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Proceeding Paper

Performance in Virtual Teams: Towards an Integrative Model †

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† Presented at the International Academic Symposium of Social Science 2022, Kota Bharu, Malaysia, 3 July 2022.

Abstract: Virtual teams (VTs) are groups of people who work interdependently with shared purpose across space, time, and organization boundaries, using technology to communicate and collaborate. This literature review examined the status of the published research on VTs functioning to identify the main factors impacting their performance. Our main findings are the conceptualization of a multi-level model integrating factors classified into six categories: (1) individual factors; (2) group dynamics or team members' interactions; (3) context factors; (4) technology-mediated communication (TMC); (5) trust; and (6) leadership. The framework elaborated from this literature review needs to be tested in different environments.

Keywords: virtual teams; technology-mediated communication; virtual collaboration; trust; leadership; team performance; literature review

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Citation: El Idrissi, A.; Fourka, M. Performance in Virtual Teams: Towards an Integrative Model. *Proceedings* **2022**, *82*, 73. https://doi.org/10.3390/proceedings2022082073

Academic Editor: Mohamad Rahimi Mohamad Rosman

Published: 21 September 2022

Publisher's Note: MDPI stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.

1. Introduction

Globalization, business competition, and rapid advancement in information and communication technology have propelled the growing prevalence of VTs in the past decade [1,2]. The use of VTs allows organizations to remotely engage specialists regardless of their physical location and enables them to respond faster to market change [1,3]. The Coronavirus (COVID-19) crisis forced many employees around the world to work from home, which has suddenly increased the number of VTs [4].

Many researchers have shown the advantages of VTs, such as bringing diverse expertise and perspectives [5], reducing costs and stress, and saving time [3]. Moreover, geographically and temporally dispersed teams enable continuous 24/7 productivity [6]. However, the lack of non-verbal cues and social interaction when communicating through technological tools hinders team consensus and makes conflict resolution more difficult [7,8]. In VTs, individuals can also experience stress and isolation due to the characteristics of virtual collaboration such as technical problems, geographic and temporal distribution, and cultural differences [2]. Leaders also face many challenges in monitoring and managing VTs, and difficulties in building trust among and between team members [6].

Alaiad and his colleagues have conducted a systematic literature review of research papers published between 2007 and 2018. They stated that there is no specific standardized model able to describe virtual collaboration. Even the few existing models of VTs are either incomplete or not tested [1].

Our research question is: what are the main factors impacting VT performance?

2. Method

This literature review is based on a search of articles across scientific databases such as Google Scholar, Scopus, Web of Science, and Science Direct, etc., using keywords such as "virtual teams", "dispersed teams", "distributed teams", "remote teams", "virtual global teams", and "team performance". We used different combinations of these keywords. After analyzing 30 recent articles published between 2017 and 2021, which allowed us to reach

saturation in terms of concept identification, we then drafted an initial model with different factors that impact team performance in a virtual environment and their relationships. In the next step, we deepened our understanding of each concept using the "snowballing" approach. We retained more than 160 papers as relevant to our research. After analyzing these papers, we completed the model. The more recent papers are prioritized for the best consistency with technological advancement and practice evolution over time. Finally, we created notifications on the scientific sites mentioned above, to receive by email new publications related to our topic.

3. Literature Review

Based on the literature review of more than 160 articles, we categorized factors impacting VT performance into five categories: (1) *individual factors* which are related to the VT members as individuals; (2) *group dynamics* that consider the team interactions; (3) *context factors* are related to the organizational, cultural, and technological context of the work; (4) *technology-mediated communication* (TMC); (5) *trust*; and (6) *leadership*.

3.1. Individual Factors

3.1.1. Team Members' Competencies

Belova and Mezhevov [9] has identified the core competencies of VT members: (a) *cognitive competence*, which is the knowledge and skills needed in the professional field; (b) *functional competence*, which focuses mainly on knowledge of digital technologies for professional use [10]; (c) *social competence*, which refers to the ability to create and maintain effective social interactions, close relationships, and respond in adaptive ways within a team [11], and (d) *meta-competence*, which is the higher-order skills and abilities upon which competencies are based. It includes initiative, responsibility, a positive perception of criticism, a high level of self-control, and conscientiousness. Conscientiousness is one of the most consistent predictors of individual performance [9,12].

