Conflict in Virtual Teams: a bibliometric analysis, systematic review, and research agenda

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Abstract

Design/methodology/approach: A dataset of 107 relevant papers on the topic was retrieved using the Web of Science Core Collection database covering a period ranging from 2001 to 2019. A comparative bibliometric analysis consisting of the integration of results from the citation, co-citation, and bibliographic coupling was performed to identify the most influential papers. The systematic literature review complemented the bibliometric results by clustering the most influential papers.

Purpose: The purpose of this study is to map the intellectual structure of the research concerning conflict and conflict management in virtual teams (VT), to contribute to the further integration of knowledge among different streams of research, and to develop an interpretative framework to stimulate future research.

Findings: The results revealed different intellectual structures across several types of analyses. Despite such differences, 41 papers resulted as the most impactful and provided evidence of the emergence of five thematic clusters: trust, performance, cultural diversity, knowledge management, and team management.

Research limitations/implications: Based on the bibliometric analyses an interpretative research agenda has been developed that unveils the main future research avenues. The paper also offers important theoretical contributions by systematizing knowledge on conflict in identifying VTs. Managerial contributions in the form of the identification of best practices are also developed to guide conflict management in VTs.

Originality/value: The uniqueness of this paper is related to its effort in studying, mapping, and systematizing the knowledge concerning the topic of handling conflicts in VTs. Considering the current contingencies this research is particularly timely.

Keywords: Virtual Teams; Conflicts; Conflict Management; Bibliometric analysis; Covid-19; remote working

1. Introduction

Handling conflicts properly in teams is crucial for possible success (Caputo *et al.*, 2019). Due to the specific contingencies experienced by virtual teams (VTs), this aspect becomes even more prominent (Gilson *et al.*, 2015). The Covid-19 pandemic forced many organizations to implement remote working, often in an abrupt and fast way, indicating a particularly favorable historic momentum to systematize previous knowledge on the topic and to offer ways forward. With such a purpose in mind, this paper aims to provide an overview of the evolution of the literature regarding conflict and conflict management in the context of VTs over the last two decades. For this study we broadly define conflict as the situation where parties within a VT perceive that their goals or interests are incompatible or in opposition (e.g., Ayoko and Konrad, 2012); whereas we consider conflict management referring to the understanding of conflict as a whole, its antecedents, the process, the styles, and strategies of handling conflicts and associated behaviors in the context of VT (e.g., Caputo, Ayoko, *et al.*, 2018). Even in the context and dynamics of the virtuality of VTs, we concur with Caputo et al. (2018, p. 11) that "the main objective of conflict management is not to eliminate conflict, but to find different ways to manage it properly by controlling the dysfunctional elements of the conflict while facilitating its productive aspects."

The Covid-19 pandemic has accelerated the already rapid development of technologies in information and communication further reducing the distances and increasing remote work interactions (Garro-Abarca *et al.*, 2021). The hyper-globalization processes of the last decades have led, already before the pandemic, to the growing importance of VTs in today's organizations (Gibson *et al.*, 2014). VTs can be considered as groups of geographically dispersed co-workers who work interdependently, share common objectives, practices, and procedures using technology to communicate and collaborate across time and space (DeSanctis and Monge, 1999). These teams may come from different cultures yet they operate in the same organizational cultural framework, can bring together a variety of knowledge and experience, and deal with a high degree of technologically mediated interactions (Batarseh *et al.*, 2017). These factors contribute to making today's organizations more diverse and possibly more conflictual.

Previous reviews and conceptual work have touched on the issues related to conflict and conflict management in the context of VTs. In particular, Schiller and Mandviwalla (2007) highlighted the issues related to conflict management in VT in an early theoretical piece that looked at the use of theories in VT research. More recently Gilson and colleagues (2015) presented a seminal overview of the research in VTs that unveiled 10 themes and 10

opportunities for future research. According to the authors, conflict management was mostly studied as a mediator in a unidimensional relation, resulting in the suggestion that conflict is more likely to happen in VTs and it negatively affects team dynamics, processes, and outcomes. A similar suggestion is made by Jimenez and colleagues (2017), in reviewing the works about global VTs, and Raghuram and colleagues (2019), reviewing studies about virtual work, who highlighted how conflicts emerge mostly from cultural and language differences affecting team dynamics. The fragmentation of empirical literature about conflict in VTs and the limited conceptual attention given to the topic, calls for an investigation and systematization of the literature about conflict and conflict management in VTs as timely and necessary, to support both research and practice to navigate the uncertainties of today's world.

Shedding light on the evolution of the study of conflicts and their associated management in VTs, a bibliometric analysis of 107 relevant articles published in peer-reviewed scientific journals has been performed to first, identify the most influential studies and second, to systematize the academic knowledge by unveiling the existence of five thematic clusters: trust, performance, cultural diversity, knowledge management, and team management. In particular, an innovative approach has been adopted by comparing results from alternative complementary bibliometric tools, i.e., citations, normalized citations, and bibliographic coupling, to identify the most influential articles in the field (Caputo *et al.*, 2021).

This study provides several contributions theoretically, methodologically, and practically. First, it contributes to strengthening the integration and systematization of the two bodies of literature in conflict management and VTs. Second, it provides a rigorous and systematic identification of the most influential papers in these fields and identifies thematic areas to bring forward the research. Third, it contributes to bibliometric and review studies by advancing the use of comparative bibliometric approaches. Finally, the paper interprets in an integrative framework the current knowledge on the field comprising non-linear and recursive loops between its elements and thanks to that elaborates future research avenues.

The paper is organized in five sections, including this introduction, as follows. Section two describes the protocol adopted for selecting the paper and analyses performed. The third section presents the results of the analyses and determines the most impactful papers. The fourth section uses the most impactful papers to propose a framework aimed at suggesting an agenda for future research. The conclusion section summarizes the contributions of the paper and its limitations.

2. Methods

This paper aims to provide a comprehensive yet succinct and timely knowledge map of the studies investigating conflict management in VTs. Such a knowledge map is purposed to provide both scholars and practitioners with an overview of what we know i.e., best practices and main findings, and what we still do not know i.e., future research directions about managing conflict in virtual workplaces. The Covid-19 pandemic that resulted in a large part of the office workforce working remotely is disrupting social relationships in the workplaces. A review of conflict management in VTs is therefore necessary and needs to be carried out in a timely fashion to serve its purpose.

To achieve these objectives, we have built upon best practices in systematic literature review and bibliometric studies and complemented the two methodologies to fulfill simultaneously the breadth and depth of the analysis. The simultaneous use of these two complementary methods albeit recent is not entirely new as it has been validated in several studies (Caputo *et al.*, 2021; Caputo, Marzi, *et al.*, 2018; Dabić *et al.*, 2020). It allows researchers to investigate a topic in depth through the systematic review while maintaining a wider picture of the evolution of knowledge through bibliometric analysis. In this study, we have also included a methodological innovation in the complementary use of alternative bibliometric analyses to identify the most influential papers in the field.

2.1 Sampling protocol

Consistent with the systematic review method (Thorpe *et al.*, 2005; Tranfield *et al.*, 2003) a panel of experts was formed to define the field of research, choose the keywords, the database, and the set of inclusion and exclusion criteria. The panel of experts consisted of two professors, one an expert in strategy, negotiation, and conflict management, and the other in organizational studies and team working, together with a Ph.D. student specifically focused on the organizational dynamics of dispersed teams. A step-by-step process was followed as outlined in this section.

Step 1. The database Web of Science (WoS) Core Collection® (research areas “Business Economics” and “Psychology”) was chosen after several alternative searches in Scopus and EBSCO because it retrieved a sample of high-quality articles representative of the best conflict in VTs research published to date. The choice of Web of Science (WoS) Core Collection® is also supported and validated as appropriate for the field of inquiry by recent bibliometric studies in the conflict management (Caputo *et al.*, 2019).

Step 2. A wide search string based on multiple levels of keywords was employed (Caputo, 2013) to ensure the capture of the most relevant papers on the topic. The first level included the keyword "Conflict". The second level included the keywords about the remote/virtual nature of the investigated relationships: "smart OR virtual OR distributed OR distant OR remote". The third level included keywords related to the organizational aspect of the teams including "team OR group OR workplace OR workspace". The search was run with Boolean operators (AND and OR) via the TS command, which searches among Title, Abstract, Author Keywords, and Keywords Plus®. Consistent with best practices in bibliometric research and to ensure the comparability among the indicators, the year 2020 was excluded (Caputo *et al.*, 2019). The search was carried out among peer-reviewed articles written in the English language and resulted in the first sample of 397 papers.

