights, which offer guidance on improving team cooperation and
4 performance in virtual teams, leading to increased individual learning.
5
6
7

8 9 **References**

10
11
12
13 Ailabouni, N., Painting, N., & Ashton, P. (2009). Factors affecting employee productivity
14 in the UAE construction industry. *25th Annual ARCOM Conference*, (September), 555–
15 564.
16
17

18 Amah, E., Nwuche, C. A., & Chukuigwe, N. (2013). Result Oriented Target Setting and
19 Leading High Performance Teams. *Industrial Engineering Letters Wwww.iiste.org*, 3(9),
20 47–60.
21
22

23 Amason, A. C. (1996). Distinguishing the effects of functional and dysfunctional conflict
24 on strategic decision making: Resolving a paradox for top management teams. *Academy*
25 *of management journal*, 39(1), 123-148.
26
27

28 Anderson, A. H., McEwan, R., Bal, J., & Carletta, J. (2007). Virtual team meetings: An
29 analysis of communication and context. *Computers in Human Behavior*, 23(5), 2558-
30 2580.
31
32
33

34 Arif, M., Mohammed, A.-Z. & Aman Deep, G. (2015). Understanding knowledge sharing
35 in the jordanian construction industry. *Construction Innovation*, 15(3), 333-354.
36
37

38 Azimi Lolaty, H., Ashktorab, T., Bagheri Nesami, M., & Bagherzadeh Ladari, R. (2011).
39 Experience of professional communication among nurses working in educational
40 hospitals: A phenomenological study. *Journal of Mazandaran university of medical*
41 *sciences*, 21(85), 108-125.
42
43
44

45 Barkhi, R., Jacob, V. S., & Pirkul, H. (2004). The influence of communication mode and
46 incentive structure on GDSS process and outcomes. *Decision Support Systems*, 37(2),
47 287-305.
48
49

50 Bell, B., & Kozlowski, S. (2002). A typology of virtual teams implications for effective
51 leadership. *Group & Organization Management*, 27(1), 14–49.
52
53

54 Bhat, S. K., Pande, N., & Ahuja, V. (2017). Virtual team effectiveness: An empirical study
55 using SEM. *Procedia Computer Science*, 122, 33-41.
56
57
58
59
60

- 1
2
3 Bhatia, M. S., & Awasthi, A. (2018). Assessing relationship between quality management
4 systems and business performance and its mediators: SEM approach. *International*
5 *Journal of Quality & Reliability Management*, 35(8), 1490-1507
6
7
8
9 Brahm, T., & Kunze, F. (2012). The role of trust climate in virtual teams. *Journal of*
10 *Managerial Psychology*, 27(6), 595–614.
11
12 Bryant, S. M., Albring, S. M., & Murthy, U. (2009). The effects of reward structure, media
13 richness and gender on virtual teams. *International Journal of Accounting Information*
14 *Systems*, 10(4), 190-213.
15
16 Carmines, E.G. & McIver, J.P. (1981). Analyzing models with unobserved variables.
17 Carmines, E.G. & McIver, J.P. (1981). Analyzing models with unobserved variables. in
18 Bohrnstedt, G.W. & Borgatta, E.F. [Eds.] *Social measurement: Current issues*. Beverly
19 Hills: Sage.
20
21
22
23
24
25 Chatfield, A. T., Shlemoon, V. N., Redublado, W., & Darbyshire, G. (2014). Creating
26 Value through Virtual Teams: A Current Literature Review. *Australasian Journal of*
27 *Information Systems*, 18(3). <https://doi.org/10.3127/ajis.v18i3.1104>
28
29
30
31
32 Chen, C. & Messner, J. (2010). A recommended practices system for a global virtual
33 engineering team. *Architectural Engineering and Design Management*, 6, 207-221.
34
35 Costa, A. (2003). Work team trust and effectiveness. *Personnel Review*, 32: 605-622.
36 doi:10.1108/00483480310488360
37
38
39 Crampton, C. D. (2001). The mutual knowledge problem and its consequences for
40 dispersed collaboration. *Organization science*, 12(3), 346-371.
41
42 Curşeu, P. L., & Schruijer, S. G. (2010). Does conflict shatter trust or does trust obliterate
43 conflict? Revisiting the relationships between team diversity, conflict, and trust. *Group*
44 *Dynamics: Theory, Research, and Practice*, 14(1), 66.
45
46
47 Dafoulas, G., & Macaulay, L. (2002). Investigating cultural differences in virtual software
48 teams. *The Electronic Journal of Information Systems in Developing Countries*, 7(1), 1-
49 14.
50
51
52 de Campos, E. A. R., Resende, L. M., & Pontes, J. (2019). Barriers, external aspects and
53 trust factors in horizontal networks of companies: a theoretical propos 1 for the
54
55
56
57
58
59
60

1
2
3 construction of a model for evaluation of trust. *Journal of Intelligent Manufacturing*,
4 30(4), 1547-1562.

5
6 Doney, P.M., Cannon, J.P., et al. (1998). Understanding the Influence of National Culture
7 on the Development of Trust. *Academy of Management Review* 23(3); 601-620.

8
9 Fornell, C., & Larcker, D. F. (1981). Structural equation models with unobservable
10 variables and measurement errors. *Journal of Marketing Research*, 18, 39–50.

11
12 Furst, S., Blackburn, R., & Rosen, B. (1999). Virtual team effectiveness : a proposed
13 research agenda. *Information Systems Research*, 9, 249–270.

14
15
16
17
18 Gibson, C. B., & Gibbs, J. L. (2006). Unpacking the Concept of Virtuality: The Effects of
19 Geographic Dispersion, Electronic Dependence, Dynamic Structure, and National
20 Diversity on Team Innovation. *Administrative Science Quarterly*, 51(3), 451–495.

21
22
23
24 Hacker, J. V., Johnson, M., Saunders, C., & Thayer, A. L. (2019). Trust in virtual teams:
25 A multidisciplinary review and integration. *Australasian Journal of Information
26 Systems*, 23, 1-36

27
28
29
30 Henderson, L.S. (2008).The impact of project managers' communication competencies:
31 Validation and extension of a research model for virtuality, satisfaction, and
32 productivity on project teams, *Project Management Journal*, 39(2), 48-59.

33
34
35
36 Henttonen, K., Blomqvist, K., (2005). Managing distance in a global virtual team: the
37 evolution of trust through technology-mediated relational communication. *Strategic
38 Change* 14, 107–119.

39
40
41 Hinds, P. J., & Bailey, D. E. (2003). Out of sight, out of sync: Understanding conflict in
42 distributed teams. *Organization science*, 14(6), 615-632.

43
44
45
46 Ho, S., & Richardson, A. (2013). Trust and distrust in open source software development.
47 *Journal of Computer Information Systems*, 84–93.

48
49
50
51 Hoch, J. E., & Dulebohn, J. H. (2017). Team personality composition, emergent leadership
52 and shared leadership in virtual teams: A theoretical framework. *Human Resource
53 Management Review*, 27(4), 678–693.

- 1
2
3 Hosseini, M. R & Chileshe, N. (2013). Global Virtual Engineering Teams (GVETs): A
4 fertile ground for research in Australian construction projects context. *International*
5 *Journal of Project Management*, 31(8), 1101-1117.
6
7
8 Hu, L.-T., & Bentler, P. (1995). Evaluating model fit. In R. H. Hoyle (Ed.), *Structural*
9 *Equation Modeling. Concepts, Issues, and Applications* (pp. 76-99). London: Sage.
10
11
12
13 Hwang, M. I. (2018). Relationship between teamwork and team performance: Experiences
14 from an ERPsim competition. *Journal of Information Systems Education*, 29(3), 157-
15 168.
16
17
18
19 Jarvenpaa, S. L., Knoll, K., & Leidner, D. E. (1998). Is Anybody Out There? Antecedents
20 of Trust in Global Virtual Teams. *Journal of Management Information Systems*, 14(4),
21 29–64.
22
23
24 Jarvenpaa, S. L., Shaw, T. R., & Staples, D. S. (2004). Toward contextualized theories of
25 trust: The role of trust in global virtual teams. *Information systems research*, 15(3), 250-
26 67.
27
28
29 Jehn, K. A. (1995). A multimethod examination of the benefits and detriments of
30 intragroup conflict. *Administrative science quarterly*, 256-282.
31
32
33
34 Jimenez, A., Boehe, D. M., Taras, V., & Caprar, D. V. (2017). Working Across
35 Boundaries: Current and Future Perspectives on Global Virtual Teams. *Journal of*
36 *International Management*, 23(4), 341–349.
37
38
39
40 Kadefors, A. (2004). Trust in project relationships—inside the black box. *International*
41 *Journal of Project Management*, 22(3), 175–182.
42
43
44
45 Kanawattanachai, P., & Yoo, Y. (2002). Dynamic nature of trust in virtual teams. *The*
46 *Journal of Strategic Information Systems*, 2(10), 42–58.
47
48
49 Kasper-Fuehrera, E. C., & Ashkanasy, N. M. (2001). Communicating trustworthiness and
50 building trust in interorganizational virtual organizations. *Journal of management*,
51 27(3), 235-254.
52
53
54
55
56
57
58
59
60

- 1
2
3 Kaur, S. (2017). Model for assessment of trust within VPTs of construction sector in the
4 Middle East (Doctoral dissertation, University of Salford).
5
6
7
8 Kaur, S., Arif, M. & Akre, V. (2015). *Factors affecting Trust in Virtual Project Teams in*
9 *Construction Sector in Middle East*. in 12th Post-Graduate Research Conference 2015,
10 Media City U.K., 10-12 June 2015, pp 262- 276.
11
12
13
14 Khan, M.S., (2012). Role of trust and relationships in geographically distributed teams:
15 exploratory study on development sector. *International Journal of Networking and*
16 *Virtual Organisations*, 10, 40–58.
17
18
19
20 Kimble, C. (2011). Building effective virtual teams: How to overcome the problems of
21 trust and identity in virtual teams. *Global Business and Organizational Excellence*,
22 30(2), 6–15.
23
24
25 Kock, N. (2014). Advanced mediating effects tests, multi-group analyses, and
26 measurement model assessments in PLS-based SEM. *International Journal of e-*
27 *Collaboration*, 10(3),1-13.
28
29
30 Kramer, R. M., & Lewicki, R. J. (2010). Repairing and enhancing trust: Approaches to
31 reducing organizational trust deficits. *Academy of Management annals*, 4(1), 245-277.
32
33
34
35 Lau, E., & Rowlinson, S. (2009). Interpersonal trust and inter firm trust in construction
36 projects. *Construction Management and Economics*, 27(6), 539–554.
37
38
39 Lee, H., Ahn, H., Kim, H., & Lee, J. (2014). Comparative Analysis of Trust in Online
40 Communities. *Procedia Computer Science*, 31(ITQM 2014), 1140–1149.
41 doi:10.1016/j.procs.2014.05.370
42
43
44 Lipnack, J., & Stamps, J. (1997). *Virtual Teams: Reaching Across Space, Time, and*
45 *Organizations with Technology*, John Wiley & Sons, Inc., New York, 1997
46
47
48 Lukić, J. M., & Vračar, M. M. (2018). Building and nurturing trust among members in
49 VPTs. *Strategic Management-International Journal of Strategic Management and*
50 *Decision Support Systems in Strategic Management*, 23(3), 010-016.
51
52
53
54 Lurey, J., & Raisinghani, M. (2001). An empirical study of best practices in virtual teams.
55 *Information & Management*, 38, 523–544.
56
57
58
59
60