3.1.2. Motivation

Vida Davidavičienė et al. [13] argued that motivation has a significant impact on VTs' knowledge sharing, which helps to achieve high VT performance. This has implicitly been confirmed by [14] who considered that enjoyment (i.e., intrinsic motivation) is one of the main predictors of knowledge sharing. Zhang et al. [15] have qualified two types of motivation: intrinsic motivation pertains to activities done for their inherent interest and enjoyment; in contrast, extrinsic motivation is related to external reasons including economic and social rewards, or punishment [13,16]. Davidavičienė and colleagues [13] concluded that organizations must implement strategies that promote motivation with rewards, collaboration, and trust between team members.

3.2. Group Dynamics

3.2.1. Shared Mental Models and Norms

Shared mental models are a common understanding or a form of team knowledge that members have regarding their tasks and how they need to interact in order to accomplish such tasks [17]. DeChurch and Mesmer-Magnus [18] have demonstrated the positive effect of shared mental models on team performance. In a high virtual context, shared mental models play an important role in enabling team members to work together effectively in the absence of direction from a singular leader [17]. On the other hand, shared norms are legitimate, socially shared standards that orient individual behavior. Shared norms enable self-managing VTs to more quickly develop agreements concerning the process of the team's work [17]. Moreover, setting clear team norms and expectations, and creating opportunities for members to share experiences through repeated interactions, help build trust among members [19]. Finally, when interpersonal norms are established, cultural differences are neglected and, in return, conflicts are reduced [20].

3.2.2. Team Awareness

Awareness in the VTs' context is an understanding of the activities of others, which provides a context for one's own activity [21]. Three types of team awareness are suggested in the literature: presence awareness, task knowledge awareness, and social awareness [22–24]. *Presence awareness* is a subjective feeling that individuals are physically available and accessible to each other as if they were co-located [23]. In VTs, ICT reinforces the feeling of being "in touch" or being connected to the team. This enables team members and leaders to monitor the work and render assistance to others who need it [5,23,25]. *Task knowledge awareness* facilitates coordination between team members through the knowledge gained about each other regarding who is doing what [22,23,25]. It also enhances team performance. *Social awareness* concerns knowledge about the team members' personal information, their social situation, and interactions [5,26]. Lim [5] listed many benefits of disclosure awareness (named here as "social awareness") in VTs, including: enhancing familiarity, liking, and interpersonal relationships, which are important for trust development and knowledge sharing.

3.2.3. Process Losses

The inability of VT members to observe each other's actual efforts tends to lead to a greater reliance on perceptions and assumptions that could be both biased and erroneously negative [3]. That can lead to significant motivation losses (such as social loafing) and coordination losses [12,25]. TMC reinforces the effect of team awareness on team performance in two ways: (1) being aware of their colleagues' effort, team members increase their own effort towards their common goals [12,25]; (2) using technology, team members can be able to better coordinate their activities in a virtual environment [25].

3.2.4. Team Experience

- Team resilience can be defined as the collective capacity to deal with adverse events and rebound as strengthened and more resourceful [27,28]. Open communication and the quality of relationships are important factors for team-resilience development [2,29,30]. In return, it contributes to reducing the level of relational conflict [2,31,32].
- Team familiarity can lower the barriers and communication concerns created by geographic, nationality, structural, and demographic differences [33]. Moreover, professional familiarity, rather than a personal one, is salient in shaping VT's information elaboration (i.e., exchanging, discussing, and integrating information), which has a positive effect on performance [34,35].

3.2.5. Knowledge Sharing

Knowledge sharing is impacted by several factors categorized into three areas: (1) *individual dimension*, including motivation, interpersonal relationships, and trust among team members; (2) *organizational dimension*, related to the organizational structure, leadership, and reward structure; (3) *technological dimension*, including tools, infrastructure quality (e.g., internet availability, hardware capacity), and system availability [13,36]. ICT plays a critical role in reducing information inconsistencies and misunderstandings by sharing needed information with team members. Consequently, this may improve team performance [1].