Step 3. Due to the wideness of the search string, we proceeded to the manual "cleaning" of the dataset by reading all the titles and abstracts of the selected papers to eliminate those that were not relevant to our search. When it was not possible to assess relevance from the abstract we obtained a digital copy of the full text of the paper. Excluded papers fell into two main categories: a) a large number of papers do not investigate conflict at all (e.g., Ebrahim, 2015; Presbitero and Toledano, 2018) although the word "conflict" is presented in the search items. This situation mainly occurs because many papers had a declaration of conflict of interest that was caught by the search, others were eliminated because they simply mentioned "conflicting results" in the abstract or where conflict was just mentioned incidentally; b) a smaller portion of papers investigated conflict but not in a virtual environment (e.g., Sheehan *et al.*, 2016). Following these criteria, two-hundred-ninety-three papers were eliminated because they were not relevant.

2.2 Analyses

The final dataset of 107 papers was used as a basis for both the bibliometric analysis and a qualitative systematic literature review to develop a comprehensive map of the knowledge of the field.

Bibliometrics is a subset of scientometrics and applies statistical methods to the study of scientific activity in a scientific community (Zupic and Čater, 2015). For our research, we followed the perspective known as the positive bibliometrics (Todeschini and Baccini, 2016). This is because we aim to describe and explain phenomena in science via the analysis of its scientific communication. In this view, bibliometric indicators represent phenomena or proxies of phenomena. For example, the citations received by an article that expresses a concept are a

proxy of the diffusion and impact of said concept in the scientific community. Examples of positive bibliometrics are citation analysis, co-citation analysis, citation networks, and productivity analysis.

Complementary bibliometric analyses were instrumental to identify the sample of the most influential papers to review. Prior studies argue for the use of more than one indicator (Caputo *et al.*, 2019; Dabić *et al.*, 2020) as an effective way to limit the intrinsic bias that every indicator has.

Firstly we undertook a performance analysis based on indicators of activity. These indicators provide data about the volume and impact of research during a given timeframe via word frequency analysis, citation analysis, and counting publications by the unit of analysis (e.g., authorship, country, affiliation, etc.).

Secondly, we built a science map based on indicators that provide spatial representations of how different scientific elements are related to one another to picture the structural and dynamic organization of knowledge about conflict management in VTs. We combined results from co-citation analysis and bibliographic coupling to identify the most influential papers, authors, and journals and the co-occurrence of keywords analysis to identify the thematic structure of the field. Co-citation analysis "constructs measures of similarity between articles, authors, or journals by using the frequency with which two units are cited together, i.e., co-citation counts" (Caputo *et al.*, 2019). Therefore, co-citation analysis is powerful in showing a picture from the past and it is biased by the time-dependency i.e., an older paper has the probability of obtaining more citations than a newer one. Bibliographic coupling is often used to aggregate papers by similarity and it "measures the similarity between papers through their common cited references" (Todeschini and Baccini, 2016). The advantage of a bibliographic coupling is to compare recent papers even if not cited yet. The analysis of the co-occurrence of keywords uses the article's keywords to investigate the conceptual structure of a field. According to Caputo et al. (Caputo *et al.*, 2019) "this is the only bibliometric method that uses the content of the articles to directly measure similarity in which others use indirect measures such as citations and authorships, co-word analysis is particularly powerful and appropriate to develop a semantic map that helps in understanding the conceptual structure of a field".

By comparing and contrasting the results from activity indicators, co-citation analysis, bibliographic coupling, and co-occurrence of keywords, it is possible to provide a systematic overview of the field (Caputo *et al.*, 2021). The activity indicators will show the evolution of the field and its impact. Co-citation and bibliographic coupling will show an unbiased view of

the most influential articles, authors, and journals; whilst the co-occurrence of keywords will show the thematic map of the topics investigated.

The software VOSViewer (van Eck and Waltman, 2010) was used to calculate the bibliometric indicators and provide the graphic representation of the networks. For a detailed explanation of the scripts and mathematical algorithms adopted in VOSViewer, please see van Eck and Waltman (2007; 2010).

Combining the results of co-citation analysis and bibliographic coupling allowed us to identify a list of most influential papers that were then considered for the qualitative systematic literature review. We have combined the top 20 papers resulting from three indicators: absolute citations, normalized citations, and bibliographic coupling strength. Absolute citations are represented by the total number of citations received by a paper. Normalized citations are represented by the number of citations of the paper divided by the average number of citations of all papers published in the same year and included in our dataset (van Eck and Waltman, 2016). The bibliographic coupling strength is measured by the bibliographic coupling total link strength algorithm in VOSViewer, indicating the level of similarity and interconnectedness of a paper in the field regardless of the received citations (van Eck and Waltman, 2016). Integrating these three measures allows us to reduce the age bias of papers and include in the evaluation the influence of a paper, not only the number of citations received but also how the content of the paper relates to other papers in the same scientific community.

The resulting dataset of unique papers in the top 20 list from each indicator is composed of 41 papers, which constituted the dataset for the literature review.

Having selected the most influential articles to review, we proceeded to the literature review based on the content analysis of selected papers (Duriau *et al.*, 2007). Following best practices, each article was read in full and analyzed qualitatively (Barclay *et al.*, 2011; Pittaway and Cope, 2007). Articles were coded, tagged, and later grouped into clusters based on their content; the articles were allowed to be part of more than one cluster (Caputo, Pellegrini, *et al.*, 2016). The process was dynamic allowing new tags to be included during the process of reading articles to allow flexibility in categorizing information and reducing biases that may arise from a rigidly pre-set system (Caputo, Pellegrini, *et al.*, 2016; Dabić *et al.*, 2020). Short and Palmer (2008, p. 279) categorize content analysis into three methods: "*human-scored systems, individual word-count systems, and computerized systems that use artificial intelligence"*. We combined computer-aided techniques with human-scored techniques, integrating rigor and insights from the bibliometric analyses with the interpretation of researchers.

3. Results of the bibliometric analyses

3.1. Activity bibliometric indicators

Our bibliometric analysis confirms a constant growth of attention to the handling problems in VTs over time with an increasing number of journal outlets.

Figure 1 shows how the field started in 2001 is on a growing directory, although the number of papers published is still limited making the study of conflict in VTs a niche.

Please insert here Figure 1 – Number of papers published per year

In terms of journals, 58 unique outlets have published 107 papers in the dataset. Table 1 shows the 20 most cited journals and indicates also the number of published papers and average citations received by them. In terms of total citations, Organ Sci., Acad. Manage. J., J. Manage. Inform. Syst., J. Int. Bus. Stud. and Inf. Manage., are the most influential outlets. However, if we consider the number of papers published, which is a proxy of the interest of a journal on the topic, Small Group Res., J. Manage. Inform. Syst., Organ Sci., Inf. Manage. and J. Manag. are the five most interested journals. Instead, looking at the impact of the individual articles the situation changes again with J. Int. Bus. Stud., Acad. Manage. J., Organ Sci., Int. J. Confl. Manage., and Inf. Manage. It can be noted how Organization Science and Information Management are the journals appearing in the top 5 in all three measures.

Please insert here Table 1 – Most cited Journals

Looking at the authors, 290 scholars have authored the 107 papers in the dataset. Out of these only three, Ahuja, Staples, and Zornoza, have authored at least three papers and can therefore be considered the most prolific in the field. Table 2 lists the most prolific authors who have authored at least two papers. Interestingly, if we look at the most cited authors only three of them (Hinds, Majchrzak and Staples) appear in the top 10 of most cited (Table 3).

Please insert here Table 2 – Most prolific Authors

Please insert here Table 3 – Most cited Authors

The studies in the dataset were authored by affiliates of 186 research institutions from 28 different countries. The research in the field of conflict in VTs appears to be predominantly made in the USA (65 papers) and other western countries.

3.2. Co-citation analysis: the foundations of the field

The co-citation analysis is a powerful tool to investigate the foundations of the research about conflict in VTs through the analysis of the references cited by the papers in our dataset. The analysis reveals those that are the most cited references, authors, and journals. Table 4 shows the statistics and criteria used for the co-citation analysis.

Please insert here Table 4 – Criteria of the co-citation analysis

By performing a co-citation analysis we were able to identify the 10 most cited papers, authors, and journals that constitute the theoretical pillars of the research in conflict in VTs. The results show how such research is grounded in the literature about VTs and remote working, (e.g., Cramton, 2001a; Jarvenpaa and Leidner, 1999) pillar studies in conflict management, (e.g., Jehn, 1995), and the early studies integrating the two (Hinds and Bailey, 2003; Mortensen and Hinds, 2001).

A combined reading of the most influential cited references and the network of similarities (Figure 2) show that the research about conflict in VTs relies on a coherent and homogeneous network grounded in the scientific community of the fields of management and organization studies.

Please insert here Table 5 – Co-citation analysis

Please insert here Figure 2 - Network diagram of co-citation analysis

3.3. Bibliographic coupling: the structure of the field

Bibliographic coupling analysis is used to evaluate the current structure of a field based on a clustering technique that allows us to compare recent papers even if not yet cited, therefore not being biased by time. However, the method has severe limitations in cases like ours that analyze smaller research fields (Jarneving, 2007) hence the technique was adopted to complement citation and co-citation analysis and was not used to create clusters but rather to identify the network relevance of papers, authors and journals. All papers (107), authors (290), and journals (58) from the dataset were included in the analysis.