- 1
2
3 MacCallum, R. C. & Austin, J. T. (2000). Applications of structural equation modeling in
4 psychological research. *Annual Review of Psychology*, 51, 201-226.
- 5
6 MacCallum, R.C., Browne, M.W., and Sugawara, H., M. (1996), "Power Analysis and
7 Determination of Sample Size for Covariance Structure Modeling," *Psychological*
8 *Methods*, 1 (2), 130-49
- 9
10
11
12 Malhotra, A., Majchrzak, A., Rosen, B. (2007). Leading Virtual Team. *Academy of*
13 *Management Perspectives*, 2, 60 -69.
- 14
15
16
17 Martins, L. L., Gilson, L. L., & Maynard, M. T. (2004). Virtual Teams: What Do We Know
18 and Where Do We Go From Here? *Journal of Management*, 30(6), 805–835.
- 19
20
21
22 McDermott, P., Khalfan, M., & Swan, W. (2005). Trust in construction projects. *Journal*
23 *of Financial Management of Property and Construction*, 10(1), 19–32.
- 24
25 Mcdonough, E.F., K.B. Kahn and G. Barczak, 2001. An investigation of the use of global,
26 virtual, and collocated new product development teams. *The Journal of Product*
27 *Innovation Management*, 18: 110-120.
- 28
29
30 Morrison-Smith, S., & Ruiz, J. (2020). Challenges and barriers in virtual teams: a literature
31 review. *SN Applied Sciences*, 2(6), 1-33.
- 32
33
34 Mukherjee, D., Renn, R. W., Kedia, B. L., & Mukherjee, D. (2012). Development of
35 interorganizational trust in virtual organizations: An integrative framework. *European*
36 *Business Review*. 24(3), 255–271.
- 37
38
39 Nakayama, M. K., Binotto, E., & Pilla, B. S. (2006, August). Trust in virtual teams: A
40 performance indicator. In *IFIP World Computer Congress, TC 3* (pp. 105-113).
41 Springer, Boston, MA.
- 42
43
44
45 Nathaniel, A., & Anthony, C. I. (2012). Barriers to the Uptake of Concurrent Engineering
46 in the Nigerian Construction Industry. *International Journal of Engineering Business*
47 *Management*, 4, 1–8.
- 48
49
50
51 Nemiro J, Beyerlein M, Beyerlein S, and Bradley L (2008). *The Handbook of High-*
52 *Performance Virtual Teams*. San Francisco: Jossey-Bass.
- 53
54
55 Nunnally, J. C. (1978). *Psychometric theory* (2nd ed.). New York, NY: McGraw-Hill.
- 56
57
58
59
60

- 1
2
3 Pangil, F., & Chan, J. M. (2014). The mediating effect of knowledge sharing on the
4 relationship between trust and virtual team effectiveness. *Journal of Knowledge*
5 *Management*, 18(1), 92–106
6
7
8 Peters, L., & Karren, R. (2009). An examination of the roles of trust and functional
9 diversity on virtual team performance ratings. *Group & Organization Management*,
10 34(4), 479–504. doi:10.1177/1059601107312170
11
12
13 Philbrick, J. H., Smith, F. R., & Bart, B. (2010). Using web surveys to determine audience
14 characteristics and product preferences. *American Journal of Business Education*
15 *(AJBE)*, 3(4), 1-6.
16
17
18
19
20 Pinto, J.K., Slevin, D.P. & English, B. (2009). Trust in projects: an empirical assessment
21 of owner/contractor relationships, *International Journal of Project Management*, 27(6),
22 638-648.
23
24
25
26 Ramalingam, S, Lobo, S, Mahalingam, A & Whyte, J. (2014), Achieving reliability in
27 transnational work on complex projects: new directions for research, *Engineering*
28 *Project Organization Journal*, 4 (4), 193-208.
29
30
31
32 Reina, D. Reina, M. (1999). Trust and Betrayal in the Workplace. San Francisco: Berre-
33 Koehler Publishers Inc.
34
35 Sagar, S. K., Arif, M., Oladinrin, O. T., & Rana, M. Q. (2021). Exploring factors affecting
36 trust in construction virtual project teams. *Journal of Architectural Engineering*
37 *Technology*. Journal of Architectural Engineering Technology.
38
39
40 Sagar, S. K., Oladinrin, O. T., Arif, M., & Rana, M. Q. (2022). Interpretive structural model
41 of trust factors in construction virtual project teams. *Construction Innovation*.
42 [https://wlv.openrepository.com/bitstream/handle/2436/624519/Sagar_et_al_Interpretiv](https://wlv.openrepository.com/bitstream/handle/2436/624519/Sagar_et_al_Interpretive_structural_2022.pdf?sequence=2&isAllowed=y)
43 [e_structural_2022.pdf?sequence=2&isAllowed=y](https://wlv.openrepository.com/bitstream/handle/2436/624519/Sagar_et_al_Interpretive_structural_2022.pdf?sequence=2&isAllowed=y)
44
45
46
47
48
49 Staples, D. S., & Webster, J. (2008). Exploring the effects of trust, task interdependence
50 and virtualness on knowledge sharing in teams. *Information systems journal*, 18(6), 617-
51 640.
52
53
54 Tsui, A. S., Egan, T. D., & O'Reilly III, C. A. (1992). Being different: Relational
55 demography and organizational attachment. *Administrative science quarterly*, 549-579.
56
57
58
59
60

1
2
3 Wakefield, R. L., Leidner, D. E., & Garrison, G. (2008). Research note—a model of
4 conflict, leadership, and performance in virtual teams. *Information systems research*,
5 19(4), 434-455.
6
7

8 Yun, G. W., & Trumbo, C. W. (2000). Comparative response to a survey executed by post,
9 e-mail, & web form. *Journal of computer-mediated communication*, 6(1), JCMC613.
10
11

12 Zakaria, N., & Yusof, S. A. M. (2020). Crossing cultural boundaries using the internet:
13 Toward building a model of swift trust formation in global virtual teams. *Journal of*
14 *International Management*, 26(1), 100654.
15
16
17
18

19 Zolin, R., Hinds, P. J., Fruchter, R., & Levitt, R. E. (2004). Interpersonal trust in cross-
20 functional, geographically distributed work: A longitudinal study. *Information and*
21 *organisation*, 14(1), 1-26.
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Modifications to revised manuscript

Manuscript ID: CI-03-2023-0039

Title: Impact of Trust in Virtual Project Teams: Structural Equation Modeling (SEM) approach

Construction Innovation: Information, Process, Management

	Reviewer 1 Comments:	Authors' Changes and Responses
1.	Originality: Does the paper contain new and/or significant information adequate to justify publication?: Yes, it does. Role of trust in virtual project teams is a timely and critical topic. Overall good paper that can be accepted for publication with few revisions.	The authors appreciate the reviewer for this comment. The few revisions are duly addressed in the revised version.
2.	Relationship to Seminal Literature: Does the paper demonstrate an adequate understanding of the relevant literature in the field and cite an appropriate range of literature sources? Is any significant work ignored?: It seems to me that most relevant literature is covered.	Thank you for this comment as well.
3.	<p>Research Methodology: Is the paper's argument built on an appropriate base of theory, concepts, or other ideas? Has the research or equivalent intellectual work on which the paper is based been well designed? Are the methods employed, robust, defensible and appropriate?:</p> <p>The authors list questionnaire survey under methodology but in my opinion, the section on "Research Model and proposed hypotheses" should also fall under it.</p> <p>Overall, the key factors and related hypotheses are well laid out. But, authors should provide a paragraph explaining how they identified/developed these factors.</p>	<p>Thank you for this comment. We have research Model and proposed hypotheses under research methodology as suggested.</p> <p>Thank you for your observation. We have now revised this section as follows: <i>This section describes the review of literature which was extensively done to identify the factors that were included in the research framework. Research articles from reputed peer-reviewed journals were identified after broad search on basis of appropriate keywords. Some existing relevant models helped the researchers to understand the role of trust in the performance of virtual project teams. Subsequently, those models helped in providing the different indicators affecting trust in virtual project teams. The indicators have been cited in various research articles and many researchers have commented on their importance with respect to building trust in a virtual project team as discussed in the following subsections.</i></p>

	<p>The questionnaire covers factors and measurement variables adequately.</p> <p>I would suggest that the authors provide more details about the "Trust: Theoretical model." Please provide how you arrived at this model and also provide legend for various signs used.</p>	<p>Thank you for this comment.</p> <p>We appreciate the reviewer. This section has been revised accordingly.</p>
4.	<p>Results: Are results presented clearly and analysed appropriately? Do the conclusions adequately tie together all elements of the paper?: Results and discussion of findings are well laid out. I would like authors to rework the last section - "Conclusion." This section is more like a summary. I believe that some good conclusions/inferences can be drawn from the work done.</p>	<p>We also appreciate the reviewer for this comment. The conclusion section has been duly revised.</p>
5.	<p>Implications for research, practice and/or society: Does the paper identify clearly any implications for research, practice and/or society? Does the paper bridge the gap between theory and practice? How can the research be used in practice (economic and commercial impact), in teaching, to influence public policy, in research (contributing to the body of knowledge)? What is the impact upon society (influencing public attitudes, affecting quality of life)? Are these implications consistent with the findings and conclusions of the paper?: Generally identifies adequate implications for the practice of VPT, not sure about the focus on construction?</p>	<p>Thank you for this comment. We have removed construction from the title to avoid confusion. However, the study addressed trust in VPT in the construction industry as construction professionals were contacted for data collection.</p>
6.	<p>Quality of Communication: Does the paper clearly express its case, measured against the technical language of the field and the expected knowledge of the journal's readership? Has attention been paid to the clarity of expression and readability, such as sentence structure, jargon use, acronyms, etc. Do the figures/tables aid the clarity of the paper?: There are few things I would suggest author to make this paper better and of publishable quality:</p> <p>1. The title says Construction VPT but the paper really does not make the case for the construction industry or attributes related to construction. Either change the title or add construction related focus.</p>	<p>Thank you for this comment. We have removed construction from the title to avoid confusion. However, the study addressed trust in VPT in the construction industry as construction professionals were contacted for data collection.</p>

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

	<p>2. Couple places it says that the focus is on United Arab Emirates (UAE), but it seems like an afterthought or forced upon. The work in the paper in the context of UAE is not supported.</p> <p>3. The paper needs good editing, especially in the beginning and the end.</p>	<p>This has been revised as well.</p> <p>Thank you for this comment. We have subjected the paper to thorough editing. The revised version now reads better.</p>
--	-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-----------------------------------------------------------------------------------------------------------------------------------------------------------------

Impact of Trust in ~~Construction~~-Virtual Project Teams: Structural Equation Modeling (~~SEM~~)-approach

Abstract

This study focuses on model development to analyse key factors affecting trust in Virtual Project Teams (VPTs). A questionnaire survey was conducted on construction professionals participating in virtual teams. Structural Equation Modelling (SEM) technique was performed to establish the effect of relevant factors on trust-building in VPTs. Team performance is highly affected by ~~the~~-trust among the team members. Trust building can be enhanced by improving the quality of team communication, organisation culture, team bonding, and team members' characteristics. The model developed in this study would benefit team productivity and team members' learning in VPTs.

Introduction

Organisations are expanding their dependence on virtual project teams (VPTs) to produce commercial value (Sagar et al., 2022), as well as gather diverse knowledge banks, time and financial savings, and identify economical solutions for collaboration (Gibson & Gibbs, 2006). VPTs have gained significant traction and usage by ~~many number of~~ major corporations, from a 60% estimate in 2003 (Gibson & Gibbs, 2006; Martins et al., 2004), to 85% in 2016 (Hacker et al., 2019). A major study spanning 100 countries surveyed 3000 managers; it outlines that 40% of the workers were using VPTs for 50% of their work time (Hoch & Dulebohn, 2017). VPTs have been researched consistently and often in information systems, Human Resource Management (HRM), and other disciplines (including the construction domain) for two decades due to significant and growing dependence on information technology (Hacker et al., 2019). However, increased dependence on VPTs has its ~~own~~-management issues (Jimenez et al., 2017; Lukić & Vračar, 2018). These issues have not been sufficiently ~~dealt with~~addressed in the current VPTs research and remain unresolved (Hacker et al., 2019). Research also indicates that challenges in trust building ~~have direct effect on~~directly affect virtual team failure (Kimble,

2011). It has also outlined that trust is a complex experience for internal and external team members due to various interconnected and dependent participants in VPTs.