3.2.6. Conflict

Different perceptions, values, norms, and communication styles in VTs may cause conflict to occur [13]. Moreover, conflicts in VTs are more difficult to manage than in co-located teams [37]. Task conflict and process conflict are not necessarily "bad" and may encourage effective team functioning through an open discussion of different alternatives [38,39]. However, if not appropriately managed, it can degenerate into relationship conflict, which is harmful to team performance [37,40].

3.3. Context Factors

3.3.1. Team Virtuality and Configuration

Teams within organizations represent various levels of virtual communication and collaboration, as opposed to daily basis face-to-face communication and collaboration. Virtuality can be approached either from a team design perspective (i.e., geographic or temporal distance, and configurational dispersion) or a technology-use perspective (i.e., the extent to which technological tools are used among team members, media richness, and media synchronicity) [41,42]. For example, high site dispersion is associated with faultlines formation and conflict, low level of cohesion, and low presence and task knowledge awareness [3,43–46].

3.3.2. Task Complexity and Interdependence

High task complexity in a high level of virtuality can lead to misunderstandings, mistakes, and coordination losses. Shared mental models and norms are a key element to enhance performance in such a situation [47,48]. Meanwhile, more interdependent work requires frequent and complex communication among the group members, with short feedback loops and multiple streams of information [49].

3.3.3. Team Diversity

VTs are characterized by significantly different backgrounds and experiences, such as cultural differences, professional and organizational background, and demographic characteristics [50]. This can promote creativity and innovation. However, diverse teams are more likely to diverge in their preferences and interests [50,51]. In sum, diversity may negatively influence team performance when subgroup formation is rated as high, but not if subgroups are perceived to be absent or low [52].

3.4. Technology-Mediated Communication

Team performance is positively impacted by knowledge exchange in climates that enable an oscillation between cooperative and assertive communication [53]. To optimize the performance of the virtual team, the leader should find a balance in the frequency of communication with each member of the team and between the available communication tools [54]. Communication mediated by technological tools, associated with geographically distributed teams, often lacks support for nonverbal cues, body language, inflection, gestures, and social interaction. This may make interactions and coordination more difficult and could increase misunderstandings and conflict among team members, which are detrimental to team performance [1,3,5,55]. Communication technology helps VT members to feel "in touch" or connected with their teammates [25]. Rivera [56] has demonstrated that team psychological safety and perceived peer support increase when richer media technology is used. In addition, team visualization tools can process complex and extensive information regarding team members' contributions to common goals. Such collaborative platforms are accessible to all team members in visual format without specific wording that can carry any negative emotions [12]. This visibility of effort may reduce social loafing and the withholding of task-oriented effort. However, a high level of effort does not necessarily reflect a high level of performance. Therefore, leadership is important to monitor team members' contributions [12].

Another advantage that face-to-face communication does not support is traceability and duplication. ICT enables VT members to access, store, retrieve, and exchange information across time and space boundaries [57,58]. Furthermore, communication through technological tools can be registered, duplicated, and repeated at any time by any team member around the world [51,59,60]. Finally, the ability to electronically capture, store, and retrieve the team's process and outcomes contributes to the organizational knowledge and learning development, and ultimately may increase VT effectiveness [58,61].

3.5. Trust

One of the most important challenges faced by VTs is building trust among and between members due to the absence of personal interaction and emotional cues in communicating through ICT. Trust is a crucial element for all aspects of collaboration and affects team performance [3,62–64]. Essentially, trust within any organization and in everyday life is a mix of feeling and rational thinking [65]. McALLISTER [66] distinguished between two main forms of trust: cognitive and affective trust. While cognitive trust is beneficial for VT performance, affective trust may increase social loafing due to the reliance on one's colleagues to provide support when needed, or even the comfort in asking them to accomplish their own work [67]. Team monitoring can reduce the relationship between affective trust and social loafing.

