Virtual Team Collaboration: a review of literature and perspectives

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ABSTRACT

Along with the widespread use of information technologies (IT) and the increasing geographical span of tasks held by various organizations, Virtual Teams (VTs) rose as an alternative organizational form which has the potential to deeply change the workplace.

This article provides a review of previously published work on collaboration in VTs. The review is organized around two perspectives adopted by scholars, namely technological and managerial. This analysis underlines two major constructs that leads to an efficient VT collaboration, i.e. the context in which the collaboration is held and the collaboration style. While the former is illustrated by knowledge and team characteristics, the latter is identified by technological media and leadership. Building on this classification, we suggest a model and explore future research directions with a particular attention to the implications for collaboration in organizations.

Keywords

Collaboration, Virtual Team, Knowledge Sharing, Literature Review

INTRODUCTION

A VT is a group of people with complementary competencies (Chinowsky et al., 2003) who may be geographically and temporally dispersed (Bell and Kozlowski, 2002; Hertel, Geister and Konradt, 2005; Kirkman and Mathieu, 2004; Lee-Kelley and Sankey, 2008; Sarker and Sahay, 2003; Zigurs, 2003), communicate via information technologies (Bell and Kozlowski, 2002; Hertel et al., 2005; Johnson , Suriya, Won Yoon, Berrett and La Fleur, 2002; Lee-Kelley and Sankey, 2008; Mihhailova, Kandela and Turk, 2009, Zigurs 2003), and execute simultaneous and collaborative work processes (Chinowsky and Rojas, 2003) in order to accomplish a common objective (Johnson et al., 2002; Zigurs, 2003).

Traditional team members have the advantage of being located at the same place. Therefore in handling operational tasks through face to face collaboration, they can conduct a project in an ad hoc fashion. Operational tasks that are performed on a regular basis can let team members share knowledge and develop unspoken terms and shared knowledge through time that guide the execution of similar future tasks and that every member agrees to follow by instinct. However organizations may also face unexpected or not so usual undertakings at an operational level. In such situation, the spontaneous way of doing things can be detrimental to collaboration efficiency given the absence of intuitive guidelines that are present at the execution of repetitive operational tasks.

VT collaborations can be an inspiration for traditional teams that are assigned with non-repetitive, operational tasks. Actually VTs are often built for non-routine tasks (Corso, Martini, Pellegrini, Massa and Testa, 2006). VT collaboration is principally based on knowledge sharing (Cramton, 2001) and what renders that possible in online media is knowledge formalization. Knowledge formalization gives VT collaboration rigor which is lacking in various traditional team collaborations in organizations. Thus the idea behind this paper is that we can learn from VT collaborations to provide with guidelines to improve traditional teams. We can alleviate the spontaneous nature of collaborations in traditional teams that carry out non-repetitive, operational tasks. As every team collaboration is virtual to a certain degree (Griffith, Sawyer and Neale, 2003; Martins, Gilson and Maynard , 2004), we can derive useful implications for efficient collaborations in organizations.

By critically reviewing recent studies, this study aims at synthesizing the literature on VT collaboration that focus on the explanation of how an efficient collaboration can be obtained. First, a review in this field is provided. Second, we suggest a framework to blend this body of research in a meaningful way. Finally we provide with possible venues of research.

LITERATURE ON VIRTUAL TEAM COLLABORATION: KEY CONCEPTS

We build our review by browsing the Management Information Systems literature throughout 2000-2009. Key words used were collaboration, virtual teams, virtual team leadership and virtual team knowledge sharing. We group studies on VT collaboration in two main groups in function of the object of analysis studied. In one stream of research, technological means have been the focus while the other has explored the role of leadership in VTs.

Technological Perspective

Technological perspective suggests that collaboration efficiency in VTs is based on the media selected for collaboration. It deals with the problem of selecting the right online tool for mediating online collaboration which is essential for a high level of task performance. Given the wide range of options ranging from emailing to instant messaging, theories adopting this perspective try to establish a set of criteria which would be used for selecting the most appropriate online tool for handling collaboration at VT practices. There are three main streams of research identified in this study that also define three groups of criteria on medium selection. First, media richness theory (Daft and Lengel, 1986) states that the type of information shared and the task realized should fit. Second, media synchronicity (Dennis and Valacich, 1999) establishes a connection between the task and the way the information is

exchanged. Finally a recent field of study refers to Knowledge Management suggesting a relationship between the task and the way the information shared is structured.