~~Building-The building~~ sector has reported low levels of productivity and performance due to trust between the client, design team and construction team (Nathaniel & Anthony, 2012). Trust significantly impacts the team's confidence in knowledge sharing within traditional settings and among VPTs (Arif et al., 2015; Sagar et al., 2021). Although a growing body of research addresses virtual teams and the function of trust (Bhat et al., 2017; Sagar et al., 2022), literature on the different variables impacting trust as a single entity in the construction industry is limited. Only a few publications in the past dealt with this issue and were limited to the education, information technology, or manufacturing sector in the United States or Europe. There is a great uptake of VPTs in the construction sector. However, significant challenges need to be explored and addressed due to the infancy of VPTs application in the construction industry. The Middle East attracts professionals from across the globe, making it a multicultural region with professionals from varied countries and backgrounds. The issue of trust in the context of VPTs is a major issue in the Middle East (Zakaria & Yusof, 2020). Therefore, it is crucial to understand trust in virtual project teams (VPTs) from professionals who work across different cultures; ~~focusing on the United Arab Emirates (UAE)~~. The current ~~body of~~ literature and knowledge on trust in virtual teams within the construction sector is limited (Kaur, 2017; Lau & Rowlinson, 2009). As a result, this study aimed to pinpoint the crucial elements contributing to trust in virtual project teams (VPTs) and examine the impact of different factors on trust within virtual teams. The researchers created an analytical trust model to offer practical guidance for managing VPTs in the construction industry.

Literature review

Trust in VPTs – Construction industry

The construction industry in the United Arab Emirates is worth billions of dollars and accounts for approximately 8% of the country's GDP (Ailabouni, Painting, & Ashton, 2009). The delivery of construction projects increasingly relies on virtual teams (Henderson, 2008; Ramalingam et al., 2014; Kaur, 2017; Sagar et al., 2021). It is a

1
2
3 combined result of globalisation and multinational teams of consultants working on
4 different construction projects. Research outlines that successful implementation of VPTs
5 requires a comprehensive awareness and outlining of diverse, interlinked and complex
6 challenges that are not otherwise experienced in traditional project teams setup (Hosseini
7 & Chileshe, 2013). While there are multiple challenges in VPTs, trust is the most critical
8 factor influencing the team's performance and productivity (Brahm & Kunze, 2012).
9

10
11
12
13 There are multiple inter-linked procedures, activities and stages in a construction project.
14 It includes procurement processes, detailed design and engineering, project estimation,
15 preliminary engineering, construction, and commission (Sagar et al., 2022). Construction
16 projects are designed, developed and constructed using coordinated information at all
17 project stages. Information management, including sharing and amending designs ~~are~~-per
18 requirements, is highly dependent on trust among the team members. Trust develops a
19 willingness to collaborate, which leads to an obligation to share knowledge (Staples &
20 Webster, 2008; Sagar et al., 2021). This obligation would result in the effectiveness of a
21 virtual team (Pangil & Chan, 2014).
22
23
24
25
26
27
28

29 The effectiveness of a virtual project team (VPT) is highly dependent on the competence
30 of its members in delivering work as promised, which is a crucial factor for success and
31 efficiency. The ability of team members to deliver work is also influenced by their level of
32 commitment to the team, which is, in turn, influenced by the level of trust within the team.
33 Trust is also essential for timely and quality information exchange among team members
34 (Jarvenpaa et al., 1998). Therefore, it has become imperative to explore trust within the
35 context of the construction industry and business literature. The successful delivery of
36 construction projects using VPTs depends on the trust, identity and cohesiveness of the
37 team, and they need to be sternly appraised for the effectiveness of VPTs (Sagar et al.,
38 2022; Kaur, 2017).
39
40
41
42
43
44
45
46
47

48 Trust is a major challenge faced by virtual teams (Morrison-Smith & Ruiz, 2020). A large
49 amount of literature emphasizes the significance of trust in virtual team performance
50 (Henttonen & Blomqvist, 2005; Khan, 2012; Malhotra et al., 2007). It is pivotal to team
51 productivity and performance (Kanawattanachai & Yoo, 2002). ~~Trust~~-Trust building to
52 develop and successful and efficient team is also one of the most complex and challenging
53
54
55
56
57
58
59
60

1
2
3 in multiple dimensions (Kaur, 2017, Sagar et al., 2022). Virtual communication and
4 international partnerships in a project set-up require trust to be earned by a collaborative
5 approach for teams to perform efficiently (Lurey & Raisingham, 2001). Research indicates
6 that trust and positive relationships between team members result in higher creativity,
7 critical thinking and a productive environment (Reina & Reina, 1999). It also helps to
8 produce higher-quality work (Nemiro et al., 2008).
9

10
11
12
13
14
15 Kaur (2017) identified five challenges that must be addressed for the effective management
16 of VPTs: (1) Trust (2) Team cohesiveness (3) Communication (4) Team diversity and (5)
17 Leadership. However, trust is crucial for Virtual Project Team managers to deal with
18 challenges since it is core to the VPT function and operation (Lukić & Vračar, 2018). Trust
19 is an essential element that influences VPT's productivity and performance. Different
20 social and physical factors such as face-to-face conversation, cultural diversity, and long-
21 distance between project team members deter trust building. Studies have highlighted that
22 trust is a foundation of positive relationships between construction teams and other
23 stakeholders (Kaur, 2017; Hacker et al., 2019). ~~A considerable amount of~~Much literature
24 outlines the importance of trust in relationships between clients, general contractors,
25 subcontractors and suppliers in the construction sector. However, a lack of literature
26 focuses on trust in VPTs (Pinto et al., 2009; Hosseini & Chileshe, 2013). Trust plays a
27 significant role in the performance of virtual team members, as shown in studies by Khan
28 (2012) and Lukić and Vračar (2018), and is crucial for the productivity and efficiency of a
29 team's processes (Lukić & Vračar, 2018). The success of virtual project teams in the
30 construction industry depends heavily on building trust, team identity, and cohesiveness,
31 as emphasized by Chen and Messner (2010) and Kaur et al. (2015). Trust serves as the
32 foundation of cross-disciplinary teams' work set-ups (Zolin et al., 2004). The ~~absence of~~
33 ~~trust in team members is considered the main resistance for~~lack of trust in team members
34 is the main resistance to effective teamwork (Kaur et al., 2015). An extensive analysis of
35 the literature suggests that most of the research on trust focuses on industry, and there is a
36 lack of literature on the construction sector. There isn't convincing literature on VPTs in
37 the construction sector (Kadefors, 2004; Lau & Rowlinson, 2009; Pinto et al., 2009).
38 However, there is compelling work in other sectors, such as I.T sector (Ho & Richardson,
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

2013) and online societies (Lee et al., 2014). The study aims to focus on this situation and lack of literature in the construction sector.

Methodology

Research Model and proposed hypotheses

This section describes the literature review, which was extensively done to identify the factors included in the research framework. Research articles from reputed peer-reviewed journals were identified after a broad search based on appropriate keywords. Some existing relevant models helped the researchers to understand the role of trust in the performance of virtual project teams. Subsequently, those models helped provide the different indicators affecting trust in virtual project teams. The indicators have been cited in various research articles, and many researchers have commented on their importance in building trust in a virtual project team, as discussed in the following subsections.

Organizational Culture and Trust in virtual project teams

Project team members' understanding of project objectives and processes is crucial for achieving the organisations' goals (Sagar et al., 2022). Doney et al. (1998) outlined that lack of clarity among team members on project objectives and degree of trust building within an organisation poses a high risk to the team and its members. Thus, trust among team members and a clear understanding of team goals in crucial for successful team planning and delivery (Brahm & Kunze, 2012). Furst et al. (1999) suggested that establishing clear and transparent goals in a project can reduce uncertainty in team performance. They also emphasized that the team selection process and outcome are important factors in a team's success. Amah, Nwuche, & Chukuigwe (2013) pointed out that professionals are members of an organization before becoming team members. Hence, selection criteria govern the character and description of team members. Bell & Kozlowski (2002) suggested that the suitability of people towards a project should manage the organisations and selection of a VPT. Lack of suitability of team members could result in distrust in a team member and their capability. Barkhi et al. (2004) investigated the effect of rewarding team members based on their contribution to team's decision outcomes. They

concluded that rewards scheme positively impacted the team members' trust towards the organization.

Bryant et al. (2009) also recommended that reward and incentive schemes at team and manager levels have a direct and compelling positive effect on the outcome and attitudes of team members in VPTs. Evaluation of a team includes analysing the transparency of outcomes, transparency and honesty in the availability of information and decision-making procedures, and clarity and fairness in team members' treatment at the interpersonal level (Bryant et al., 2009). An honest and impartial team analysis strongly affects team members' confidence in team evaluation; thus increasing their trust in team operation, governance and evaluation. Cohesion acts as a connection agent among team members, and the close operation and communication among the team members highly influence the probability of team success. It also contributes in team building a team. Also, any conflict between team members on task execution and distribution, and process-process contributes to range of equivalent solutions. It contributes to the efficient achievement of project and organisational goals. Based on this analysis, following hypothesis are proposed:

H1: A positive relationship exists between organisational culture and trust in virtual project teams.

H2: Conflict mediates the positive effect of organisational culture on trust.

H3: Cohesion increases the positive effect of organisational culture on trust.

Team diversity and trust among virtual project team members.

A team's diversity encompasses diversity in functions, culture, and different problem-solving approaches. Peters and Karren (2009) argued that diversity among team members in virtual projects ~~can result in differences in attitudes, values, and performance, which may lead~~ould result in differences in attitudes, values, and performance, leading to conflicts. Virtual teams with members from diverse backgrounds and cultures are more likely to experience these conflicts than homogenous teams (Jehn, 1995).

Shachaf (2008) argued that cultural diversity within virtual teams could present additional challenges for leaders and members, including language barriers that can lead to communication difficulties and conflicts. Additionally, Curşeu & Schrujjer (2010)

1
2
3 presented that, according to the similarity-attraction hypothesis, diversity within a team
4 may lead to an increase in conflict, but can have a negative impact on the development of
5 trust.
6

7
8 Diversity within a team may lead to increased conflict and decreased trust. Research has
9 also shown that team members may view those who share their culture as more trustworthy
10 and feel a stronger sense of belonging with them compared to those who do not share their
11 culture (Zolin *et al.*, 2004). Tsui *et al.* (1992) discovered that psychological attachment
12 among group members is negatively related to diversity within a work unit. Based on these
13 findings, it can be inferred that diversity within a team may obstruct the interactions
14 required for team members to ~~invest in the team and each other~~ fully invest in the team
15 and each other. As a result, the researchers propose the following hypotheses:
16
17

18
19
20
21
22 *H4: A negative relationship exists between the diversity of team members and trust*
23 *in virtual project teams.*
24

25 ***Communication and trust among virtual project team members***

26
27 Effective communication is crucial in building trust among team members, especially in
28 virtual project teams where members may be geographically dispersed and have different
29 time zones and holidays (Sagar *et al.*, 2021). The communication process may involve ~~the~~
30 ~~use of~~ various tools and techniques, and training may be required to ensure that team
31 members can communicate and collaborate effectively. According to Amah *et al.* (2013),
32 it is recommended that managers provide training opportunities to their employees to
33 acquire the necessary skills and experiences to become effective team players. Effective
34 communication, particularly during the early stages of team development, is critical for
35 establishing and sustaining trust, as Anderson *et al.* (2007) emphasised.
36
37

38
39 The global character of virtual teams can make communication a persistent challenge,
40 resulting in diminished mutual understanding within the team (McDonough, Kahn &
41 Barczak, 2001). This can be exacerbated when team members do not have a shared
42 language and when only some are co-located while others are geographically dispersed
43 (Crampton, 2001). The researchers are proposing the following hypotheses as a result:
44
45

46
47
48
49
50
51 *H5: A positive relationship exists between communication between team members*
52 *and trust in virtual project teams.*
53
54
55
56
57
58
59
60

Team member's characteristics and trust in virtual project teams

Kramer and Lewicki (2010) suggest that initial trust in a relationship may be established based on fundamental factors, but as the relationship develops and team members become more acquainted with each other, trust may depend on the personal attributes of team members. As people gain a deeper understanding of their colleagues, they may form trust or distrust based on their perceived traits. The trust of team members can be influenced by several characteristics, such as their cognitive elements, ability, integrity, and benevolence. These attributes were described by Jarvenpaa et al. (1998) as dyadic trust attributes, which include the trustee's perceived benevolence, integrity, and ability. Benevolence refers to one party's willingness to benefit another, while ability represents the trustor's belief in the trustee's skills to fulfil their obligations as expected.