Please insert here Table 6 – Bibliographic coupling analysis

Please insert here Figure 3 - Network diagram of bibliographic coupling analysis

By performing a bibliographic coupling analysis, we were able to identify the 10 most connected papers, authors, and journals that constitute the current structure of the research in conflict in VTs. Via the visualization of networks technique is it also possible to show how the field is well interconnected across the three levels of analysis, confirming the finding that the research about conflict in VTs relies on a coherent and homogeneous scientific community.

3.4. Co-occurrence of keywords

The analysis based on the co-occurrence of keywords allows us to show the intellectual structure of the field by identifying and grouping the main topics that have been subject to investigation. This method is particularly useful to complement the previous analysis as it offers a direct measure of similarity of topics by analyzing the actual content of the papers via the keywords.

The keyword analysis was performed adopting the Keyword Plus tool from Web of Science. Even though the Keyword Plus is usually chosen to ensure consistency across the classification of articles' keywords it was necessary to perform a manual harmonization of the spelling of those keywords.

Previous studies have considered Keyword Plus to be effective as the keywords provided by the authors in terms of bibliometric analysis, investigating the knowledge structure of scientific fields (Zhang *et al.*, 2016). The adoption of Keyword Plus allows the researcher to limit biases

and risks associated with the manual tagging of content. Only keywords that occurred at least 5 times were kept; this resulted in having only 39 keywords to constitute the largest usable set of connected terms.

Please insert here Table 7 – Main topics from the co-occurrence of keywords analysis

Please insert here Figure 4 - Network diagram and overlay visualization of keywords

The network diagram and overlay visualization of the keywords (Figure 4) show that the intellectual structure of the topics is quite homogeneous and has evolved. In particular, the research on conflict in VTs started with the investigation of technological topics and issues related to cultural diversity, personality, and leadership.

3.5. Synthesis of results

Having shown the individual results of activity indicators, co-citation, bibliographic coupling, and co-occurrence of keywords, we moved our attention to a synthesis that allowed us to identify the most influential papers to be included in the systematic literature review.

Table 8 shows the top 20 articles according to three complementary metrics: the normalized citations, the total citations, and the link strength. The total citations are computed by counting all citations received by a paper in the Web of Science Core Collection at the time of the study. The normalized number of citations in a paper equals the number of citations in the paper divided by the average number of citations of all papers published in the same year and included in the dataset (van Eck and Waltman, 2016). The total link strength indicates the total strength of the links of an article with the other articles in the dataset calculated via the bibliographic coupling analysis (van Eck and Waltman, 2016). By comparing these three measures we can countereffect the biases of each of them in terms of age of the article, relative impact, and connectedness in the field. As a result, 41 unique articles were discovered to be included in at least one of the metrics and formed the basis for our systematic literature review.

Please insert here Table 8 – Most influential articles

4. Systematic literature review

This section presents the results of the systematic literature review that has been based on the most influential articles belonging to each cluster and the classification obtained by analyzing the content of each article. We have identified five thematic clusters: trust, performance, cultural diversity, knowledge management, and team management.

4.1 Trust cluster

The issue of trust is among the key topics in the conflict and conflict management studies (Caputo *et al.*, 2019). Trust is an extremely important variable for successful collaboration (Donovan, 1993) and increased relational capital (Connelly and Turel, 2016). Nevertheless, trust is also regularly perceived as a challenging issue for team effectiveness (Breuer *et al.*, 2016), particularly under virtuality due to the lack of clarity on interaction mechanisms (Bierly *et al.*, 2009; DeRosa *et al.*, 2004). Being a crucial construct for any variation of teams, trust is proved as more difficult and important to achieve in the circumstances of physical dispersion of team members (Brahm and Kunze, 2012; Breuer *et al.*, 2016; Connelly and Turel, 2016; Staples and Webster, 2008; Yakovleva *et al.*, 2010). Penarroja et al. (2013) concluded that the level of virtuality negatively influences team trust, whilst trust is also vital for reducing both interpersonal and task conflicts (Connelly and Turel, 2016; Curseu and Schruijer, 2010) as well as for successful conflict management processes (Bierly *et al.*, 2009). Virtuality is mainly considered to be a moderating variable in the relationship between trust and conflict (Bierly *et al.*, 2009) where trust may be both an output and an input of the group processes, such as conflict (Marks *et al.*, 2001). A further explanation is provided by studies that determined that the greater the degree of virtuality, the greater the negative impact on trust by relationship conflict (Bierly *et al.*, 2009; Peñarroja *et al.*, 2013). In this vein, Breuer et al. (2016) showed that a high degree of virtuality increases internal team risks that in turn increase the necessity for trust, thus forming a loop relationship between a group functioning, conflict, and trust (De Dreu and Weingart, 2003). In general, the relationship between team functioning, conflict, and trust could be described as a negative association between conflicts and trust exacerbated by the degree of virtuality (Bierly *et al.*, 2009; Polzer, Crisp, Jarvenpaa, Kim, *et al.*, 2006).

4.2 Performance cluster

The next cluster is based on team performance which is considered to be highly influenced by internal team communication in VTs (Massey *et al.*, 2014; Montoya-Weiss *et al.*, 2001; Sarker *et al.*, 2011). VTs have different characteristics than traditional teams (Brahm and Kunze, 2012), and it was found that people are capable of adapting to the conditions of VTs such as restricted communication channels, probable instability of internet connection, lacking opportunities for informal communication, etc. (van der Kleij *et al.*, 2009). Moreover, video communication and similar technologies reduce the main differences between teams that are co-located and geographically dispersed teams (Bradley *et al.*, 2013). A great number of studies have shown that geographical distance between team members may complicate conflict management (Cramton, 2001b; Hill and Bartol, 2016). However, the extensive usage of mediated communication technologies may exaggerate the negative impacts of conflict in teams (Kankanhalli *et al.*, 2006), due to complexities such as the unavailability for frequent discussions, information exchange, and clarifications regarding personal and task issues, which may result in misunderstandings and further communication closure (Mortensen and Hinds, 2001). In other words, virtuality increases the complexity of the triggers and the dynamics of conflicts as well as their management and resolution (Friedman and Currall, 2003). In turn, such communication complexities among team participants (e.g. conflicts) negatively influence the team performance (Connelly and Turel, 2016; Turel and Zhang, 2010). However, the understanding of the underlying mechanisms of how conflicts work and their influence on team performance in VTs still demands additional research (Connelly and Turel, 2016). There are several debates about the impact of conflict on VT performance. For instance, Hinds and Mortensen (2005) state that the virtuality of teams increases the vulnerability of the conflicts due to the lack of casual, unplanned communication between team members, which in turn negatively influences the overall team performance. However, in a review of the literature, Ortiz de Guinea et al. (2012) emphasize contrasting findings where virtuality and performance correlate both in positive and negative directions. The recent body of research regarding conflicts and team performance in VTs admits that virtuality should be perceived as a continuous rather than binary variable, to avoid clashing results (e.g. Griffith et al., 2003; Malhotra & Majchrzak, 2014; Ortiz De Guinea et al., 2012). It was discovered that a level of virtuality should include distance indicators of separation, the configuration of a proportion working virtually and face-to-face, and time parameters of virtual collaboration (Ortiz De Guinea *et al.*, 2012). For studies looking at team performances, it is crucial to consider contextual conditions, degrees of virtuality, and mediating technologies as they may

significantly alter the relationship (Malhotra and Majchrzak, 2014). For example, research, where virtuality is treated as a continuous variable, shows less presence of conflicts in more VTs and no impact on the performance (Ortiz De Guinea *et al.*, 2012). Kankanhalli et al. (2006) propose a theoretical framework where both task conflict and relationship conflict do not have a direct influence on VT performance, contingent upon the conflict resolution approach (for both), task complexity (for task conflict), and task interdependence (relationship conflict). Looking at conflict management, research has indicated that the conflict management style (Paul, Seetharaman, *et al.*, 2004) and conflict management behavior (de Dreu and van de Vliert, 1994; Montoya-Weiss *et al.*, 2001) are critical conditions for successful team performance in the dimension of virtual collaboration. Additionally, collaborative conflict management style was indicated as a positive influencing factor on team performance, while group heterogeneity was found to be a barrier for successful conflict management and an effective group performance (Paul, Seetharaman, *et al.*, 2004).