Media richness theory: Type of Information Shared

Media Richness Theory explores the fit between the information provided by the mediating technology and the task to accomplish by classifying technologies in terms of their capacity to i) let use different languages, i.e. written, oral, corporal, ii) enable a certain level of personalization and iii) support exchange through different communication channels (Ferry, Kydd and Sawyer, 2001). Each technology has unique advantages. Thus VTs mostly use a combination of different tools ranging from basic tools with a low level of richness such as emailing to much richer, face-to-face meetings or video conferences which allow seeing, hearing and observing body language (Kirkman and Mathieu, 2005; Mihhailova et al., 2009). Media with low level of richness such as emailing are considered more convenient for analytic tasks compared to those which let communicate a wider range of information. Therefore a richer medium of collaboration does not necessarily yield to efficiency. It rather depends on whether the tool used is pertinent to the stage of collaboration (Jawadi and Kalika, 2008).

Media Synchronicity Theory: Temporal Characteristic of Information Exchange

The theory of media richness is frequently compared to the theory of media synchronicity. Dennis and Valacich (1999) define synchronicity as the extent to which team members share a focus. With increasing focus they work more together on the same task at the same time. They suggest that a communication medium entails two processes and five capabilities. Conveyance and convergence constitute the processes where the former entails the propagation of knowledge and helps understanding the situation. The latter focuses on understanding individual interpretations on pieces of knowledge and coming up with a common explanation shared by everyone. In the absence of these two processes participants would make wrong conclusions. On the other hand the capabilities are i) symbol variety: possibilities of representing and codifying knowledge; ii) parallelism: possibility to conduct diverse conversations simultaneously; iii) feedback: the capacity to provide fast bidirectional communication; iv) rehearsability: the possibility to reformulate a message while creating it; and v) reprocessability: the ability to retreat previously shared messages. The principal idea of the media synchronicity theory is that a team can achieve performance when the set of present capabilities in a medium matches the exigencies of the two processes.

Chinowsky and Rojas (2003) define collaboration technologies in terms of their capacity to enable the synchronous manipulation of information in real time. These technologies are grouped into three: information management, conference and project management technologies. The first group of technologies such as emailing responds to the needs of a basic level of collaboration. Conference tools (e.g. instant messaging, audio/video conferencing) help team members gather in a virtual environment and exchange ideas and information in real time. Finally project management technologies are designed to let VTs create their own virtual environment. This set of technologies have emerged as a response to the limits of the initial two groups where the first suffered from interoperability problems while the second did not provide means for documenting the exchange among members. Given the complementary features of synchronous and asynchronous technologies beyond the confines of this classification,

these technologies provide with a high level of flexibility in communication facilitating collaboration in a virtual context.

Munkvold and Zigurs (2007) observed different interactions that take place in VT collaboration. Following the Time, Interaction and Performance (TIP) theory of McGrath (1991), they concluded that for an efficient collaboration, these teams need different complementary technologies where each one responds to the needs of different tasks of the online collaboration process. Karpova, Correia and Baran (2009) studied the necessity of using complementary tools in an online collaboration. They suggested that synchronous media such as videoconferencing are appropriate for problem formulation and giving key decisions whereas others such as collaborative document management tools (e.g. Google Docs) are more adequate for tasks such as the exchange of ideas and the organization of tasks across the team.

Knowledge Management Perspective: Structural Characteristic of Information

More recently another stream of research emanating from Knowledge Management has focused on VTs although it is yet at an early stage. Major observations of this group of research state that VT collaboration is majorly based on knowledge sharing which has direct consequences on the selection of the medium of collaboration. Following the Knowledge Mix idea of Hansen, Nohria and Tiemey (1999), Gupta, Matarelli, Seshasai and Broschak (2009) showed that two different strategies of knowledge sharing i.e. codification and personalization exist in VTs where each strategy puts different IT in use, regarding their capacity of structuring information. Teams with higher virtuality, consequently with higher dependence on electronic communication, will have tendency to opt for codification. Thus they will choose technologies which can structure shared information. This strategy allows archiving decisions upon the accomplishment of tasks for future access. Technologies that do not provide structure for shared information such as face to face meetings and videoconferences have other advantages as they enable a personalization strategy which supports the stimulation of ideas and creation of creativity.