Sagar et al. (2021) argue that capability, honesty, and good intentions are the essential components of trust in virtual teams, which are crucial for different phases of virtual team formation and operation. Similarly, Jarvenpaa et al. (1998) emphasize the importance of team members' abilities, honesty, and good intentions for trust. According to Mukherjee et al. (2012), trustors in virtual teams evaluate the trustee's ability to make positive contributions to the team. In a dynamic and uncertain environment where the ability to respond quickly and adapt is crucial for seizing market opportunities, the trustor ~~needs~~ must have faith in the trustee's positive intentions towards the relationship, even without a formal agreement or prior commitment.

According to Kasper-Fuehrer and Ashkanasy (2001), the absence of formal contracts in virtual teams highlights the significance of benevolence in establishing "organizational trustworthiness." Business ethics and integrity are also crucial in virtual settings to convey trustworthiness. Trust among virtual project team members may be formed cognitively after evaluating their teammates' ability, benevolence, and integrity (Mukherjee et al., 2012). As a result of the strong bond between team members, their traits and characteristics may have a greater impact on the development of trust. The trust level among team members may be higher when they are more competent and have high levels of benevolence and integrity. Based on this, the researchers suggest the following hypotheses:

1
2
3 *H6: A positive relationship exists between team member characteristics and trust in*
4 *virtual project teams.*

5
6 *H7: Cohesion increases the positive effect of team member characteristics on trust.*
7
8
9

Conflict on Cohesion relevance on the team in virtual projects

10
11
12 According to Dafoulas and Macaulay (2002) and Kaur (2017), virtual teams may require a
13 ~~greater degree of~~ greater trust to succeed and avoid conflicts compared to traditional, co-
14 located teams. Conflicts within a team can negatively affect both the relationships within
15 the team and task performance (Sagar et al., 2021). Jehn (1995) suggests that differences
16 in personal preferences, values, ideology, and political views among team members can
17 result in relationship conflicts and generate tension, animosity, and annoyance. This, in
18 turn, can decrease the overall cohesion of the team. Conflict based on emotional or
19 interpersonal problems can greatly hinder a team's performance. In teams where the
20 members are highly dependent on each other, this type of conflict is likely to ~~hinder the~~
21 ~~formation of trust significantly~~ significantly hinder the formation of trust. Amason (1996)
22 suggested that relationship conflict can negatively impact decision-making, team unity,
23 commitment, and decision acceptance. Additionally, it can lead to division, diminished
24 trust, and weakened team relationships. Based on this, the researchers put forward a
25 hypothesis:
26
27
28
29
30
31
32
33
34
35

36 *H8: The more conflict among virtual team members, the less cohesion among them.*
37
38

Impact of experience on diversity and communication in virtual projects

39
40 Experience is used as a moderating factor. This refers to the time an individual has spent
41 working in virtual project teams and the number of virtual projects they have completed.
42 This is significant because the more time a team spends together, the greater opportunity
43 its members have to interact and form positive relationships, which can positively impact
44 the team's performance (Kaur, 2017). Experience with virtual teams can play a role in
45 reducing conflicts, particularly when team members have diverse backgrounds. This could
46 be because more experienced team members can foster better team cohesion due to their
47 maturity. Furthermore, senior members of the team, who typically possess extensive
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3 experience in their field and are responsible for teamwork, are more likely to provide
4 dependable, objective, and trustworthy information (Hwang, 2012).
5
6
7

8 **Trust: Theoretical model**

9
10 Based on the reviewed literature and proposed hypotheses, it is suggested that positive team
11 traits, communication, diversity, and a favorable organizational culture can enhance trust
12 within virtual project teams in the construction industry. The role of two mediators, conflict
13 and cohesion, and how they affect trust are also considered. The theoretical research model
14 of trust, shown in Figure 1, includes variables that represent the main factors directly
15 influencing trust, with the addition of a moderating variable that ~~will~~was be introduced in
16 the analysis. The main task is to test whether the variables influence trust as hypothesized
17 (H1 – H8). Given the inherently complex nature of virtual project teams in the construction
18 sector, the researchers proposed that trust in virtual project teams, as a dependent variable,
19 will increase with the development of positive organizational culture (H1) +ve, team
20 member characteristics (H6) +ve, and degree of communication (H5) +ve. It has been
21 observed that trust is negatively affected by the diversity of team members (H4) -ve. There
22 are two mediators – conflict in the team and cohesion of the team, which should positively
23 influence trust building if properly managed. A careful review of the model led the
24 researcher to identify one prime moderator experience (age) in virtual project teams.
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

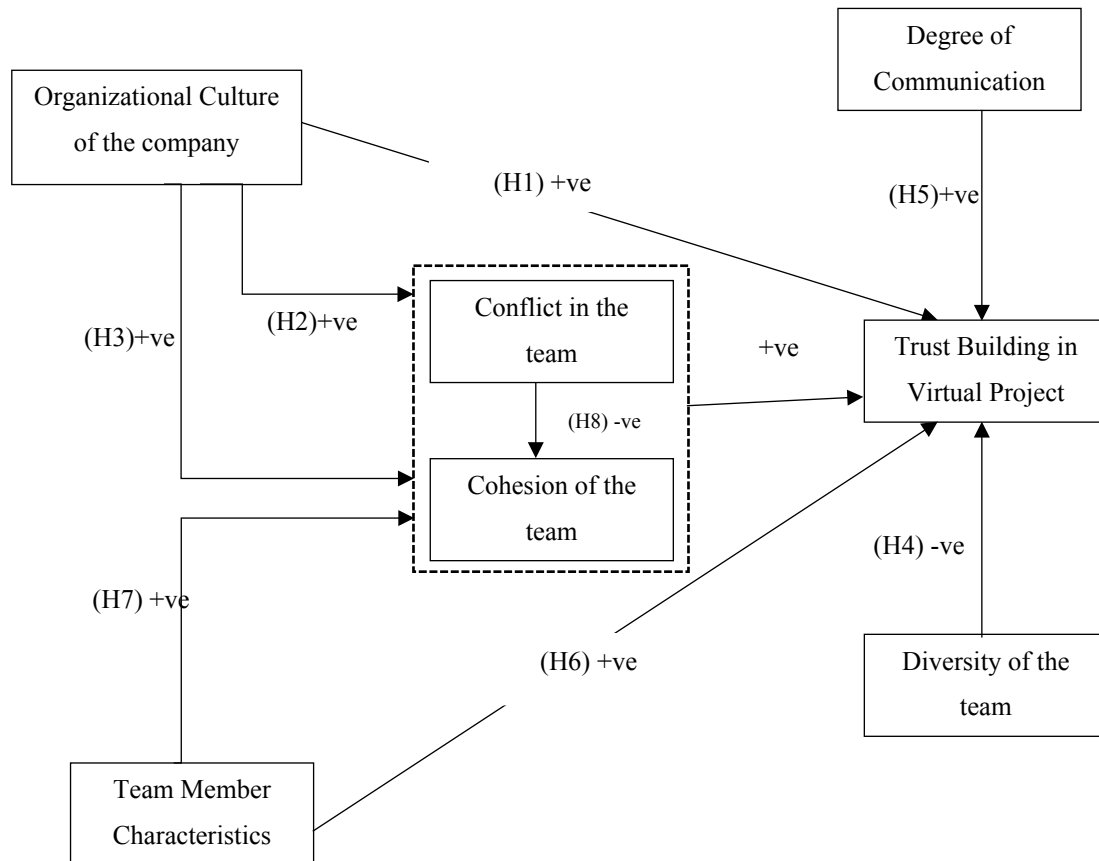


Figure 1: Trust building model in VPTs

(Note: H represent 'hypothesis', +ve – positive relationship, -ve – negative relationship)

Methodology

Questionnaire Survey

In this study, a survey questionnaire was developed based on a theoretical model that incorporated factors identified in previous literature by Kaur (2017). The questionnaire was then pre-tested with seven construction professionals to ensure content validity, following the guidelines by Bhatia and Awasthi (2018), and was subsequently modified based on their feedback. The survey questionnaire, which comprised 25 items across seven constructs, was finalized and is detailed in Table 1. The survey was aimed at

professionals who work as either team members or project managers in different construction companies. The email addresses for virtual project team communities were sourced from online directories of construction companies, and the participants were provided with a link to an online questionnaire. The survey was conducted online.

The study recruited virtual project professionals, ~~such as project managers or team members, from various construction companies through online directories from various construction companies through online directories, such as project managers or team members~~. These participants were then sent a link to an online survey, which mostly contained closed-ended questions that required them to choose from predetermined options. The responses were measured using a 5-point Likert scale that ranged from “strongly disagree” to “strongly agree”. Additionally, there were some open-ended questions to gather further information about the participant’s background and job description. The survey was conducted through an online platform. Additionally, online surveys provide a convenient and accessible platform for participants to respond from the comfort of their location without travelling or scheduling appointments (Yun & Trumbo, 2000). Moreover, the anonymity of the respondents in online surveys can also increase their willingness to provide honest and complete answers, potentially leading to higher-quality data (Philbrick et al., 2010).

Table 1: Factors and measurement variables of the research study

<i>Factor name</i>	<i>Variables/ items</i>
Organizational Culture	OrgC1: Clear Objectives and Goals
	OrgC2: Recruitment Strategy
	OrgC3: Rewards
	OrgC4: Team Evaluation
	OrgC5: Availability of Mentor
	OrgC6: Task Interdependence in the organisation
Conflict within the team	Conf1: Conflict in the execution of Task
	Conf2: Conflict in delegation of task
	Conf3: Relationship conflict
	Conf4: Lack of Employee Satisfaction

Characteristics of team members	Char1: Integrity of the team member
	Char2: Benevolence of the team member
	Char3: Propensity to trust
	Char4: Functional diversity of the team
Trust within the team members	Tru1: Relying on the information provided by team
	Tru2: Accepting procedural suggestions from team
Diversity of the team	Div1: Cultural Diversity
	Div2: Differ in Problem Solving Approach
	Div3: Time difference and holidays
Communication of the team	Comm1: Training on core technical skills
	Comm2: Training on personal development and conflict resolution.
Cohesion in the team	Coh1: Cognitive ability of the team
	Coh2: Mutual Respect within the team
	Coh3: Affective (Caring) elements within the team
	Coh4: Technical ability of the team

Data analysis techniques

The main characteristics of the collected data were identified through descriptive statistics, and after cleaning and removing extreme values, 323 responses out of 403 participants were included in the final analysis. Confirmatory factor analysis (CFA) was used instead of exploratory factor analysis (EFA) as the measurement variables had been previously established in research and were expected to align with their respective construct. The reason for this approach was explained by Bhatia and Awasthi (2018), who stated that this method is more appropriate when the measurement variables have already been chosen from a well-established body of literature. Therefore, the researchers used a Structural Equation Modeling (SEM) approach to evaluate the relationship between trust-building and other factors in virtual teams. This method allows for the examination of both latent and observable variables through statistical analysis. A theoretical model must be developed to understand the connection between the key variables involved in trust-building in a virtual team environment to utilise SEM. This required identifying the key

factors contributing to trust-building in such a setting. Thus, the initial creation of a theoretical model shows constructs of factors affecting trust-building. SEM is a statistical method that was utilized to test the hypothesis and examine the relationship between trust-building and other variables in a virtual team setting. The approach was previously employed in a study by De Campos et al. (2019). The theoretical model was tested by analyzing the entire system of variables simultaneously to determine the degree of consistency between the hypothesised model and the collected data.

