Syst Pract Action Res (2014) 27:607–624
DOI 10.1007/s11213-014-9315-2

ORIGINAL PAPER

Leading Effective Global Virtual Teams: The Consequences of Methods of Communication

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Published online: 19 February 2014

Abstract This paper explores the relationship between communication and team effectiveness within the context of global virtual teams, arguing that a range of communication methods may impact upon the team's effectiveness. To explore this relationship empirically, we present a key informant insights based on the activities deployed by a participant in a global team. The paper reports on the team's effectiveness, their communication strategies and the team's psychological traits: trust, shared understanding and co-operation. Findings from the pattern matching analysis indicate that the limited range of communication methods available to a global virtual team was not a major contributing factor to a team's effectiveness. The paper offers communication/management techniques that could be beneficial to the global virtual team leader in facilitating team effectiveness, highlighting some issues surrounding the level of dispersion within teams that could be further explored in future research.

Keywords Communication · Global virtual teams · Effectiveness · Leadership

Introduction

The traditional co-located team structure has been challenged because of the increased need to react quickly to consumers' needs (Sridhar et al. 2007), ever-more global competition and the advancement of new information technologies (Jackson 1999). The need to find more flexible and adaptive structures has encouraged the rise of virtual working, whereby members of a team work apart from each other (Cascio 2000). These teams offer organisations a flexible and effective approach to managing knowledge and tailoring expertise to the market or project; this is increasingly important in an accelerating

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knowledge-sharing culture, (Zakaria et al. 2004). The global virtual team is intended to provide an organisation with flexibility and adaptability, whilst reducing overheads and costs through improved resource utilisation (Jarvenpaa and Leidner, 1999). However whilst the intentions of the global virtual team are impressive, the teams also provide a higher level of complexity compared to co-located teams.

Opinion is divided as to whether global virtual teams differ significantly to a co-located team. However, there is considerable support for the proposition that the global virtual team is the more complex form. Leadership and team research has highlighted communication as an important aspect of such teams, and that to enable relationships to build, trust to develop and the cohesion to be created, a varied range of communication methods is necessary (Hayes 2002; Jarvenpaa and Leidner 1999). These psychological traits are known to be associated within higher performing and effective teams (Maznevski 2008). These traits tend to be developed on a basis of face-to-face interaction through interpersonal communication and non-verbal behaviours (Guirdham 2002; O'Hara-Devereaux and Johansen 1994). However, the global virtual team will often function with minimal or no face-to-face contact, and technological interaction is not as rich as face-to-face interaction, lacking social and communicative cues. It has been established that trust, power and cohesion are communicated through the non-verbal interactions that are often found within face-to-face communication (Guirdham 2002), and it has even been suggested that face-to-face communication is irreplaceable (Jarvenpaa and Leidner 1999). The trait, labelled 'behavioural complexity' has been identified in the operation of virtual teams in which effective team leaders have managed to deal with the seemingly paradoxical and sometimes contradictory situation of being able to perform multiple leadership roles simultaneously, (Kayworth Timothy and Leidner 2001).

This paper explores the link between communication and virtual team effectiveness, specifically addressing whether the limited range of communication methods available to a global virtual team influences their effectiveness. Using Sundstrom et al. (1990) definition, effectiveness was measured by both the team performance and the team viability, that is, the team's capability to work together co-operatively. This allowed both a results-driven measurement to be ascertained, as well as evaluation of the social dimension.

Building on previous research (Hinds and Weisband 2003; Jarvenpaa and Leidner 1999; Maznevski and Chudoba 2000), we argue that a limited range of communication methods can influence the development of trust and shared understanding. This in turn can influence global virtual team effectiveness. Furthermore, we also examine the degree of 'virtualness' of the sub-groups to determine the extent to which the range of communication methods available can impact a team's performance and viability.

The Global Virtual Team

A global virtual team is a group of people that have a common goal or task to perform, but are separated by distance or time (Edwards and Wilson 2004). Relying upon communications media, such as teleconferencing, video-conferencing, email and other computer-mediated communications technology, the global virtual team is expected to achieve the same performance and deliver the same results as a traditional co-located team. In this paper, we define a global virtual team as a temporary, culturally diverse, geographically dispersed, electronically communicating work group (Jarvenpaa and Leidner 1999:792). The network of a global virtual team will also often cross cultures, functions and

organisations in order to deliver the required expertise and skills that are needed to achieve tasks and goals.