Managerial Perspective

Scholars adopting a managerial perspective have identified the lack of structure as the major obstacle against collaboration and leadership rose as a way to deal with this issue. The classical, transactional view of leadership took leader and his subordinates as people engaged in a process of exchange where people were awarded on the basis of their productivity and were also sanctioned if necessary (Bass and Avolio, 1993). This somewhat taylorian view of management is based on command and control. However transformational leadership which rose as a response to the transactional leadership suggests that a leader should aim at motivating team members by showing her consideration for individuals and providing intellectual support. This way the absence of structure and socio-relational context would be compensated (Bass and Avolio, 1993). In the presence of anonymity related to the prevalent use of electronic media, this leadership style is considered as the most appropriate for VTs (Hambley, O'Neill and Kline, 2007; Purvanova and Bono, 2009). This view suggests three dimensions of leadership: i) leader as an organizer, ii) leader as a trust and cohesion builder and iii) context-dependent leadership.

Leader as an organizer

VT members who are likely to be dispersed geographically, mostly work under temporal constraints while cultural diversity and widespread use of Information and Communication Technologies (ICT) may pose additional problems. Under such constraints, as an organizer, a leader should assume the coordinator role by planning and allocating the work across team members and clearly defining the role of everyone (Bell and Kozlowski, 2002; Hertel et al., 2005; Kayworth and Leidner, 2000) as unclear assignment of roles yield to coordination problems (Hertel et al., 2005; Munkvold and Zigurs, 2007). In addition to coordinating, the leader should set goals (Chinowsky and Rojas 2003), provide deadlines for the achievement of these goals, synchronize individual efforts (Giuri, Rullani and Torrisi, 2008) and select team members in function of the requirements of the task in hand (Chutnik and Grzesik, 2009; Giuri et al., 2008; Lee-Kelley and Sankey, 2008; Lurey and Raisinghani, 2001).

Leader as a builder of trust and cohesion

Due to the short duration of the VT tasks and the absence of social cues in electronic media, building a social presence and developing interpersonal relations become cumbersome. As Yoo and Alavi (2004) note, their lack hampers team performance. Therefore VTs have a disadvantage with respect to face-to-face interactions where trust building and securing cohesion is easier.

Kanawattanachai and Yoo (2007) conjecture that expert localization and the task oriented communications in VTs favor building cognitive trust. However such process takes time and when combined with the lack of socio-relational communication and cultural diversity, conflicts may arise (Chutnik and Grzesik, 2009; Munkvold and Zigurs, 2007). Good leaders are therefore those who support transmitting socio-relational knowledge, cohesion and trust (Chutnik and Grzesik, 2009; Kayworth and Leidner 2000, Lurey and Raisinghani 2001; Yoo and Alavi 2004). As Zigurs (2003) suggests, leadership should be redefined in a VT where the leader should care less about control and more about developing interpersonal relations.

Context-dependent leadership

Providing structure to collaboration, building trust and cohesion are facilitated by leaders as mentioned above. The way such leader is selected changes with respect to the context as there are two types of leader: emergent and shared. Emergent leaders as their name implies, assume the leader role through time in an unplanned manner. Giuri et al. (2008) argue that being an emergent leader in an open source project is related to the individual's competencies as well as the modularity of the project. Increasing modularity implies also the need for a multi-competent leader. Yoo and Alavi (2004) posit that an emergent leader assumes the following three roles: initiator as the author of first organizational propositions, planner as decision maker on deadlines and tasks to accomplish, finally integrator as the collector of different parts into a final deliverable.

Pearce, Manz and Sims (2009) defines shared leadership as the management style where the power and influence is distributed across a group of people where the conveyance of influence can be both upward and downward in the hierarchical chain. Teams can also assign a new leader at every task in function of the match between the requirements of the task and the competencies of members (Johnson et al., 2002). Therefore, rotation and allocation

of leadership can increase efficiency by optimally benefiting from the expertise dispersed across team members (Pearce et al., 2009).