Structural Equation Modelling (SEM) is a statistical method used to analyze the relationships between multiple variables, including both observed and underlying (latent) variables. One advantage of SEM is its ability to account for measurement errors, which can improve the accuracy of the analysis. This study employed SEM to determine if the proposed theoretical model aligns with the collected data, thereby establishing its validity. The trust model's validity and reliability were assessed through various tests, which provided valuable insights. The Comparative Fit Index (CFI) and Non-Normed Fit Index (NNFI) were used to evaluate how well the theoretical model aligned with the collected data. On the other hand, the Root Mean Square Error of Approximation (RMSEA) measured the level of error present in the model's fit. These evaluations were crucial in determining the effectiveness of the proposed trust model and how it accurately represents the relationships between variables in the real world.

The validity of the proposed trust model was analyzed using SEM. The SEM was used to evaluate the measurement and structural models. The model's accuracy was verified by comparing the Average Variance Extracted (AVE) of each component with the variance due to measurement error. To ensure validity, the model required an AVE greater than 0.50 (Fornell & Larcker, 1981) and a comparison between the square root of the AVE and correlations with other constructs in the model to confirm discriminant validity (Fornell & Larcker, 1981).

Results and discussion of findings

Descriptive statistics

According to the survey results, the majority of respondents were team members, comprising 73.7% of the total, while the remaining 26.3% were team leaders. A large

proportion of participants had higher education, with 60.1% holding a Bachelor's degree, 31.6% holding a Master's degree, and only 8.4% having a diploma. Furthermore, the respondents had considerable experience working in virtual project teams, with an average of 6.9 years.

Measurement Model

The measurement model's validity was evaluated through three methods: reliability, convergent validity, and discriminant validity. Composite reliability values were used to measure reliability, with a minimum threshold of 0.7 considered acceptable, according to Fornell and Larcker (1981). The results presented in Table 2 demonstrated that all composite reliability values ranged from 0.716 to 0.795, indicating that they are higher than the minimum acceptable threshold. To evaluate discriminant validity, the study used Fornell and Larcker's (1981) approach of comparing each construct's square root of the Average Variance Extracted (AVE) with the correlations between that construct and other constructs in the model. The results in Table 2 indicated that the square root of AVE for each construct was greater than the correlation values between that construct and other constructs in the model. This suggests that the discriminant validity was acceptable for all constructs.

Table 2: Validity and Reliability Values

	CR	Communica tion	OrgCul	Confl ict	TeamM em Char	Trust	Diversity	Cohesion
Communica tion	0.795	0.818						
OrgCul	0.743	0.571	0.752					
Conflict	0.731	0.179	0.304	0.751				
Team member Char	0.758	0.148	0.135	0.063	0.742			
Trust	0.783	0.346	0.383	0.425	0.285	0.721		
Diversity	0.716	0.038	0.059	-0.043	0.298	0.200	0.767	
Cohesion	0.726	0.448	0.677	0.558	0.398	0.570	0.144	0.756

In order to ensure that the scales were measuring the same concept accurately and reliably, it was important to establish their convergent validity. This was done by checking that the Average Variance Extracted (AVE) value for each construct was greater than the measurement error variance for that particular construct. This was done by comparing the AVE to a benchmark of 0.50. The results in Table 3 showed that the AVE for each of the constructs ranged from 0.52 to 0.67, indicating that the convergent validity was established. The results of the analysis support the convergent validity of the scales. The standardised factor loadings of the items were examined to verify the convergent validity of the measurement variables. This process helps to confirm that the measurement variables are measuring the intended concept and not some other related or unrelated concept. Ensuring convergent validity is crucial because it confirms that the measurement variables are accurately measuring the same concept with reliability. The standardised loading value of each measurement variable was evaluated to ensure quality, requiring a value equal to or greater than 0.5, according to Kock (2014). All of the statistical results were significant, and any items that did not meet the required statistical standards, including OrgC6, Conf2, Conf4, Div3, and Coh4, were removed from the analysis. The Cronbach alpha (α) value was used to assess the reliability of each construct, and all of the Cronbach alpha values exceeded the 0.7 threshold value established by Nunnally (1978).

Table 3: Loading values, cronbach alpha (α), and AVE values

Construct	Standardized Loadings	Cronbach Alpha (α)	Average Variance Extracted (AVE)
Organizational Culture			
OrgC1	0.64	0.753	0.567
OrgC2	0.59		
OrgC3	0.63		
OrgC4	0.61		
OrgC5	0.55		
Conflict within the team		0.713	0.564
Conf1	0.60		
Conf3	0.75		
Team member characteristics		0.766	0.551
Char1	0.89		
Char2	0.67		
Char3	0.53		
Char4	0.54		

Trust		0.703	0.520
Tru1	0.69		
Tru2	0.76		
Diversity		0.700	0.588
Div1	0.98		
Div2	0.50		
Communication		0.757	0.669
Comm1	0.63		
Comm2	0.97		
Cohesion		0.757	0.573
Coh1	0.80		
Coh2	0.63		
Coh3	0.62		

Structural Model

The adequacy of a structural model is determined by its fit indices, which determine whether the model is acceptable or not. In this study, the model is deemed a good fit since all the goodness-of-fit indices meet the recommended thresholds. For instance, CMIN/DF (Minimum discrepancy) value, which should range from 3 to 1 (Carmines & McIver, 1981), is 1.882. Also, the Goodness of fit Index (GFI) is 0.904 (Hu & Bentler, 1995), Root Mean Square Error of Approximation (RMSEA) records 0.052 (MacCallum et al. 1996), Comparative Fit Index (CFI) is 0.913 (Raykov, 2005), which are all indications of good fit. It is possible to infer that the findings of this study were stable. As a result, the SEM model suited the data well, and the conceptual framework discussed in the previous section was validated. The final SEM model is presented in Figure 2. The justification for this paradigm is described in the section that follows.

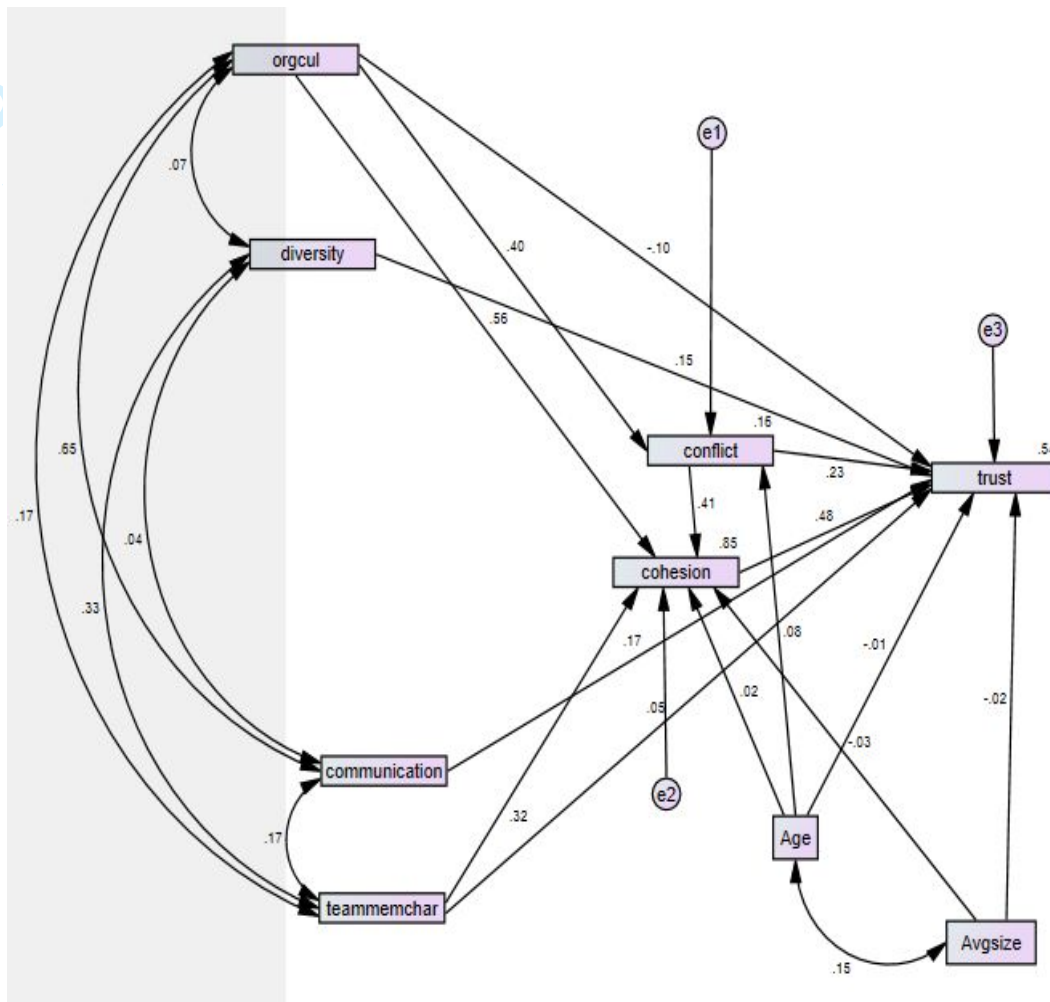


Figure 2: Final SEM Model of Trust

Discussion on Model of Trust and hypothesis testing

The model shown in [figure-Figure 2](#) constitutes various factors affecting trust positively or negatively. As shown in **Table 4**, after the SEM analysis was conducted, 3 out of the 11 hypotheses were rejected. The discussion of the different relationships between the variables was based on the results of the statistical data analysis.

Table 4: Results of the hypothesis test.

Hypothesis Number	Statement of Hypothesis	Coefficient	p-values	Results
H1	A positive relationship exists between organizational culture and trust in virtual project teams.	0.065	0.000	Supported

H2	<i>Conflict increases the positive effect of organizational culture on trust.</i>	0.243	0.001	Supported
H3	<i>Cohesion increases the positive effect of organizational culture on trust.</i>	0.464	0.001	Supported
H4	<i>A negative relationship exists between diversity of team members and trust in virtual project teams.</i>	0.000	0.991	Not supported; came out to be positive relationship
H5	<i>A positive relationship exists between communication of team members and trust in virtual project teams.</i>	0.168	0.004	Supported
H6	<i>A positive relationship exists between characteristics of team member on trust in virtual project teams.</i>	0.149	0.001	Supported
H7	<i>Cohesion increases the positive effect of team member characteristics on trust.</i>	0.149	0.001	Supported, full mediation
H8	<i>The more conflict among virtual team members, the less is the cohesion among them.</i>	0.203	0.001	Supported

The result of hypothesis 1 verification

The company's organisational culture encompasses various components such as setting clear goals and objectives, outlining a recruitment strategy, providing incentives to team members, ensuring unbiased performance appraisals, offering mentorship programs to employees, and the ~~level of interdependence of tasks within the team~~ team's level of interdependence of tasks. Research has shown that team members committed to the team's objectives, especially long-term goals critical to the team's overall success, are more likely to ~~actively pursue the team's objectives~~ pursue the team's objectives actively (Sagar et al., 2021; Kaur, 2017). Thus, it is crucial to establish a clear understanding of the team's objectives and goals during the planning stage to foster trust among team members (Brahm

1
2
3 & Kunze, 2012). ~~The process of e~~Choosing team members also holds significant
4 importance in determining a team's success. Amah et al. (2013) proposed that individuals
5 become members of organizations before they join teams, indicating that the organization's
6 selection criteria can affect the type of individuals who are chosen to be part of the team.
7
8 Additionally, Barkhi et al. (2004) discovered in their research that rewarding team
9 members based on the results of their individual or team decisions could improve team
10 members' trust in the organization. It is crucial to have fairness in team evaluations to
11 encourage trust and motivation among team members. When team members perceive that
12 the evaluation process is just and unbiased, they tend to be more dedicated to the team's
13 objectives and less inclined to resist change (Bryant et al., 2009). Mentoring and coaching
14 ~~to~~ team members can also increase their skills and improve their performance, leading to a
15 more effective and cohesive team (Sagar et al., 2021).
16
17
18
19
20
21
22
23
24

25 ***The result of hypotheses 2 and 3 verification***

26 The study's findings align with previous research on the subject and support the idea that
27 team members dedicated to the team and its goals are more likely to cooperate in pursuit
28 of organizational objectives. This positive correlation between trust, collaboration, and
29 goal attainment can be further enhanced when teams work through task-related conflicts
30 constructively and transparently, ultimately contributing to the development of mutual trust
31 among team members.
32
33
34
35

36 Researchers have shown that conflicts arising from tasks, processes, and relationships can
37 harm the effectiveness of remote teams (Hinds & Bailey, 2003; Sagar et al., 2021). While
38 some conflicts can be beneficial, it is essential to effectively manage conflicts that have a
39 negative impact on team results and organizational objectives. In virtual teams, active
40 conflict management and early conflict detection may be crucial (Kaur, 2017). Process
41 conflict is a type of conflict that arises from disagreement or differences in opinions about
42 how work should be done. On the other hand, relational conflict is typically caused by a
43 lack of understanding about personal situations or differences among team members
44 (Wakefield, Leidner, & Garrison, 2008). Organizations ~~need to~~ must address relational and
45 process conflict promptly and effectively to maintain a positive organizational culture and
46 improve team performance. Addressing conflict can help to create a culture of trust,
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3 cooperation, and commitment to the organization's objectives, and it can help to foster
4 positive outcomes and achieve the team's objectives.