Considering the time windows of virtual communication, exchange between team members is often explicit, formal, and work issues-oriented. This lack of spontaneous and informal communication induces low team cohesion and mistrust [3]. However, [68] found that trust can be built by alternating the use of rich ICT media (e.g., discussion forums and instant messaging) with lean ICT media (e.g., document sharing and presentation display).

3.6. Leadership

Leadership in a virtual environment is a process whereby a person influences others through TMC to achieve a common goal towards team performance [17,51]. Leaders may play two main roles: first, task-oriented (or directive) leadership, in which the leader's behavior is directed at managing and monitoring the task performance; second, a relationship-oriented (or supportive) leader's behavior that aims to improve team cohesion and facilitate good relationships between team members. The social role is critical in virtual settings to overcome the negative effects of the lack of physical proximity and direct supervision [5,17,58,69]. In their study, Carte and colleagues [70] found that high-performing VTs are very task-focused, but the monitoring behavior is shared among team members. However, the increased difficulties of geographical dispersion and cultural diversity hinder team members' abilities to coordinate activities, influence, and motivate others. Self-management may increase the team's flexibility in setting goals and keeping track of teamwork to achieve a higher level of performance. These teams are characterized by distributed power, authority and ownership [17,70]. Shared leadership can also be considered as a result of successful self-management in VTs [17]. It is generally more convenient for task-related leadership, while the responsibility of formal leaders may consist of building trust among VTs [19].

Leaders need to understand how to take advantage of the use of technology by selecting the appropriate tools and features adapted to the organizational context and objectives, and continually driving members toward a shared vision. In addition, digital tools, such as social media platforms, help to build relationships and communication channels with external actors (e.g., partners, customers, etc.). Digital tools allow access to a large number of individuals and the possibility to interact with them through immediate communication [51].

Finally, leaders play a critical role in managing conflict before it negatively impacts team performance [39]. Leaders should help team members adopt the appropriate technology and adapt it to reduce conflict and increase their productivity [38].

4. Research Model

To answer our research question, we retained, through this literature review, the most important factors impacting VT performance and then conceptualized a multi-level model. Our conceptual model in Figure 1 represents the twelve (12) factors and nineteen (19) propositions that describe the relationships between factors influencing team performance in virtual settings.