4.3 Cultural diversity cluster

Cultural diversity is one of the most ambiguous concepts regarding communication, teams, and organizational studies. A series of meta-analyses validate this point stressing the nature of the complex notion to be both a benefit and a challenge (Smith *et al.*, 1994; Stahl *et al.*, 2010). In the context of teams and team working, cultural diversity refers to the different cultural backgrounds of the team members (Harush *et al.*, 2018), including diversity in nationality, (Gibbs *et al.*, 2017), and broader cultural aspects (Kankanhalli *et al.*, 2006), such as linguistic diversity (McDonough *et al.*, 1999) and cultural dimensions (Hofstede, 1991). As a concept, cultural diversity is perceived as a key to a greater and innovative performance (Polley and McGrath, 1984) or the contrary, as a reason for ingroup miscommunications (Brett *et al.*, 2006; Staples and Zhao, 2006). Globalization dynamics and technological advancements (Paul, Samarah, *et al.*, 2004) are increasing virtuality and multiculturality in teams (Gibson *et al.*, 2014), resulting in the prevalence of geographically dispersed international teams over face-to-face ones (Stahl *et al.*, 2010). The combination of physical dispersion and cultural diversity (Shachaf, 2008) increases the complexity of VTs due to the more radical differences between team members' attitudes and perceptions (Zimmermann, 2011). As a result, communication and the gaining of possible benefits associated with diversity may become more problematic (Gibson and Gibbs, 2006). Implementing cultural diversity may result in misunderstandings and conflicts between team members (Maznevski *et al.*, 2006; Paul, Seetharaman, *et al.*, 2004;

Stahl *et al.*, 2010) due to reasons such as the communication (Shachaf, 2008) and social categorization (Harush *et al.*, 2018). Hence, conflict management is of significant importance as often team dynamics are complicated by not only the virtual settings but also by the cultural heterogeneity (Paul, Samarah, *et al.*, 2004; Paul, Seetharaman, *et al.*, 2004). The debate whether cultural diversity increases or decreases conflicts in VTs is continuing (Kankanhalli *et al.*, 2006; Mortensen and Hinds, 2001). Kankanhalli et al. (2006) discovered from their in-depth study that cultural diversity in VT leads to relationship and task conflicts, which they explain by the similarity attraction theory (e.g., Wells and Aicher, 2013) and social identity theory (e.g., Ashforth and Mael, 1989). Usage of the latter theory is also supported by Mortensen & Hinds (2001) and Harush (2018), who emphasized the vital role of forming a global identity as a self-categorization process to a shared team ingroup identity to reduce a level of relational conflicts in GVT's environment, especially in the circumstances of low task interdependence. Paul, Seetharaman, et al. (2004) support the negative impact of team members' cultural diversity on conflict resolution processes and group interactions due to the variations in values. Furthermore, Staples & Zhao (2006) concluded that culturally diverse teams indicated lower levels of satisfaction and cohesion and higher levels of conflicts. However, it was also pointed out that culturally diverse VTs showed higher performance rates and fewer conflicts than face-to-face ones. This finding emphasizes the importance of taking under consideration not just every separate characteristic of a team, but the combinations of the teams' settings. Whilst to some, cultural heterogeneity of teams can negatively impact interactions and communication processes, increasing conflicts (Pelled, 1996), to others, diversity can be very beneficial for teams' dynamics and conflict reduction (Staples and Zhao, 2006). These opposing viewpoints could be explained by several factors. For instance, Paul, Samarah, et al. (2004) in contrast to a widespread belief about the negative impact of cultural diversity on group dynamics found that higher levels of agreement within international groups could be achieved by conflict management (Paul, Samarah, *et al.*, 2004) and relevant media choices (Klitmøller and Lauring, 2013). Additionally, according to Stahl et al. (2010), the physical dispersion of team members tends to moderate the impact of cultural diversity on conflicts as the virtual international teams showed lower levels of conflicts and higher social integration in comparison with multicultural collocated teams. These findings were similarly indicated by Mortensen & Hinds (2001) in their earlier research with the reason that the notion of reduced conflicts could be a result of either stronger ingroup integration or an adverse environment for conflicts to arise.

4.4 Knowledge management cluster

Efficient knowledge management is vital for the success of a company, project, or team (Chiravuri *et al.*, 2011). The process of knowledge transferring, sharing, and exchanging provides additional challenges for collocated teams (Ortiz De Guinea *et al.*, 2012). Due to the globalization dynamics, knowledge sharing between geographically distributed team members and experts became an integral part of international companies and VTs (Raab *et al.*, 2014). Consequently, knowledge management in VTs and presumed conflicts came to the scholars' attention due to the complex settings of geographically distributed teams. The implied challenges are explained as difficulties in sharing comprehensive knowledge with no face-to-face communication, potentially creating sub-groups (Boh *et al.*, 2007) and reducing the attention of team members under virtual circumstances (Ortiz De Guinea *et al.*, 2012). This in turn may lead to misunderstandings, (Hinds and Bailey, 2003) failure of information sharing, (Hinds and Mortensen, 2005), and other interpersonal difficulties (Boh *et al.*, 2007). Ortiz De Guinea et al. (2012) argue that the predominantly multicultural composition of geographically dispersed teams issues such as language diversity may jeopardize the knowledge sharing process and boost the frequency of conflicts. Chiravuri et al. (2011) indicated that a combination of a lack of face-to-face cues (Klitmøller and Lauring, 2013) and probable culturally contrasting behavioral models can cause different patterns of information exchange, which in turn leads to misunderstandings (Cramton, 2001b; Kayworth and Leidner, 2002) and conflicts during the knowledge capture process. At the end of the study, the authors emphasized a repertory grid cognition-based technique ("cognitive mapping technique that attempts to describe how people think about the phenomena in their world" (Tan and Hunter, 2002, p. 40)) as a reliable measure for decreasing conflicts in VTs in the knowledge capture process (Chiravuri *et al.*, 2011). Furthermore, Klitmøller and Lauring (2013) put a value on the multicultural element of VTs and its important role in the process of selecting particular types of media for knowledge exchange (e.g. using a rich media for more ambiguous matters, and a lean media in case of canonical knowledge exchange). Raab et al. (2014) researched the mechanisms of knowledge sharing in a globally dispersed context identifying a link between the imbalance of the geographical distribution of group members and the low efficiency of knowledge sharing due to the strong social categorization processes (Polzer, Crisp, Jarvenpaa and Kim, 2006) and potential conflicts between subgroups (Fiol and O'Connor, 2005; Hinds and Mortensen, 2005). Indeed, a proper mix of technological and organizational elements is believed to be crucial for proper knowledge exchange, open knowledge sharing, and all other issues connected to knowledge management in the conditions of the virtual collaboration

(Zammuto *et al.*, 2007). Tools of virtual communication may reduce cultural differences (Stahl *et al.*, 2010) and positively impact knowledge-sharing processes (Klitmøller and Lauring, 2013).

4.5 Team management cluster

The final cluster is devoted to team management issues related to conflicts in VTs. In general, managers' intention to run a project with a presence of geographically distributed teams can be guided by the benefits of flexible conditions of working (Majchrzak *et al.*, 2004). This regards both: 1) managers looking for the particular targeted expertise needed for the certain case (Boh *et al.*, 2007; Hitt *et al.*, 2001); 2) and team members who can work remotely due to telecommunication tools (May and Carter, 2001) and therefore avoiding travel costs and improving time management. However, along with these valuable advantages, several adverse effects may be experienced (Saunders and Ahuja, 2006) that consequently lead to conflicts in its varied expressions. For instance, Boh and colleagues (2007) refer to the result of their longitudinal research concluding that the VTs accumulated more net earnings than the co-located ones by better matching of team members' expertise with the project's characteristics. However, in the cases of a very significant percentage of geographically distributed team members, net earnings declined because of increased coordination expenses. Managers have to take into account additional costs for the difficulty for VT members to develop a collaborative environment (Kraut *et al.*, 2002), diminish cases of free-riding (Weisband, 2002), and avoid destructive conflicts (Boh *et al.*, 2007) and misunderstandings (Cramton, 2001b). Therefore, taking into account the increased coordination costs due to the geographical distribution and potential interpersonal difficulties, the benefits of attracting experts/team members remotely may be limited (Boh *et al.*, 2007) and should be carefully thought through by a manager before the implementation of the project. Sarker et al. (2018) identify work-life balance conflicts as important in VTs, stressing that virtuality adds additional challenging issues, such as time difference, usage of telecommunication tools, and adaptability. In their research the hypothesis that higher schedule flexibility will cause lower work-life conflicts was not supported by the results. That could be explained by the "Border Theory" (Clark, 2000), which implies that flexible timing normally makes team members more frustrated because of the need to figure out when they should assume their home and work responsibilities. The potential managerial solution is seen to be as suggesting special creative techniques to self-manage virtual working arrangements to the advantage of employees by employees