5
6 The study's findings indicate that virtual teams are susceptible to performance and team
7 dynamics challenges, including ~~issues such as~~ low cohesion and trust. In traditional teams,
8 high levels of team cohesion, which is the sense of unity and shared purpose among team
9 members, can facilitate cooperation and help teams achieve common goals (Brahm &
10 Kunze, 2012). Virtual teams may face challenges in building trust and avoiding
11 misunderstandings due to the lack of face-to-face interaction (Blackburn et al., 2003). To
12 address these issues, virtual teams can use communication and collaboration technologies,
13 like video conferencing and instant messaging, to enhance interpersonal interactions and
14 facilitate regular and transparent communication. Effective communication and
15 cooperation among virtual team members can promote trust and strengthen team cohesion.
16 Strong trust among team members can help reduce the potential negative impacts of limited
17 interaction and virtual communication on team cohesion (Kaur, 2017). A high trust climate
18 can foster a sense of shared identity and purpose, leading to more effective communication
19 and collaboration among team members and, ultimately, better organizational outcomes.
20
21
22
23
24
25
26
27
28
29
30

31 32 ***The result of Hypothesis 4 verification***

33
34 The data analysis revealed that diversity did not negatively impact trust levels in virtual
35 teams operating in the construction sector. This could be attributed to the fact that these
36 teams may include members from various cultural backgrounds, leading to an environment
37 that encourages trust through enhanced comprehension and respect of differing views and
38 work styles. Additionally, it is possible that the virtual nature of the teams, with its
39 increased focus on communication and collaboration, has helped to mitigate any potential
40 negative effects of diversity on trust. Overall, virtual teams in the construction sector can
41 effectively manage diversity to promote trust and positive outcomes for the organization.
42
43
44
45
46
47
48

49 However, the data collected from experts as part of this research showed that diversity can
50 actually enhance a team's trust. Teams comprising individuals from different backgrounds
51 and with various levels of expertise and experience can benefit from this diversity. Despite
52 this, Peters & Karren (2009) noted that diversity within a team could sometimes result in
53
54
55
56
57
58
59
60

1
2
3 distrust due to differences in attitudes, values, and performance among team members.
4
5 Research data suggests that diversity can foster trust among team members. Teams with
6
7 members from different backgrounds or cultures can benefit from their varying
8
9 perspectives, skills, and experiences. Although differences among team members can
10
11 sometimes cause conflicts, these can be overcome by the team's collective ability to
12
13 understand and respect each other's differences. On the other hand, people are more likely
14
15 to trust others who share similar characteristics and values, which is why trust is more
16
17 prevalent in homogeneous teams. Diversity among team members can provide an
18
19 opportunity for mutual learning and trust-building through understanding and cooperation,
20
21 as emphasized by Costa (2003).

22 ***The result of Hypothesis 5 verification***

23 The findings of the study indicate that establishing and sustaining trust among members of
24
25 virtual teams is closely linked to effective communication. The ~~result of the~~ relationship
26
27 between communication and trust-building is statistically significant and underscores the
28
29 crucial role that efficient and regular communication practices play in virtual team settings.

30 The findings of Sagar et al. (2021) support ~~the idea~~ that improved communication leads to
31
32 increased trust among virtual team members, further emphasizing communication's critical
33
34 role in virtual team performance and success. As per the findings of Amah et al. (2013),
35
36 offering training programs to employees is a useful method for managers to enhance team
37
38 performance. These training sessions can aid in building the necessary skills required to
39
40 work collaboratively within a team and create a sense of achievement and contentment
41
42 among employees. Potential topics for the training program may involve coaching,
43
44 communication, conflict resolution, negotiation, and problem-solving.

45 ***The result of hypothesis 6 verification***

46 The analysis of Hypothesis 6 showed that certain team members' characteristics could
47
48 positively impact trust development in a team. Virtual teams often consist of individuals
49
50 with diverse qualities, including skill level, honesty, kindness, expertise, dependability, and
51
52 professional conduct. According to Kramer and Lewicki (2010), trust in virtual teams may
53
54 start out being based on basic factors. Still, as the relationship develops and team members
55
56
57
58
59
60

1
2
3 better understand each other, they may form trust or distrust based on their individual
4 characteristics. Additionally, Kramer & Lewicki (2010) suggest that trust in virtual teams
5 may depend on the competence of team members. Competence refers to a team member's
6 ability to perform tasks effectively and efficiently. Furthermore, the results of Sagar et al.
7 (2021) indicate that reliability, professionalism, and other related characteristics are also
8 important components that can positively impact trust in virtual teams. These findings
9 suggest that team members' characteristics are crucial in developing trust among virtual
10 teams. Trustworthiness is not only based on individual skills but also on personal qualities.

18 ***The result of hypothesis 7 verification***

20 The analysis revealed that Hypothesis 7 was supported, indicating that team cohesion
21 positively affects the association between team member characteristics and trust. The
22 findings suggest that trust is primarily influenced by the cognitive aspects of team member
23 characteristics, such as their competency, professional ethics and constancy, rather than the
24 affective components like care and emotional connection. These findings align with
25 Kanawattanachai and Yoo's (2002) and Sagar et al. (2021) research. According to
26 Nakayama et al. (2006), trust is associated with competency, loyalty, and openness.
27 Besides having favourable qualities in team members, team cohesion also plays a
28 significant role in trust building. When a team has a tight-knit bond and a strong sense of
29 unity, the impact of team member characteristics on building trust is expected to be more
30 potent.
31
32
33
34
35
36
37
38
39
40

41 ***The result of hypothesis 8 verification***

43 The statistical analysis results showed that this hypothesis was supported, and the literature
44 also supports this idea. The findings from the statistical analysis support the hypothesis,
45 which is in line with previous research. Conflicts arise from perceived incompatibilities or
46 disagreements among team members. Dafoulas and Macaulay (2002) and Kaur (2017)
47 have noted that virtual teams require a higher level of trust to operate effectively and
48 prevent delays and conflicts compared to traditional, co-located teams. Team members play
49 a crucial role in a team by contributing through both social interactions and task-related
50 activities. When there are incompatible interpersonal dynamics among team members, it
51
52
53
54
55
56
57
58
59
60

1
2
3 can lead to relationship conflict, which includes tension, animosity, and annoyance. This
4
5 can negatively impact team cohesion and trust in highly interdependent groups. (Jehn,
6
7 1995; Sagar et al., 2021). In teams where conflict is prevalent, there is a risk of reduced
8
9 trust and cohesion among team members. If such conflicts are not managed appropriately,
10
11 they can damage relationships and hinder learning, resulting in a lack of trust. The
12
13 relationship between conflict and cohesion is inverse, indicating that as conflict increases,
14
15 cohesion decreases. It is essential to effectively address and manage conflicts to sustain
16
17 positive relationships and maintain team cohesion.

18 19 *The result of moderating effect of experience*

20
21 The study's findings support the notion that individuals with more experience working in
22
23 virtual project teams are better equipped to handle ~~challenges related to diversity and~~
24
25 ~~communication, reducing the negative impact of conflicts~~diversity and communication
26
27 challenges, reducing conflicts' negative impact. This aligns with previous research, which
28
29 has demonstrated that experience and expertise can assist individuals in navigating the
30
31 difficulties of virtual work and developing stronger relationships with their team members
32
33 (Kong et al., 2016; Xiong et al., 2018). These results have significant implications for
34
35 organizations seeking to establish and manage virtual project teams, as they indicate that
36
37 prioritizing the recruitment of experienced individuals may be advantageous. Additionally,
38
39 it appears that increasing experience in virtual teams can lead to increased maturity and
40
41 improved cohesion among team members. It seems that gaining experience working in or
42
43 leading virtual teams, ~~especially ones that are culturally diverse~~culturally diverse ones, can
44
45 improve cohesion and trust within a team. Developing effective communication practices
46
47 and sharing experiences and goals can also help build strong team relationships. Azimi et
48
49 al. (2011) suggest that certain measures can be taken to optimize the contributions of
50
51 seasoned team members across multiple projects. Cultivating expertise and fostering strong
52
53 bonds among team members can promote cohesiveness and triumph in virtual teams.

54 55 **Implications of Model of Trust**

56
57
58
59
60

1
2
3 The trust model created through Structural Equation Modeling (SEM) has significant
4 implications. Firstly, it highlights the significance of effective communication in building
5 trust within virtual project teams. To enhance communication and trust among virtual team
6 members, it is recommended to use suitable communication tools and strategies, provide
7 training on conflict resolution and interpersonal skills, and improve problem-solving
8 techniques. Weak communication within a team can lead to a lack of mutual
9 comprehension and hinder overall team understanding.

10
11
12
13
14
15 Second, ~~in United Arab Emirates's (UAE) case,~~ having diversity among team members
16 can contribute to building trust within the team. This is likely due to the diverse team
17 members bringing different skills and alternative solutions to the tasks. Furthermore, a
18 well-defined and structured organizational culture that communicates objectives and
19 expectations can enhance trust among team members. However, policy ambiguity, unfair
20 evaluation methods, and unstructured reward systems can lead to a lack of trust among
21 team members. Therefore, ~~it is essential for management~~ management needs to establish a
22 structured approach to the company's organizational culture to foster trust among team
23 members. Third, organizations should consider team members' previous experiences and
24 expertise in virtual team settings. Individuals who have previous experience working in
25 virtual teams may be better equipped to handle the challenges that come with virtual
26 collaboration and have a positive influence on team performance. Additionally, a diverse
27 team with varying backgrounds, viewpoints, and abilities can bring new and creative ideas
28 to the project. Still, it is crucial to ~~managing-manage~~ diversity effectively to reduce the
29 potential for conflict. In the end, selecting the appropriate team members and ensuring their
30 effective management and communication can play a crucial role in the success of virtual
31 projects.