Leadership has therefore three dimensions. First, a leader provides structure by organizing tasks across the team, sets goals and deadlines. Second, a leader should promote the development of interpersonal ties and trust across people. Finally the way such leadership is executed vary given that it may be attributed to a single person, allocated across a group of individuals or carried out through rotation. The outcome of the literature review on VTs can therefore be presented as in Table 1 below across two perspectives as managerial and technological:

Collaboration with respect to the Technological Perspective	**Collaboration with respect to Managerial Perspective**
An efficient collaboration depends on the fit between the task in hand and the IT. Other related determinants are: →Information type: - written - oral - corporal →The temporal characteristic of information exchange : - Synchronous - Asynchronous →Structural characteristic of information - Structured - Non-structured	An efficient collaboration depends on the coordination of tasks allocated to VT members. Other related determinants are : →Team structure, comprises whether… - roles are attributed clearly to VT members - task definitions and planning are stated clearly - goals are updated continuously →Building trust and cohesion, comprises… - development of interpersonal relations on the basis of emotional and cultural sensitivity - cognitive trust which depends on the selection of people with expertise →Conformity to context, enabled by leadership which is… - either associated with a single person - or rotated across VT members according to the requirements of each task
Chinowsky and Rojas, 2003; Griffith et al., 2003; Gupta et al., 2009; Jawadi and Kalika, 2008; Karpova et al., 2009; Kirkman and Mathieu, 2005; Mihhailova et al., 2009; Munkvold and Zigurs, 2007.	Bell and Kozlowski, 2002; Chinowsky and Rojas, 2003; Chutnik and Grzesik, 2009; Hertel et al., 2005; Kanawattanachai and Yoo, 2007; Kayworth and Leidner, 2000; Lurey and Raisinghani, 2001; Pierce and Hansen, 2008; Yoo and Alavi, 2004; Zigurs, 2003;.

Table 1 Synthesis of perspectives on VT collaboration

PROPOSITION OF A THEORETICAL FRAMEWORK

Literature review on VT collaborations above yields the framework depicted in Figure 1. The framework suggests three major constructs namely, context, collaboration styles and efficient collaboration where the latter is a consequence of the other two.

Efficient Collaboration

The way VT success is measured usually touches upon terms such as efficiency, effectiveness, productivity etc. This variety results from the different levels of organization taken into account i.e. individual, team and firm levels in studying outcomes. Individual level outcome entails the fulfillment of participants' expectations in terms of factors such as enjoyment, reputation, learning etc. Team level point of view takes into account whether the team is content as a whole for having worked together and whether it would consider another assignment in the future. Finally the firm level view considers the gains that have the potential to increase financials of the firm. For example a task completed faster when it is assigned to a team would improve labor productivity or the work of an efficient new product development team may yield higher quality products that improve sales.