themselves, or careful implementation of agile approaches by managers (Sarker *et al.*, 2018). It is crucial to detect the scale of that intervention for the appropriate functioning of the VT (Raab *et al.*, 2014). Ruiller & Dumas (2018) proposed a framework on the role of the manager in a virtual environment. They define two management modes: *a)* "e-communicational", i.e., a manager positions himself as a part of a VT and takes under consideration teleworking specificities maintaining informal communication, interpersonal trust, increasing perceived proximity, and also exposing a strong shared identity that tends to prevent conflicts (Mortensen and Hinds, 2001); and *b)* "control mode", i.e., managers are not co-teleworkers as they manage VTs prevailingly focusing on work objectives with high levels of institutionalization and formalization. On the one hand, managerial interference may impede establishing social connections between group representatives (Gulati, 1995). On the other hand, managers should intervene in the virtual setting of a team stimulating frequent and effective communication. In this way: team members could build better social relationships (Malhotra *et al.*, 2007; Raab *et al.*, 2014; Saunders and Ahuja, 2006) and not experience conflicts due to obstacles in the technological adaptation (Thomas and Bostrom, 2010). The latter claim is also supported by Chiravuri et al. (2011), who consider that a manager has to be involved in the in-group processes to discern the nature of conflicts. In the case of a cognitive conflict, this should be closely monitored as it is capable of causing either stagnation of the process or improved solutions (Chiravuri *et al.*, 2011). In the study by Raab et al. (2014) managerial involvement was found to be a mitigator of cultural boundaries but had no moderating effect on the relationship between trust and satisfaction with knowledge sharing in globally dispersed groups. Thus, managers may be concerned to track the essence and type of a conflict in VT's dynamics and implement appropriate conflict management techniques to increase the productivity of a project.

5. Setting-up a Research Agenda

The purpose of this paper is the systematization of the accumulated knowledge of the field and because of that, paving interesting and promising research avenues (Caputo, Marzi, *et al.*, 2018; Tranfield *et al.*, 2003), especially about the results of the systematic literature review, the clear focus characterizing research of emerging conflicts and conflict management in VT, and these are interpreted in a framework stressing possible interconnections and relationships among them.

Please insert here Figure 5 – A framework for conflict management in virtual teams

The logic of the framework is consistent with the traditional input-process-output (IPO) approach to studies on VT and used in previous systematic literature reviews (e.g., Garro-Abarca *et al.*, 2021; Gilson *et al.*, 2015). Differently from that, however, the linearity of a pure IPO logic did not emerge from the results of that literature. For this reason, our interpretative framework cannot postulate a single or cause-effect directionality between its theoretical blocks, hypothesizing fuzzy and yet to be untangled relationships. The 'fuzziness' refers to 1) a non-linearity, i.e., a block seems to have several impacts on others e.g. direct, indirect, moderated, or mediated effects; 2) recursive relationships, i.e., most of the blocks have bi-directional relationships with the others, thus self-reinforcing loops based on previous interaction either positive and negative may occur; 3) configurational approach, i.e., a single block when considered in isolation seems to hold a limited explanatory power, and better results would be achieved analyzing several factors together. Thus, it would be reasonable to say that it is not so much the presence or the intensity of a single element/block to determine the outcomes, but the co-presence or conversely the co-absence, of a set of elements that is the key interpretation. In figure 5 we only adopted the categorization of the IPO framework, specifically the antecedents, dynamics, and outcomes and we also depicted rippled lines among these categories to represent the fuzziness of these relationships. However, any category of the theoretical blocks potentially influences and is influenced by the others, thus the arrows are present at both ends of the lines.

The first category of antecedents is fixed elements that come from the structural contingencies in which a VT operates its composition. These structural elements refer to the demographic, cultural, and individual characteristics of team members, and they can be grouped under the umbrella concept of the heterogeneity existing in a team. This heterogeneity is the root of several latent or actual conflicts and conflict-related dynamics that may affect individual team members or the whole group (Schaubroeck and Yu, 2017). For example, different personalities or intensity of traits, e.g. consciousness and extraversion may increase or lessen dyadic conflicts among members (Turel and Zhang, 2010). However, these elements do not affect only conflicts but also shape different strategies to manage them, opening the debate to a contingent and contextual approach to conflict management in VTs. As evidenced from the thematic clusters, heterogeneity may pertain to different cultural backgrounds that may hinder the process of cohesion due to the homophily phenomenon, thus preferring individuals with similar

characteristics or common shared culture. This stimulates the formation of sub-groups (Gibson and Gibbs, 2006), highlighting the necessity of specific strategies to reduce conflicts and the fault-lines within a team. Heterogeneity however is a broader concept than merely culture (Boh *et al.*, 2007). As the geographical dispersion of team members increase the higher is the likelihood to have team members with diverse institutional, economic, and other contingencies that may stimulate an increment of conflicts, stricter management of them, and other problems in the functioning of a team (Jimenez *et al.*, 2017). This heterogeneity may directly influence a team or individual performance but its indirect effect via conflicts, conflict management strategies and functioning processes of a team are still yet to be explored (dynamics). Future research avenues could inquire what type of heterogeneity factors can have a different impact in VT from those traditionally stressed for co-located teams. Even more interesting could be a study of whether heterogeneity plays a different role in the strategy to manage those conflicts or affect team functioning of a VT in different ways. For instance; are these potential tensions more marked in VTs related to the fact that interactions are less frequent and with less embedded exchanges (Hinds and Bailey, 2003)? Conversely, since individual differences seem to play a minor role in VTs, can these tensions be lessened when in co-located teams (Wakefield *et al.*, 2008)? Paying attention to the heterogeneity of a VT also holds strong implications for practice; managers and leaders should firstly carefully design the composition of a virtual team and not only for reasons of technical competencies but also of cultural and soft skill aspects related to the team members. This may reduce potential conflicts at several levels. Secondly, even if a proper design is not implementable, the heterogeneity of a VT should be fully acknowledged to counterbalance the tendency to disengage.

The second category of this interpretative framework is represented by what has been termed as dynamics as all these elements pertain to interactions among members and the several processes through which VT functions and performs (Breuer *et al.*, 2016). In our framework based on identified clusters, we consider these categories: the conflicts, in terms of their nature and level of impact, the conflict management process, and other relevant dynamic interactions occurring in a team, called team functioning that specifically includes the process of building trust and that of managing knowledge flows. As premised, the fuzziness of these relationships also reveals that blocks of the same category have internal relationships e. g, conflict management impacts, and is impacted by, the characteristic of conflicts in VTs and by the team functioning elements of VTs. Similarly, we expect conflicts to impact team functioning directly and via the various degrees of conflict management and vice versa.

In terms of conflicts in VTs, discriminations should be made about the nature of the conflict. Virtuality on the one hand may stimulate relational conflicts, as misunderstandings in communication and lack of trust occur more readily (Hinds & Bailey, 2003). Caputo and colleagues (2019) in a bibliometric overview of conflict management studies highlighted the important role of culture in the relationship between trust and conflict. It is expected that building trust, and managing trust-based conflicts, are more complex in virtual settings due to their enhanced multi-cultural composition and the difficulty for individuals to decodify clues in a virtual environment. However, about task-based conflict, such a clear negative influence does not seem so prominent (Gibbs *et al.*, 2017). To summarize; can conflicts of different nature be affected by virtuality, and in which ways? Are there interactional effects? Similarly, the specific level at which conflicts are embedded is also relevant. Conflicts may spur at an individual level, for example, a team member that has to juggle between work and personal life (Clark, 2000). The Covid-19 pandemic poses serious questions about the ambivalence of flexible work arrangements and also in VTs, especially concerning team members with care duties (Hilbrecht *et al.*, 2008). Conflicts can be related to a dyadic sphere from a faction of the team members to the whole group (Park *et al.*, 2020). These different levels are not well addressed in team literature and the virtuality adds complexity to the debate. How do individual, dyadic, and group-level conflicts influence each other? How does virtuality impact the propagation of a specific level of conflict onto others? Is it stronger or more insulated?

Conflict and conflict management strategy should also be clear prerogatives of the leaders of VT. Leaders should determine the specific nature and level of impacts of this conflict to design proper conflict management strategies. Escalating or de-escalating strategies should be in place to keep a high level of engagement and other team dynamics.

There are several dynamic processes such as the communication (Jarvenpaa and Leidner, 1999), leadership (Hill and Bartol, 2016), and temporality (Saunders and Ahuja, 2006), all of which may cause or redeem conflicts in VTs. In turn, when properly (or poorly) executed these dynamics create sediment (or detriment) for social identification and trust, fueling (or hindering) any further in-group interactions, exchanges, and conflicts (Brahm and Kunze, 2012; Harush *et al.*, 2018). Future studies are required to untangle the nexus between such dynamics, especially as moderators and mediators (Gilson *et al.*, 2015). This is also true about the structural elements: are there joint processes influencing each other to cause conflicts? In addition, as Garro-Abarca and colleagues (2021) highlighted, the Covid-19 pandemic has quickly changed organizational routines moving traditional co-located teams into the virtual space. Did the changes induced by the pandemic create alternatives processes and their related

conflict? Does a "new normal" exist in which processes will be managed differently from the past, blending elements of virtuality into traditional teams? All these considerations are research avenues to be considered.