32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
66
67
68
69
70
71
72
73
74
75
76
77
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
93
94
95
96
97
98
99
100
101
102
103
104
105
106
107
108
109
110
111
112
113
114
115
116
117
118
119
120
121
122
123
124
125
126
127
128
129
130
131
132
133
134
135
136
137
138
139
140
141
142
143
144
145
146
147
148
149
150
151
152
153
154
155
156
157
158
159
160
161
162
163
164
165
166
167
168
169
170
171
172
173
174
175
176
177
178
179
180
181
182
183
184
185
186
187
188
189
190
191
192
193
194
195
196
197
198
199
200
201
202
203
204
205
206
207
208
209
210
211
212
213
214
215
216
217
218
219
220
221
222
223
224
225
226
227
228
229
230
231
232
233
234
235
236
237
238
239
240
241
242
243
244
245
246
247
248
249
250
251
252
253
254
255
256
257
258
259
260
261
262
263
264
265
266
267
268
269
270
271
272
273
274
275
276
277
278
279
280
281
282
283
284
285
286
287
288
289
290
291
292
293
294
295
296
297
298
299
300
301
302
303
304
305
306
307
308
309
310
311
312
313
314
315
316
317
318
319
320
321
322
323
324
325
326
327
328
329
330
331
332
333
334
335
336
337
338
339
340
341
342
343
344
345
346
347
348
349
350
351
352
353
354
355
356
357
358
359
360
361
362
363
364
365
366
367
368
369
370
371
372
373
374
375
376
377
378
379
380
381
382
383
384
385
386
387
388
389
390
391
392
393
394
395
396
397
398
399
400
401
402
403
404
405
406
407
408
409
410
411
412
413
414
415
416
417
418
419
420
421
422
423
424
425
426
427
428
429
430
431
432
433
434
435
436
437
438
439
440
441
442
443
444
445
446
447
448
449
450
451
452
453
454
455
456
457
458
459
460
461
462
463
464
465
466
467
468
469
470
471
472
473
474
475
476
477
478
479
480
481
482
483
484
485
486
487
488
489
490
491
492
493
494
495
496
497
498
499
500
501
502
503
504
505
506
507
508
509
510
511
512
513
514
515
516
517
518
519
520
521
522
523
524
525
526
527
528
529
530
531
532
533
534
535
536
537
538
539
540
541
542
543
544
545
546
547
548
549
550
551
552
553
554
555
556
557
558
559
560
561
562
563
564
565
566
567
568
569
570
571
572
573
574
575
576
577
578
579
580
581
582
583
584
585
586
587
588
589
590
591
592
593
594
595
596
597
598
599
600
601
602
603
604
605
606
607
608
609
610
611
612
613
614
615
616
617
618
619
620
621
622
623
624
625
626
627
628
629
630
631
632
633
634
635
636
637
638
639
640
641
642
643
644
645
646
647
648
649
650
651
652
653
654
655
656
657
658
659
660
661
662
663
664
665
666
667
668
669
670
671
672
673
674
675
676
677
678
679
680
681
682
683
684
685
686
687
688
689
690
691
692
693
694
695
696
697
698
699
700
701
702
703
704
705
706
707
708
709
710
711
712
713
714
715
716
717
718
719
720
721
722
723
724
725
726
727
728
729
730
731
732
733
734
735
736
737
738
739
740
741
742
743
744
745
746
747
748
749
750
751
752
753
754
755
756
757
758
759
760
761
762
763
764
765
766
767
768
769
770
771
772
773
774
775
776
777
778
779
780
781
782
783
784
785
786
787
788
789
790
791
792
793
794
795
796
797
798
799
800
801
802
803
804
805
806
807
808
809
810
811
812
813
814
815
816
817
818
819
820
821
822
823
824
825
826
827
828
829
830
831
832
833
834
835
836
837
838
839
840
841
842
843
844
845
846
847
848
849
850
851
852
853
854
855
856
857
858
859
860
861
862
863
864
865
866
867
868
869
870
871
872
873
874
875
876
877
878
879
880
881
882
883
884
885
886
887
888
889
890
891
892
893
894
895
896
897
898
899
900
901
902
903
904
905
906
907
908
909
910
911
912
913
914
915
916
917
918
919
920
921
922
923
924
925
926
927
928
929
930
931
932
933
934
935
936
937
938
939
940
941
942
943
944
945
946
947
948
949
950
951
952
953
954
955
956
957
958
959
960
961
962
963
964
965
966
967
968
969
970
971
972
973
974
975
976
977
978
979
980
981
982
983
984
985
986
987
988
989
990
991
992
993
994
995
996
997
998
999
1000

Fourth, teams consisting of individuals with diverse cultural and functional backgrounds may encounter disputes, particularly regarding their relationships. Such conflicts, stemming from personal ego issues, can diminish the ~~level of~~ trust shared among team members. Conversely, conflicts arising from the team's tasks can be advantageous, as they foster constructive discussions and encourage examining novel solutions to challenges. Nonetheless, the team must regulate the occurrence of these conflicts to prevent them from becoming excessive and interfering with the team's overall productivity. Fifth, assembling

1
2
3 a well-rounded team with a diverse range of individuals is vital. This can facilitate more
4 robust connections and trust between team members. When team members believe in each
5 other's abilities and collaborate effectively, it can lead to enhanced knowledge sharing and
6 prompt project completion. Furthermore, incorporating experienced team members can
7 decrease conflicts, improve information exchange, and refine team communication,
8 fostering overall team cohesiveness and success.
9
10
11
12

13 14 **Conclusion**

15
16 This study aimed to explore interrelationships between trust and various factors that
17 enhance Virtual Project Teams (VPTs) in the construction industry. ~~These Virtual~~ teams
18 consist of individuals from diverse cultural backgrounds and countries working together
19 on various projects. The research focuses on multidisciplinary VPTs and seeks to
20 comprehend the factors that impact their effectiveness. By examining existing literature, it
21 was discovered that the performance of virtual teams is heavily influenced by the level of
22 trust established among team members. The study identified various factors that can impact
23 the trust level within virtual project teams and introduced a model to evaluate the effect of
24 these factors on trust. The final SEM supports the hypothesized positive interrelationships
25 between trust and organizational culture, team diversity, degree of communication and
26 team members' characteristics. Conflict within the team behaves in two different ways.
27 First, the task conflict brings more discussions and different perspectives to the problem;
28 hence, it helps build trust in team members' capabilities towards achieving the company's
29 goal. Second, if the conflicts result in relationship controversy, it will affect the bonding of
30 the team members as it leads to ego and hence affects trust building. Cohesion of the team
31 helps in building trust among team members. The more bonding the team members are, the
32 less conflicts will occur.
33
34
35
36
37
38
39
40
41
42
43
44
45

46 ~~This The~~ trust model, developed ~~through in this the~~ research, can provide useful guidance
47 to construction management professionals who aim to cultivate trust among members of
48 virtual teams. It underscores essential trust-related themes that senior management and
49 project managers should consider when building and managing virtual project teams.
50

51 This study's investigation of the critical factors that influence the success or failure of
52 virtual project teams in the construction sector adds to the current understanding of this
53
54
55
56
57
58
59
60

1
2
3 topic. Previously, such information was not available specifically in the construction
4 industry context. The findings of this study are expected to draw the interest of
5 professionals and policymakers in this field. In particular, project managers can benefit
6 from ~~this~~-these research's insights, which offer guidance on improving team cooperation
7 and performance in virtual teams, leading to increased individual learning.
8
9

14 References

- 18 Ailabouni, N., Painting, N., & Ashton, P. (2009). Factors affecting employee productivity
19 in the UAE construction industry. *25th Annual ARCOM Conference*, (September), 555–
20 564.
21
22
23 Amah, E., Nwuche, C. A., & Chukuigwe, N. (2013). Result Oriented Target Setting and
24 Leading High Performance Teams. *Industrial Engineering Letters Wwww.iiste.org*, 3(9),
25 47–60.
26
27
28 Amason, A. C. (1996). Distinguishing the effects of functional and dysfunctional conflict
29 on strategic decision making: Resolving a paradox for top management teams. *Academy*
30 *of management journal*, 39(1), 123-148.
31
32
33 Anderson, A. H., McEwan, R., Bal, J., & Carletta, J. (2007). Virtual team meetings: An
34 analysis of communication and context. *Computers in Human Behavior*, 23(5), 2558-
35 2580.
36
37
38
39 Arif, M., Mohammed, A.-Z. & Aman Deep, G. (2015). Understanding knowledge sharing
40 in the jordanian construction industry. *Construction Innovation*, 15(3), 333-354.
41
42
43 Azimi Lolaty, H., Ashktorab, T., Bagheri Nesami, M., & Bagherzadeh Ladari, R. (2011).
44 Experience of professional communication among nurses working in educational
45 hospitals: A phenomenological study. *Journal of Mazandaran university of medical*
46 *sciences*, 21(85), 108-125.
47
48
49
50 Barkhi, R., Jacob, V. S., & Pirkul, H. (2004). The influence of communication mode and
51 incentive structure on GDSS process and outcomes. *Decision Support Systems*, 37(2),
52 287-305.
53
54
55
56
57
58
59
60

- 1
2
3 Bell, B., & Kozlowski, S. (2002). A typology of virtual teams implications for effective
4 leadership. *Group & Organization Management*, 27(1), 14–49.
- 5
6 Bhat, S. K., Pande, N., & Ahuja, V. (2017). Virtual team effectiveness: An empirical study
7 using SEM. *Procedia Computer Science*, 122, 33-41.
- 8
9
10 Bhatia, M. S., & Awasthi, A. (2018). Assessing relationship between quality management
11 systems and business performance and its mediators: SEM approach. *International*
12 *Journal of Quality & Reliability Management*, 35(8), 1490-1507
- 13
14
15
16 Brahm, T., & Kunze, F. (2012). The role of trust climate in virtual teams. *Journal of*
17 *Managerial Psychology*, 27(6), 595–614.
- 18
19 Bryant, S. M., Albring, S. M., & Murthy, U. (2009). The effects of reward structure, media
20 richness and gender on virtual teams. *International Journal of Accounting Information*
21 *Systems*, 10(4), 190-213.
- 22
23
24 Carmines, E.G. & McIver, J.P. (1981). Analyzing models with unobserved variables.
25 Carmines, E.G. & McIver, J.P. (1981). Analyzing models with unobserved variables. in
26 Bohrnstedt, G.W. & Borgatta, E.F. [Eds.] *Social measurement: Current issues*. Beverly
27 Hills: Sage.
- 28
29
30
31
32 Chatfield, A. T., Shlemoon, V. N., Redublado, W., & Darbyshire, G. (2014). Creating
33 Value through Virtual Teams: A Current Literature Review. *Australasian Journal of*
34 *Information Systems*, 18(3). <https://doi.org/10.3127/ajis.v18i3.1104>
- 35
36
37
38
39 Chen, C. & Messner, J. (2010). A recommended practices system for a global virtual
40 engineering team. *Architectural Engineering and Design Management*, 6, 207-221.
- 41
42 Costa, A. (2003). Work team trust and effectiveness. *Personnel Review*, 32: 605-622.
43 doi:10.1108/00483480310488360
- 44
45
46 Crampton, C. D. (2001). The mutual knowledge problem and its consequences for
47 dispersed collaboration. *Organization science*, 12(3), 346-371.
- 48
49 Curşeu, P. L., & Schruijer, S. G. (2010). Does conflict shatter trust or does trust obliterate
50 conflict? Revisiting the relationships between team diversity, conflict, and trust. *Group*
51 *Dynamics: Theory, Research, and Practice*, 14(1), 66.
- 52
53
54
55
56
57
58
59
60