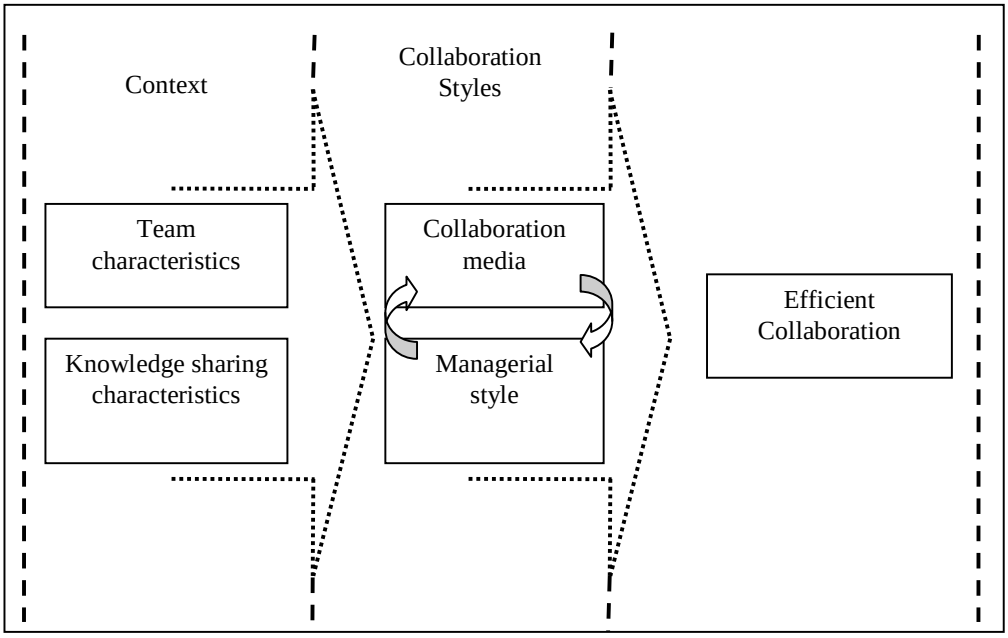

Figure 1 A Model for VT collaborations

Collaboration Style: Convergence between Media and the Adopted Managerial Approach

Scholars have studied two immediate antecedents to efficiency in VT collaboration, medium of collaboration and the managerial style which are also suggested to be interrelated and shape the style of collaboration. For an efficient collaboration i) the medium of collaboration should conform to the needs of knowledge sharing preferred by the VT and be capable of delivering different forms of information such as written, oral and corporal at the right time with the desired structure; ii) managerial approach adopted provides with a structure by guiding VT members in the use of technologies. Managers also promote trust building and group cohesion.

Context

Collaboration styles are influenced by the context in which the collaboration takes place. Thus an efficient collaboration should take contextual factors into consideration which has two constituents: team characteristics and knowledge sharing characteristics:

Team Characteristics

Team characteristics entail: i) The degree of virtuality (Mihhailova et al., 2009; Griffith et al. 2003; Jawadi and Kalika, 2008): implies that the electronic character of communication can be associated with a value on a continuum. The more the virtuality is, the more will be the need to structure collaboration. ii) Task complexity (Bell and Kozlowski 2002): when the task complexity increases, so does the need to conduct collaboration through synchronous and intensive sessions due to the high interdependence of VT members. iii) Team size (Kirkman and Mathieu 2005): increasing team size implies less use of rich media. iv) Team history: as life span of the collaboration among VT members increases, anonymity decreases and group identity gets more powerful (Hertel et al., 2005).

Knowledge sharing characteristics

VT members develop their collaboration on the basis of knowledge sharing. However a smooth knowledge sharing process is not very likely. Because tasks that the VT handles, do not follow a routine while the temporary and virtual character of the team limit shared knowledge accumulation (Ahn, Lee, Cho and Park, 2005). Thus scholars highlight the need for creating a knowledge sharing culture (Kanawattachai and Yoo, 2007) and familiarity by using technologies mediating knowledge sharing (Kayworth and Leidner 2000).

CONCLUSIONS ON FUTURE RESEARCH DIRECTIONS

Studies on VTs have reached a certain degree of maturity although its appearance as a research stream took place about a decade ago. Starting from the aforementioned framework, we suggest three directions for future research on collaboration in VTs: developing a deeper understanding of context, improving the collaboration style and learning from VTs for better collaboration practices in business. A fourth research path is added on developing a better understanding of efficiency as there is an ambiguity on what efficiency is depending on which stakeholder perspective is taken into account.

Better Understanding the Context

The majority of research on VT collaboration studies university students (Balthazard, Waldman and Warren, 2009; Johnson et al., 2002; Karpova et al., 2009; Munkvold and Zigurs 2007; Purvanova and Bono 2009) or open source software development (Gallivan, 2001; Giuri et al., 2008; Hertel, Niedner and Herrmann, 2003; Krogh, Spaeth and Lakhani, 2003; Stewart and Gosein, 2006). However VTs are worth being studied in organizations, particularly in a business context. Intra-organizational VT studies can be a starting point to understand what organizational constraints are imposed on collaborations within organizations.

Knowledge sharing in VTs also merits further attention to understand the influence of context. The outcome of Knowledge Management (KM) research can be exploited for this purpose. There are already some recent studies

adopting the KM approach. One possible research direction can be the comparison of these studies with VT collaboration research as outlined also by Ahn et al., (2005) and Gupta et al., (2009).