Virtuality, in general, seems to reduce the ability of a VT to manage knowledge (Raab *et al.*, 2014), but some positive effects have also been depicted (Klitmøller and Lauring, 2013). These contrasting results are probably because knowledge management is a broad concept traditionally articulated in sub-processes: knowledge acquisition, creation, sharing or transferring, accumulation or retrieving, and application or usage (Inkinen, 2016). Each of these processes may be influenced, differently from virtuality, the heterogeneity of the team, and the other team functioning dynamics. For example, knowledge sharing is reinforced by participative leadership styles (Pellegrini *et al.*, 2020) but participation and engagement may be reduced in VT due to latent conflicts. Conversely, knowledge accumulation in a virtual environment may be enhanced as to properly function most VTs need a large stock of codified knowledge. Thus, future studies should address the relationships between every single process of knowledge management and their interactional effects with the antecedents of conflicts, the type, and level, and strategies to manage them, not forgetting to consider the indirect and interactional effects of other team functioning processes. To summarize, how do the different processes of knowledge management relate to conflicts, conflict management strategies, and team functioning in a VT context? Future studies may consider the fast-changing technological environment of the last decade, for example considering the advent of the 4.0 revolution. If more inclusive and far-reaching ITC tools alleviate the differences between co-located and VTs (Bradley *et al.*, 2013), the sophisticated approaches of the 4.0 such as the Internet of Things (Caputo, Marzi, *et al.*, 2016), big data (Rialti *et al.*, 2020), and artificial intelligence algorithms may offer interesting modifications about the impact on knowledge management and team performance in general (Manesh *et al.*, 2020). How will the 4.0 revolution affect conflicts in VTs?

Considering the practical implications related to several teams' functioning processes, leaders may consider constructing a managerial grid to keep control of either the individual performance or the overall group-level results. These ongoing evaluations can help to detect conflicts earlier and thus structure a proper conflict management strategy.

Considering the final category of outcomes, conflicts have been generally studied concerning their negative impacts on the performance of VTs. Virtuality tends to exacerbate conflicts and may reduce the consequentially a VT's performance (Hinds & Mortensen, 2005). However, as already presented in this framework, a relationship of linearity must be excluded. Too many

other co-factors may intervene due to the heterogeneity of the composition of the team, the way conflicts are handled, and their impacts on other crucial dynamics. Conflicts cannot be reduced to this univocal direction (Ortiz De Guinea *et al.*, 2012). Future studies are thus invited to clearly define their performance variables and hopefully to consider virtuality as a continuum (Malhotra and Majchrzak, 2014) to avoid partial conclusions. Adopting this framework interesting avenues may be explored about the interactional effects of its several theoretical building blocks. For example, does the different nature of conflicts impact differently on performance? Are these impacts also affected by the specific sources of conflicts (processes of latent elements)?

Further future research avenues may also come from the adoption of newer methodologies in the field of conflict management such as fuzzy-set Qualitative Comparative Analysis (fsQCA), a methodology we could not find in the analyzed dataset but that is receiving growing attention in management research (Kraus *et al.*, 2018; Pappas *et al.*, 2021). FsQCA is a set-theoretic approach that is used to investigate complex causality and therefore allows for the identification of specific combinations of conditions called configurations, that are non-exclusive and lead to the same outcome (De Crescenzo *et al.*, 2020; Ragin, 2008). Future studies could employ fsQCA to test empirically our proposed framework allowing the complexity of conflict and conflict management in VTs to be investigated.

6. Conclusion

This paper presents the results of an investigation into the existing literature published over the last two decades about conflict management and VTs. To provide a thorough and systematic analysis in support of the growing needs of managing virtual workforces and projects, innovative bibliometric methods have been deployed displaying an overall view of the field of research and a systematic review has provided us with the details of the five identified thematic clusters enabling a holistic framework to be developed. Results have shown the importance of the interlinkages between the five clusters, like trust, performance, cultural diversity, knowledge management, and team management are well-defined topics that rely on each other's findings for advancing knowledge and practice.

Although this study adopted a rigorous and systematic methodology of review, some limitations remain. Specifically, a limitation may lie in the focus on management studies that contribute to focusing and positioning the paper in a clear discipline of research and homogeneity of data, but it may result in overlooking contributions from other fields. Moreover, to fulfill the need for homogeneity of bibliographic data the study focused only on

published journal articles omitting books, book chapters, conference papers, and non-peer-reviewed papers. This limitation is balanced by the higher quality and rigor of studies that have been peer-reviewed and future studies, perhaps using a meta-analytic approach, may also consider these outputs. As in previous systematic review studies our study has privileged to offer a wider overview and research agenda, rather than deepening into fine-grained details. However, as this tradeoff is a natural consequence of review studies our review and agenda offer a solid ground for future studies to build upon and further advance our knowledge of conflict management in VTs satisfying the latest needs of organizations and societies linked to the increase in remote working conditions.

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Figures and tables

in order of appearance in the manuscript

Figure 6 – Number of papers published per year

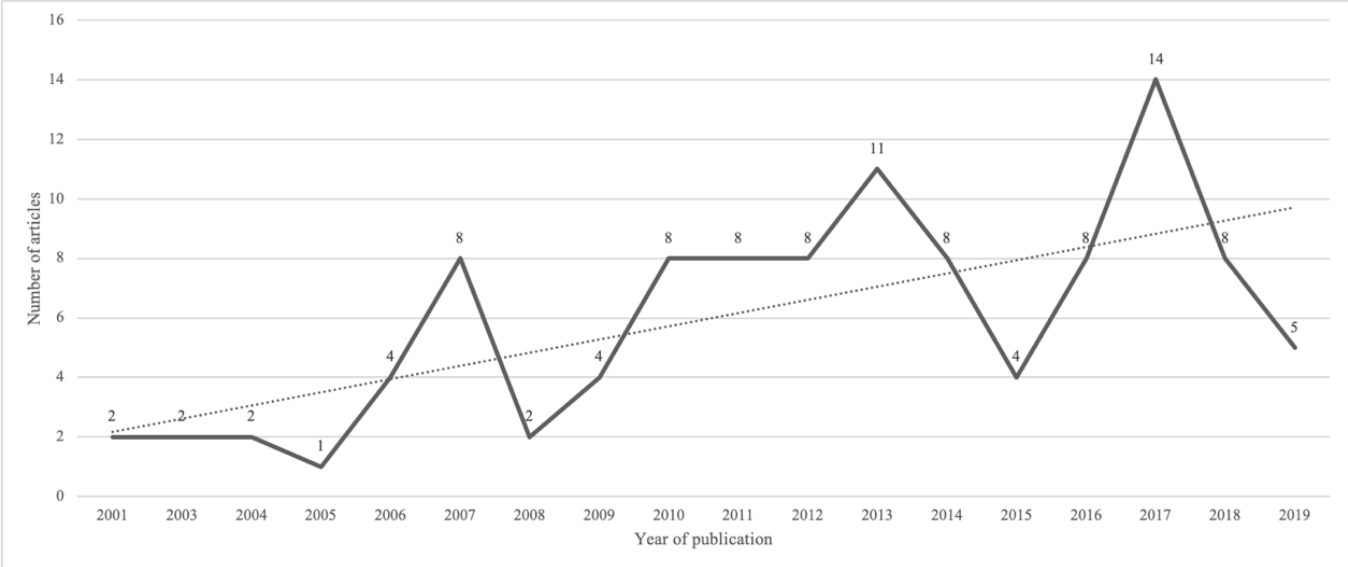

Table 9 – Most cited Journals

Rank	Journal	Citations	Papers	Citations per Paper
1	Organ Sci.	839	4	209.75
2	Acad. Manage. J.	583	2	291.50
3	J. Manage. Inform. Syst.	380	6	63.33
4	J. Int. Bus. Stud.	345	1	345.00
5	Inf. Manage.	292	4	73.00
6	Small Group Res.	267	8	33.38
7	Int. J. Confl. Manage.	207	2	103.50
8	J. Manag.	188	3	62.67
9	Group Decis. Negot.	120	3	40.00
10	J. World Bus.	92	2	46.00
11	Group Dyn.-Theory Res. Pract.	73	2	36.50
12	Comput. Hum. Behav.	69	3	23.00
13	J. Manage. Psychol.	58	3	19.33
14	Hum. Relat.	57	3	19.00
15	J. Int. Manag.	52	3	17.33
16	Int. J. Proj. Manag.	51	3	17.00
17	Int. J. Electron. Commer.	45	1	45.00
18	J. Appl. Psychol.	39	1	39.00
19	Group Organ. Manage.	36	2	18.00
20	J. Prod. Innov. Manage.	36	1	36.00