- 1
2
3 Dafoulas, G., & Macaulay, L. (2002). Investigating cultural differences in virtual software
4 teams. *The Electronic Journal of Information Systems in Developing Countries*, 7(1), 1-
5 14.
6
7
8 de Campos, E. A. R., Resende, L. M., & Pontes, J. (2019). Barriers, external aspects and
9 trust factors in horizontal networks of companies: a theoretical proposal for the
10 construction of a model for evaluation of trust. *Journal of Intelligent Manufacturing*,
11 30(4), 1547-1562.
12
13
14 Doney, P.M., Cannon, J.P., et al. (1998). Understanding the Influence of National Culture
15 on the Development of Trust. *Academy of Management Review* 23(3); 601-620.
16
17
18 Fornell, C., & Larcker, D. F. (1981). Structural equation models with unobservable
19 variables and measurement errors. *Journal of Marketing Research*, 18, 39–50.
20
21
22 Furst, S., Blackburn, R., & Rosen, B. (1999). Virtual team effectiveness : a proposed
23 research agenda. *Information Systems Research*, 9, 249–270.
24
25
26
27 Gibson, C. B., & Gibbs, J. L. (2006). Unpacking the Concept of Virtuality: The Effects of
28 Geographic Dispersion, Electronic Dependence, Dynamic Structure, and National
29 Diversity on Team Innovation. *Administrative Science Quarterly*, 51(3), 451–495.
30
31
32
33 Hacker, J. V., Johnson, M., Saunders, C., & Thayer, A. L. (2019). Trust in virtual teams:
34 A multidisciplinary review and integration. *Australasian Journal of Information*
35 *Systems*, 23, 1-36
36
37
38
39 Henderson, LS. (2008). The impact of project managers' communication competencies:
40 Validation and extension of a research model for virtuality, satisfaction, and
41 productivity on project teams, *Project Management Journal*, 39(2), 48-59.
42
43
44
45 Henttonen, K., Blomqvist, K., (2005). Managing distance in a global virtual team: the
46 evolution of trust through technology-mediated relational communication. *Strategic*
47 *Change* 14, 107–119.
48
49
50
51 Hinds, P. J., & Bailey, D. E. (2003). Out of sight, out of sync: Understanding conflict in
52 distributed teams. *Organization science*, 14(6), 615-632.
53
54
55
56
57
58
59
60

- 1
2
3 Ho, S., & Richardson, A. (2013). Trust and distrust in open source software development.
4 *Journal of Computer Information Systems*, 84–93.
5
6
7
8 Hoch, J. E., & Dulebohn, J. H. (2017). Team personality composition, emergent leadership
9 and shared leadership in virtual teams: A theoretical framework. *Human Resource*
10 *Management Review*, 27(4), 678–693.
11
12
13
14 Hosseini, M. R & Chileshe, N. (2013). Global Virtual Engineering Teams (GVETs): A
15 fertile ground for research in Australian construction projects context. *International*
16 *Journal of Project Management*, 31(8), 1101-1117.
17
18
19 Hu, L.-T., & Bentler, P. (1995). Evaluating model fit. In R. H. Hoyle (Ed.), *Structural*
20 *Equation Modeling. Concepts, Issues, and Applications* (pp. 76-99). London: Sage.
21
22
23
24
25 Hwang, M. I. (2018). Relationship between teamwork and team performance: Experiences
26 from an ERPsim competition. *Journal of Information Systems Education*, 29(3), 157-
27 168.
28
29
30
31 Jarvenpaa, S. L., Knoll, K., & Leidner, D. E. (1998). Is Anybody Out There? Antecedents
32 of Trust in Global Virtual Teams. *Journal of Management Information Systems*, 14(4),
33 29–64.
34
35
36 Jarvenpaa, S. L., Shaw, T. R., & Staples, D. S. (2004). Toward contextualized theories of
37 trust: The role of trust in global virtual teams. *Information systems research*, 15(3), 250-
38 67.
39
40
41 Jehn, K. A. (1995). A multimethod examination of the benefits and detriments of
42 intragroup conflict. *Administrative science quarterly*, 256-282.
43
44
45
46 Jimenez, A., Boehe, D. M., Taras, V., & Caprar, D. V. (2017). Working Across
47 Boundaries: Current and Future Perspectives on Global Virtual Teams. *Journal of*
48 *International Management*, 23(4), 341–349.
49
50
51
52 Kadefors, A. (2004). Trust in project relationships—inside the black box. *International*
53 *Journal of Project Management*, 22(3), 175–182.
54
55
56
57
58
59
60

- 1
2
3 Kanawattanachai, P., & Yoo, Y. (2002). Dynamic nature of trust in virtual teams. The
4 Journal of Strategic Information Systems, 2(10), 42–58.
- 5
6 Kasper-Fuehrera, E. C., & Ashkanasy, N. M. (2001). Communicating trustworthiness and
7 building trust in interorganizational virtual organizations. *Journal of management*,
8 27(3), 235-254.
- 9
10
11
12
13 Kaur, S. (2017). Model for assessment of trust within VPTs of construction sector in the
14 Middle East (Doctoral dissertation, University of Salford).
- 15
16
17 Kaur, S., Arif, M. & Akre, V. (2015). *Factors affecting Trust in Virtual Project Teams in*
18 *Construction Sector in Middle East*. in 12th Post-Graduate Research Conference 2015,
19 Media City U.K., 10-12 June 2015, pp 262- 276.
- 20
21
22
23 Khan, M.S., (2012). Role of trust and relationships in geographically distributed teams:
24 exploratory study on development sector. *International Journal of Networking and*
25 *Virtual Organisations*, 10, 40–58.
- 26
27
28
29
30 Kimble, C. (2011). Building effective virtual teams: How to overcome the problems of
31 trust and identity in virtual teams. *Global Business and Organizational Excellence*,
32 30(2), 6–15.
- 33
34
35 Kock, N. (2014). Advanced mediating effects tests, multi-group analyses, and
36 measurement model assessments in PLS-based SEM. *International Journal of e-*
37 *Collaboration*, 10(3),1-13.
- 38
39
40 Kramer, R. M., & Lewicki, R. J. (2010). Repairing and enhancing trust: Approaches to
41 reducing organizational trust deficits. *Academy of Management annals*, 4(1), 245-277.
- 42
43
44
45 Lau, E., & Rowlinson, S. (2009). Interpersonal trust and inter firm trust in construction
46 projects. *Construction Management and Economics*, 27(6), 539–554.
- 47
48 Lee, H., Ahn, H., Kim, H., & Lee, J. (2014). Comparative Analysis of Trust in Online
49 Communities. *Procedia Computer Science*, 31(ITQM 2014), 1140–1149.
50 doi:10.1016/j.procs.2014.05.370
- 51
52
53 Lipnack, J., & Stamps, J. (1997). *Virtual Teams: Reaching Across Space, Time, and*
54 *Organizations with Technology*, John Wiley & Sons, Inc., New York, 1997
- 55
56
57
58
59
60

- 1
2
3 Lukić, J. M., & Vračar, M. M. (2018). Building and nurturing trust among members in
4 VPTs. *Strategic Management-International Journal of Strategic Management and*
5 *Decision Support Systems in Strategic Management*, 23(3), 010-016.
6
7
8
9 Lurey, J., & Raisinghani, M. (2001). An empirical study of best practices in virtual teams.
10 *Information & Management*, 38, 523–544.
11
12 MacCallum, R. C. & Austin, J. T. (2000). Applications of structural equation modeling in
13 psychological research. *Annual Review of Psychology*, 51, 201-226.
14
15 MacCallum, R.C., Browne, M.W., and Sugawara, H., M. (1996), “Power Analysis and
16 Determination of Sample Size for Covariance Structure Modeling,” *Psychological*
17 *Methods*, 1 (2), 130-49
18
19
20
21
22 Malhotra, A., Majchrzak, A., Rosen, B. (2007). Leading Virtual Team. *Academy of*
23 *Management Perspectives*, 2, 60 -69.
24
25
26
27 Martins, L. L., Gilson, L. L., & Maynard, M. T. (2004). Virtual Teams: What Do We Know
28 and Where Do We Go From Here? *Journal of Management*, 30(6), 805–835.
29
30
31 McDermott, P., Khalfan, M., & Swan, W. (2005). Trust in construction projects. *Journal*
32 *of Financial Management of Property and Construction*, 10(1), 19–32.
33
34 Mcdonough, E.F., K.B. Kahn and G. Barczak, 2001. An investigation of the use of global,
35 virtual, and collocated new product development teams. *The Journal of Product*
36 *Innovation Management*, 18: 110-120.
37
38
39 Morrison-Smith, S., & Ruiz, J. (2020). Challenges and barriers in virtual teams: a literature
40 review. *SN Applied Sciences*, 2(6), 1-33.
41
42 Mukherjee, D., Renn, R. W., Kedia, B. L., & Mukherjee, D. (2012). Development of
43 interorganizational trust in virtual organizations: An integrative framework. *European*
44 *Business Review*. 24(3), 255–271.
45
46
47
48 Nakayama, M. K., Binotto, E., & Pilla, B. S. (2006, August). Trust in virtual teams: A
49 performance indicator. In *IFIP World Computer Congress, TC 3* (pp. 105-113).
50 Springer, Boston, MA.
51
52
53
54
55
56
57
58
59
60

- 1
2
3 Nathaniel, A., & Anthony, C. I. (2012). Barriers to the Uptake of Concurrent Engineering
4 in the Nigerian Construction Industry. *International Journal of Engineering Business*
5 *Management, 4*, 1–8.
6
7
8
9 Nemiro J, Beyerlein M, Beyerlein S, and Bradley L (2008). The Handbook of High-
10 Performance Virtual Teams. San Francisco: Jossey-Bass.
11
12 Nunnally, J. C. (1978). Psychometric theory (2nd ed.). New York, NY: McGraw-Hill.
13
14
15 Pangil, F., & Chan, J. M. (2014). The mediating effect of knowledge sharing on the
16 relationship between trust and virtual team effectiveness. *Journal of Knowledge*
17 *Management, 18*(1), 92–106
18
19
20 Peters, L., & Karren, R. (2009). An examination of the roles of trust and functional
21 diversity on virtual team performance ratings. *Group & Organization Management,*
22 *34*(4), 479–504. doi:10.1177/1059601107312170
23
24
25 Philbrick, J. H., Smith, F. R., & Bart, B. (2010). Using web surveys to determine audience
26 characteristics and product preferences. *American Journal of Business Education*
27 *(AJBE), 3*(4), 1-6.
28
29
30
31
32 Pinto, J.K., Slevin, D.P. & English, B. (2009). Trust in projects: an empirical assessment
33 of owner/contractor relationships, *International Journal of Project Management, 27*(6),
34 638-648.
35
36
37
38 Ramalingam, S, Lobo, S, Mahalingam, A & Whyte, J. (2014), Achieving reliability in
39 transnational work on complex projects: new directions for research, *Engineering*
40 *Project Organization Journal, 4* (4), 193-208.
41
42
43
44 Reina, D. Reina, M. (1999). Trust and Betrayal in the Workplace. San Francisco: Berre-
45 Koehler Publishers Inc.
46
47
48 Sagar, S. K., Arif, M., Oladinrin, O. T., & Rana, M. Q. (2021). Exploring factors affecting
49 trust in construction virtual project teams. *Journal of Architectural Engineering*
50 *Technology*. Journal of Architectural Engineering Technology.
51
52
53 Sagar, S. K., Oladinrin, O. T., Arif, M., & Rana, M. Q. (2022). Interpretive structural model
54 of trust factors in construction virtual project teams. *Construction Innovation.*
55
56
57
58
59
60

https://wlv.openrepository.com/bitstream/handle/2436/624519/Sagar_et_al_Interpretive_structural_2022.pdf?sequence=2&isAllowed=y

Staples, D. S., & Webster, J. (2008). Exploring the effects of trust, task interdependence and virtualness on knowledge sharing in teams. *Information systems journal*, 18(6), 617-640.

Tsui, A. S., Egan, T. D., & O'Reilly III, C. A. (1992). Being different: Relational demography and organizational attachment. *Administrative science quarterly*, 549-579.

Wakefield, R. L., Leidner, D. E., & Garrison, G. (2008). Research note—a model of conflict, leadership, and performance in virtual teams. *Information systems research*, 19(4), 434-455.

Yun, G. W., & Trumbo, C. W. (2000). Comparative response to a survey executed by post, e-mail, & web form. *Journal of computer-mediated communication*, 6(1), JCMC613.

Zakaria, N., & Yusof, S. A. M. (2020). Crossing cultural boundaries using the internet: Toward building a model of swift trust formation in global virtual teams. *Journal of International Management*, 26(1), 100654.

Zolin, R., Hinds, P. J., Fruchter, R., & Levitt, R. E. (2004). Interpersonal trust in cross-functional, geographically distributed work: A longitudinal study. *Information and organisation*, 14(1), 1-26.