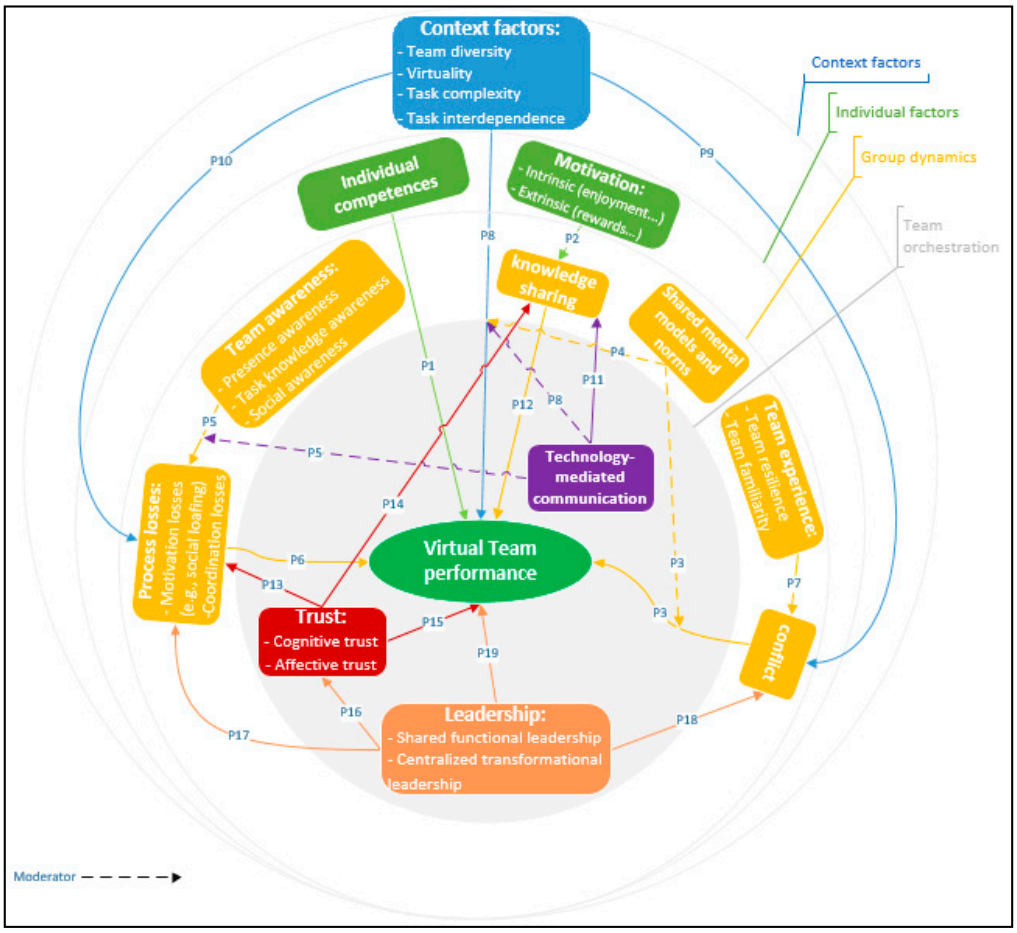

Figure 1. Multi-level model of team performance.

P1. Team members' competencies positively impact performance in VTs.

P2. Motivation positively impacts knowledge sharing in a virtual environment.

P3. Shared mental models and norms reduce the negative impact of conflict on VT performance.

P4. Shared mental models and norms reduce (moderate) the negative impact of context factors (cultural diversity, virtuality, and task complexity and interdependence) on team performance.

P5. TMC reduces (moderates) the negative relationship between team awareness and process losses in VTs.

P6. Process losses negatively impact team performance in virtual environments.

P7. Team experience (team resilience and familiarity) reduces the level of conflict between VT members.

P8. TMC reduces (moderates) the negative relationship between context factors and team performance.

P9. Context factors increase team conflict.

P10. Context factors increase process losses.

P11. TMC positively impacts knowledge sharing by storing, duplicating, and retrieving information.

P12. Knowledge sharing positively impacts team performance in VTs.

P13. Affective trust and process losses are positively related in VTs.

P14. Trust enhances knowledge sharing in VTs.

P15. Trust positively impacts team performance in VTs.

P16. Leadership increases trust level through leader–member exchange in a virtual setting.

P17. Leadership reduces process losses through objectives setting, planning, coordination, and monitoring in VTs.

P18. Leadership reduces team conflict through training, communication media selection, monitoring, establishing a safe communication climate, and conflict resolution in VTs.

P19. Leadership (shared functional leadership and centralized transformational leadership) positively impacts team performance by enabling continuous improvement of shared mental models and norms among VT members.

5. Conclusions

This literature review provides an insight into the factors influencing team performance in virtual settings. The main finding is that factors influencing team performance can be conceptualized as a multi-level model in which each level either adds complexity or helps to overcome challenges, or a mix of both. Context factors as inherent characteristics of VTs negatively impact team performance by hindering communication and knowledge sharing and increasing conflicts between VT members. As VT members start to work together, many challenges could emerge, such as conflict and process losses. These challenges can be mitigated by other factors such as team resilience, familiarity, knowledge sharing, referring to the same mental models and norms, and team awareness. Finally, TMC, trust, and leadership are the three important factors that orchestrate and regulate team behavior towards the best performance.

This study presents opportunities to VT managers, human resources managers, and top management in terms of team configuration, communication media selection, and important behaviors to reinforce in each stage of the project. However, this model needs to be tested in different environments, including cross-cultural contexts. Our future research work will focus on this proposed model test, and then we will strive to shed more light on the TMC and its role in improving VT performance.

Author Contributions: Conceptualization is delivered by A.E.I. and discussed with M.F.; writing and original draft preparation are made by A.E.I.; reviewing and editing are given by M.F., and methodology is constructed by A.E.I. and M.F. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Conflicts of Interest: The authors declare no conflict of interest.

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