Table 10 – Most prolific Authors

Rank	Authors	Papers	Citations	Citations per paper
1	Ahuja, M	3	138	46
2	Staples, DS	3	174	58
3	Zornoza, A	3	69	23
4	Aliyev, M	2	6	3
5	Bierly, PE	2	48	24
6	Gibbs, JL	2	13	6.5
7	Glikson, E	2	17	8.5
8	Gonzalez-Navarro, P	2	45	22.5
9	Hertel, G	2	55	27.5
10	Hill, N	2	26	13
11	Hinds, PJ	2	574	287
12	Hunter, EM	2	13	6.5
13	Lin, CP	2	43	21.5
14	Majchrzak, A	2	379	189.5
15	Marks, A	2	22	11
16	Martinez-Moreno, E	2	45	22.5
17	Mykytyn, P	2	137	68.5
18	Paul, S	2	137	68.5
19	Sarker, S	2	106	53
20	Sarker, S	2	106	53
21	Seetharaman, P	2	137	68.5
22	Stark, EM	2	48	24
23	Tsai, Y-H	2	43	21.5
24	Vahtera, P	2	6	3

Table 11 – Most cited Authors

Rank	Authors	Papers	Citations
1	Hinds, PJ	2	574
2	Bailey, DE	1	399
3	Majchrzak, A	2	379
4	Massey, AP	1	365
	Montoya-Weiss, MM	1	365
	Song, M	1	365
5	Dougherty, DJ	1	348
	Faraj, S	1	348
	Griffith, TL	1	348
	Zammuto, RF	1	348
6	Jonsen, K	1	345
	Maznevski, ML	1	345
	Stahl, GK	1	345
	Voigt, A	1	345
7	Crisp, CB	1	218

	Jarvenpaa, SL	1	218
	Kim, JW	1	218
	Polzer, JT	1	218
8	Gilson, LL	1	178
	Hakonen, M	1	178
	Maynard, MT	1	178
	Vartiainen, M	1	178
	Young, NCJ	1	178
9	Mortensen, M	1	175
10	Staples, DS	3	174

Table 12 – Criteria of the co-citation analysis

	Cited references	**Cited authors**	**Cited journals**
Total	5,814	3,872	1,984
Threshold for inclusion in the analysis	Cited by 8 papers	Cited by 12 papers	Cited by 20 papers
Included in the analysis	91	93	93

Table 13 – Co-citation analysis

	Cited References	**Citations**	**Cited Authors**	**Citations**	**Cited Journals**	**Citations**
1	Cramton, C. D. (2001). The mutual knowledge problem and its consequences in geographically dispersed teams. *Organization Science*, *12*(3), 346-371.	43	Jehn, KA	101	Organ Sci	456
2	Jarvenpaa, S. L., & Leidner, D. E. (1999). Communication and trust in global virtual teams. *Organization science*, *10*(6), 791-815.	43	Jarvenpaa, SL	85	J Appl Psychol	435
3	Martins, L. L., Gilson, L. L., & Maynard, M. T. (2004). Virtual teams: What do we know and where do we go from here?. *Journal of management*, *30*(6), 805-835.	43	Cramton, CD	73	Acad Manage J	352
4	Mortensen, M. and Hinds, P.J. (2001), "Conflict and shared identity in geographically distributed teams", *International Journal of Conflict Management*, Vol. 12 No. 3, pp. 212-238.	33	Hinds, PJ	73	Acad Manage Rev	224
5	Montoya-Weiss, M. M., Massey, A. P., & Song, M. (2001). Getting it together: Temporal coordination and conflict management in global virtual teams. *Academy of management Journal*, *44*(6), 1251-1262.	32	Kirkman, BL	53	Admin Sci Quart	223
6	Hinds, P. J., & Bailey, D. E. (2003). Out of sight, out of sync: Understanding conflict in distributed teams. *Organization science*, *14*(6), 615-632.	31	Walther, JB	53	J Manage	217
7	Maznevski, M. L., & Chudoba, K. M. (2000). Bridging space over time: Global virtual team dynamics and effectiveness. *Organization science*, *11*(5), 473-492.	28	Martins, LL	51	Mis Quart	197
8	Hinds, P. J., & Mortensen, M. (2005). Understanding conflict in geographically distributed teams: The moderating effects of shared identity, shared context, and spontaneous communication. *Organization science*, *16*(3), 290-307.	28	Gibson, CB	48	Small Gr Res	166
9	Jehn, K. A. (1995). A multimethod examination of the benefits and detriments of	25	De Dreu, CKW	42	J Pers Soc Psychol	127

	intragroup conflict. *Administrative science quarterly*, 256-282.					
10	Gibson, C. B., & Gibbs, J. L. (2006). Unpacking the concept of virtuality: The effects of geographic dispersion, electronic dependence, dynamic structure, and national diversity on team innovation. *Administrative science quarterly*, *51*(3), 451-495.	24	Daft, RL	41	Organ Behav Hum Dec	120

Figure 7 - Network diagram of co-citation analysis

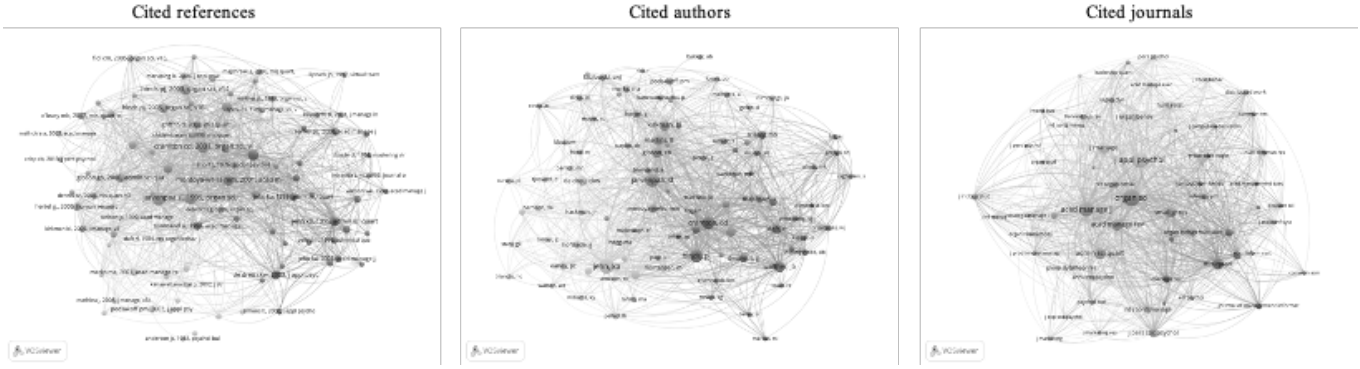

Table 14 – Bibliographic coupling analysis

	Articles	**Link strength**	**Cited Authors**	**Citations**	**Cited Journals**	**Citations**
1	Raghuram, S., Hill, N. S., Gibbs, J. L., & Maruping, L. M. (2019). Virtual work: Bridging research clusters. *Academy of Management Annals*, *13*(1), 308-341.	1052	Gibbs, JL	5268	Small Group Research	2515
2	Breuer, C., Hüffmeier, J., & Hertel, G. (2016). Does trust matter more in virtual teams? A meta-analysis of trust and team effectiveness considering virtuality and documentation as moderators. *Journal of Applied Psychology*, *101*(8), 1151.	552	Hill, NS	5264	Journal Of Management Information Systems	1865
3	Harush, R., Lisak, A., & Glikson, E. (2018). The bright side of social categorization: The role of global identity in reducing relational conflict in multicultural distributed teams. *Cross Cultural & Strategic Management*, *25*(1), 134-156.	547	Maruping, LM	3739	Academy Of Management Annals	1527
4	Saunders, C. S., & Ahuja, M. K. (2006). Are all distributed teams the same? Differentiating between temporary and ongoing distributed teams. *Small Group Research*, *37*(6), 662-700.	536	Raghuram, S	3739	Human Resource Management Review	1101
5	MacDuffie, J. P. (2007). HRM and distributed work: Managing people across distances. *The Academy of Management Annals, 1*(1), 549–615.	531	Zornoza, A	3635	Organization Science	1070
6	Stahl, G. K., Maznevski, M. L., Voigt, A., & Jonsen, K. (2010). Unraveling the effects of cultural diversity in teams: A meta-analysis of research on multicultural work groups. *Journal of international business studies*, *41*(4), 690-709.	520	Ahuja, M	3048	Human Relations	1023

7	Brahm, T., & Kunze, F. (2012). The role of trust climate in virtual teams. *Journal of Managerial Psychology, 27*(6), 595-614.	508	Hertel, G	3020	Information & Management	952
8	Schiller, S. Z., & Mandviwalla, M. (2007). Virtual team research: An analysis of theory use and a framework for theory appropriation. *Small group research*, *38*(1), 12-59.	502	Glikson, E	2924	International Journal Of Project Management	856
9	Schaubroeck, J. M., & Yu, A. (2017). When does virtuality help or hinder teams? Core team characteristics as contingency factors. *Human resource management review*, *27*(4), 635-647.	500	Mykytyn, PP	2562	Journal Of Management	774
10	Hill, N. S., & Bartol, K. M. (2016). Empowering leadership and effective collaboration in geographically dispersed teams. *Personnel Psychology*, *69*(1), 159-198.	488	Paul, S	2562	Journal Of Managerial Psychology	755