Works on Knowledge Management Systems efficiency in organizations can help improve our understanding and design adequate collaborations (Alavi and Leidner, 2001; Aviv, Levy and Hadar, 2008; Dudezert and Lancini, 2006; Nonaka and Takeuchi, 1995; Wenger, 1998). These works suggest that knowledge held in an organization can be both tacit and explicit. Development of such knowledge requires community identity, collaborative knowledge, organizational support, knowledge formalization procedures and knowledge diffusion and acquisition. These results also help understand knowledge sharing at VTs.

Improving the Collaboration Style

This research direction covers technological artifacts and managerial approach as subjects of future studies. Characteristics of different managerial styles can be embodied in technological tools paving the way for the design of new tools. Considering the factors related to the way the team work is structured, we consider collaboration engineering studies (Boughzala, 2007; Briggs, Vreede and Numaker 2003; Briggs and Vreede, 2005) in this path. They suggest formalizing collaboration process as in Thinklets (Briggs et al., 2003) which has the potential to reduce the workload of leaders in a VT in case they are integrated into the technological medium of collaboration. This would also let leader focus on building trust. Therefore possible improvements in the collaboration style imply improving the technological means with respect to managerial expectations. Such research would require the integration of MIS and Computer Sciences disciplines.

Virtual Teams for Better Offline Collaboration

Past studies show that the main issue of VT management is the problem of integrating technologies into actual work practices rather than redesigning the way these practices are done. Actually research studying managerial approaches for better efficiency do not provide with a new insight given that similar problems had been detected in 'offline' team work as well. On the other hand, results from the VT collaboration studies can be used for improving collaboration in organizations. There are two reasons that render this approach potentially fruitful. First various technological means are widely adopted by organizations. Therefore various tasks conducted in organizations already posses a certain level of virtuality (Griffith et al., 2003; Martins et al., 2004). Second, there is a tendency in supporting knowledge sharing and collaboration at all hierarchical levels in an organization. Therefore VTs can have useful implications for classical organizations. However except knowledge-intensive organizations, firms are more likely to conduct their tasks in a hierarchical way as typical workplaces are characterized by supervision and control. Therefore research aiming at exploring connections between the collaborations held in VTs and those in organizations should look into ways to let these two organizational approaches coexist without any conflict.

Present generation of employees in organizations constitute another reason for extending VT implications to organizations. These employees look for new ways of management prioritizing knowledge sharing, self-organization and collaboration challenging the classical way of management (Dudezert, Boughzala and Mounoud 2009).VT experiences can be used for redesigning management styles as well. Thus future managers in positions dealing with

knowledge sharing practices can also find inspiration at VTs. Future research can test whether a manager who is a good listener, motivator and relation developer performs better than a manager who emphasizes supervision and control. Such research would provide insight on what type of operational management conforms best to the exigencies of the knowledge economy.

Efficiency Centered Research

A point that draws attention in VT studies on team efficiency is that researchers put themselves in enterprises' shoes although efficiency is a subjective term given that it may have different and contrasting interpretations for different stakeholders. For deriving implications from VT collaborations for offline collaborations in organizations, one should keep in mind that the group may have objectives different from the organization. We believe that for the sake of successful collaboration, one should prioritize efficiency with respect to the team rather than the organization. Therefore future research can deal with what output should be taken into account in calculating efficiency for group vs. organization. For instance an improvement in an individual's level of knowledge through team work points out individual efficiency whereas it is not considered at firm level. However as individuals get more knowledgeable through time, the firms that they make part of become more likely to be efficient as well. Such impacts across levels are worth exploring through longitudinal studies.

Conclusion

In this article we have reflected on our knowledge on VT collaboration and what we should do to further it. We believe that research on knowledge sharing at VT collaborations has the potential to improve collaborations that take place in traditional teams as well. Research with such orientation can enable deriving guidelines for non-repetitive, operational tasks that are mostly carried out through spur of the moment decisions on collaboration methods. To make a contribution in that, we critically reviewed the literature on VT collaborations through technological and managerial perspectives. We have then suggested a framework to organize past work. Finally we concluded with a set of research questions to stimulate future research in this field.

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