Figure 8 - Network diagram of bibliographic coupling analysis

Table 15 – Main topics from the co-occurrence of keywords analysis

Topic	**Keywords**
Outputs	Performance, Decision-Making, Conflict Management, Trust, Information, Impact, Information Systems, Richness, Cooperation, Geographic Dispersion, Behavior
Dynamics	Distributed Teams, Knowledge, Technology, Computer-Mediated Communication, Understanding Conflict, Global Virtual Teams, Shared Identity, Group Decision-Making, E-Mail, Cultural-Diversity
Differences	Face-To-Face, Work, Intragroup Conflict, Leadership, Task, Top Management Teams, Interpersonal-Trust, Task Conflict, Strategic Decision-Making, Personality
Processes	Communication, Organization, Diversity, Management, Time, Demographic Diversity, Group-Performance, Consequences

Figure 9 - Network diagram and overlay visualization of keywords

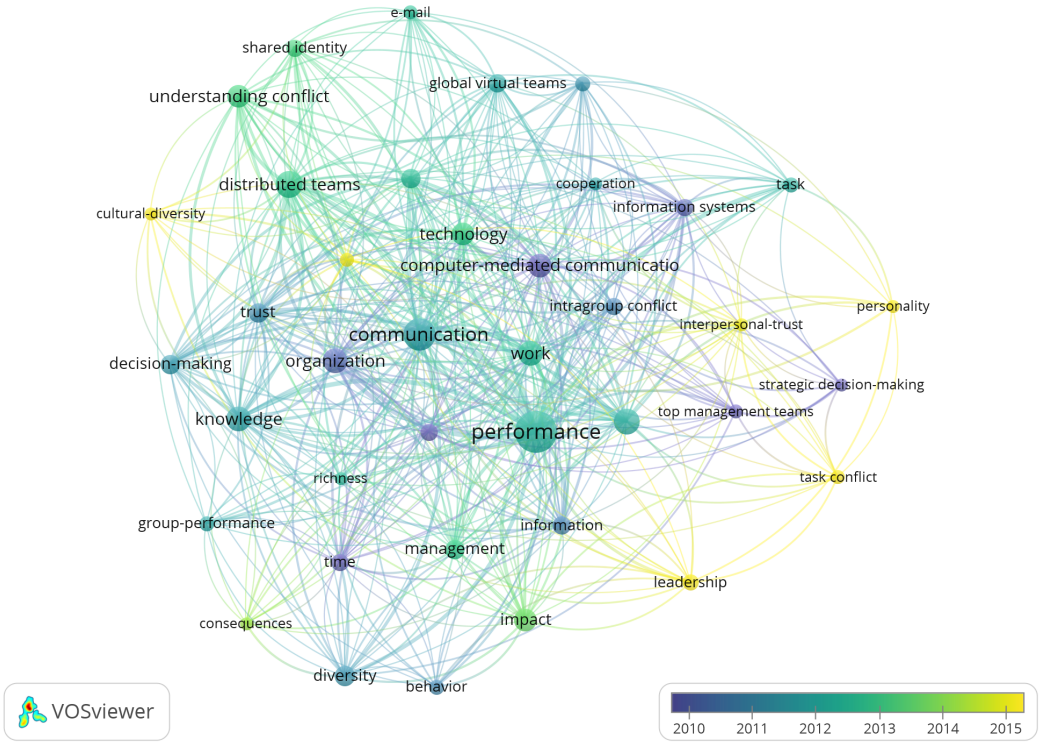

Table 16 – Most influential articles

	Top 20 most cited articles (normalised)		Top 20 most cited (absolute)		Top 20 important articles by bibliographic coupling	
Rank	**Article**	**Norm citations**	**Article**	**Total citatons**	**Article**	**Link strength**
1	Stahl, GK; Maznevski, ML; Voigt, A; Jonsen, K (2010)	5.20	Hinds, PJ; Bailey, DE (2003)	399	Raghuram, S; Hill, NS; Gibbs, JL; Maruping, LM (2019)	1052
2	Zammuto, RF; Griffith, TL; Majchrzak, A; Dougherty, DJ; Faraj, S (2007)	4.62	Montoya-Weiss, MM; Massey, AP; Song, M (2001)	365	Breuer, C; Huffmeier, J; Hertel, G (2016)	552
3	Klitmoller, A; Lauring, J (2013)	3.98	Zammuto, RF; Griffith, TL; Majchrzak, A; Dougherty, DJ; Faraj, S (2007)	348	Harush, R; Lisak, A; Glikson, E (2018)	547
4	Jimenez, A; Boehe, DM; Taras, V; Caprar, DV (2017)	3.68	Stahl, GK; Maznevski, ML; Voigt, A; Jonsen, K (2010)	345	Saunders, CS; Ahuja, MK (2006)	536
5	Gilson, LL; Maynard, MT; Young, NCJ; Vartiainen, M; Hakonen, M (2015)	3.47	Polzer, JT; Crisp, CB; Jarvenpaa, SL; Kim, JW (2006)	218	MacDuffie, JP (2007)	531
6	Sarker, S; Ahuja, M; Sarker, S; Kirkeby, S (2011)	3.25	Gilson, LL; Maynard, MT; Young, NCJ; Vartiainen, M; Hakonen, M (2015)	178	Stahl, GK; Maznevski, ML; Voigt, A; Jonsen, K (2010)	520
7	Breuer, C; Huffmeier, J; Hertel, G (2016)	2.76	Mortensen, M; Hinds, PJ (2001)	175	Brahm, T; Kunze, F (2012)	508
8	Grossman, R; Feitosa, J (2018)	2.67	Shachaf, P (2008)	156	Schiller, SZ; Mandviwalla, M (2007)	502
9	Sarker, S; Ahuja, M; Sarker, S (2018)	2.67	Kankanhalli, A; Tan, BCY; Wei, KK (2006)	145	Schaubroeck, JM; Yu, A (2017)	500
10	Raghuram, S; Hill, NS; Gibbs, JL; Maruping, LM (2019)	2.50	Staples, DS; Zhao, L (2006)	101	Hill, NS; Bartol, KM (2016)	488
11	Ruiller, C; Van Der Heijden, B; Chedotel, F; Dumas, M (2019)	2.50	Sarker, S; Ahuja, M; Sarker, S; Kirkeby, S (2011)	100	Penarroja, V; Orengo, V; Zornoza, A; Hernandez, A (2013)	475
12	Ghislieri, C; Emanuel, F; Molino, M; Cortese, CG; Colombo, L (2017)	2.45	Saunders, CS; Ahuja, MK (2006)	87	Zimmermann, A (2011)	472
13	Gibbs, JL; Sivunen, A; Boyraz, M (2017)	2.10	Paul, S; Seetharaman, P; Samarah, I; Mykytyn, PP (2004)	74	Gibbs, JL; Sivunen, A; Boyraz, M (2017)	459
14	Hinds, PJ; Bailey, DE (2003)	1.92	Klitmoller, A; Lauring, J (2013)	72	Kankanhalli, A; Tan, BCY; Wei, KK (2006)	441
15	Malhotra, A; Majchrzak, A (2014)	1.77	Paul, S; Samarah, IM; Seetharaman, P; Mykytyn, PP (2004)	63	Malhotra, A; Majchrzak, A (2014)	436
16	Hill, NS; Bartol, KM (2016)	1.77	Boh, WF; Ren, YQ; Kiesler, S; Bussjaeger, R (2007)	62	Bierly, PE; Stark, EM; Kessler, EH (2009)	433
17	Shachaf, P (2008)	1.68	Curseu, PL; Schruijer, SGL (2010)	60	Raab, KJ; Ambos, B; Tallman, S (2014)	423
18	de Guinea, AO; Webster, J; Staples, DS (2012)	1.68	de Guinea, AO; Webster, J; Staples, DS (2012)	53	Chiravuri, A; Nazareth, D; Ramamurthy, K (2011)	420
19	Bradley, BH; Baur, JE; Banford, CG; Postlethwaite, BE (2013)	1.60	Schiller, SZ; Mandviwalla, M (2007)	47	Connelly, CE; Turel, O (2016)	418
20	Polzer, JT; Crisp, CB; Jarvenpaa, SL; Kim, JW (2006)	1.58	Yun, H; Kettinger, WJ; Lee, CC (2012)	45	Hinds, PJ; Bailey, DE (2003)	414

Figure 10 – A framework for conflict management in virtual teams