A global virtual team may be deployed for several reasons, and each type of virtual team is distinguishably different, in terms of both their purpose and their frequency of collaboration. A team may remain exclusively virtual whereby there is no face-to-face contact, or alternatively, there may be intermittent meetings. Opinion is divided as to whether a virtual team performs differently to a co-located team. It has been argued that 'virtualness' is a concept that applies to all teams (Shin 2005), as they all communicate virtually to some degree (Griffith and Neale 2001). Four dispersion dimensions have been identified to characterise virtual teams (Shin 2005): spatial, temporal, cultural and organisational. The degree of 'virtualness' is be dependent upon the level of dispersion that the team operates under in each category. On this basis, it can be argued that all teams sit somewhere on a continuum between extreme virtual teams and low level virtual teams. Therefore, the level of complexity and challenges that may present themselves within a global virtual team may be affected by their level of dispersion within the four dimensions.

Communication Within Global Virtual Teams

Often communication can be pivotal in addressing many of the challenges faced by global virtual teams (Gibson and Cohen 2003). The advancement of the Internet and technology has been defined as the 'foundations' of the global virtual team whilst communication, a vital element in all team-working (Maznevski 2008), has been identified as their 'cement' (Hulnick 2000).

The communication exchange is not solely reliant upon the words, but also the interpersonal aspects of the communication, such as behaviour and context. These present further meanings and depth to the sender's words. The sender and receiver can often comprehend that the message has been successfully transmitted through feedback. This is an important stage in the communication process, as instant, rich feedback allows effective communication to take place. However, instant feedback tends to only be available within a face-to-face context, in which it is conveyed through the tone of reply or facial expressions and hand gestures. Where feedback is delayed or absent, the receiver must carefully decode the message in order to ensure that the accurate meaning is received. A lack of face-to-face contact can frequently lead to miscommunication and misinterpretation as communicating electronically can negatively impact on the receiver's understanding of the message (DeSanctis and Monge 1999).

Communication not only transmits information; it facilitates relationship-building and trust (Jarvenpaa and Leidner 1999), and has been identified as one of the most effective factors in establishing group cohesion (Hayes 2002). However, the channel or medium itself can often influence the effectiveness of the communication (Cleland and Ireland 2006). Computer-mediated communication, such as email, bulletin boards and intranet, can often lack interpersonal aspects and non-verbal behaviours, therefore the lack of rich feedback may lead to misinterpretation and misunderstanding. There is some disparity in the outcomes of research that seeks to understand if computer-mediated communication differs from face-to-face communication. On the one hand, it is suggested that there is no difference in the capability of social relationship building, but the difference lies in the pace at which it can happen (Walther 1995, 1997). Other studies however, suggest that face-to-face communication is irreplaceable in building trust within teams (Jarvenpaa and Leidner 1999; O'Hara-Devereaux and Johansen 1994). Computer-mediated communication is the enabler that allows the virtual team to exist, allowing team members to

communicate regardless of location and time constraints (Feldman 1987; Sproull and Kiesler 1986). Whilst computer-mediated communication unites virtual team members, it can provide barriers and challenges to the team that emanate from the lack of social cues and rituals that often reveal further meaning behind a message (Cramton and Orvis 2003).

Global virtual teams can suffer from a lack of shared understanding which leads to misinterpretations and miscommunications (Hinds and Weisband 2003). Shared understanding is a way of communicating relevant knowledge; often the team's common goal, or organisation's mission. It is also necessary for the team to have a shared understanding of the processes that will aid them in achieving their goals. Shared experiences, similar backgrounds and norms, as well as developing a relationship over time contribute to these shared understandings. Global virtual team members are often geographically distant from one another, with different backgrounds and have less time allocated to non-task interaction. Therefore, there is less opportunity for social or informal contact and spontaneous communication; this in turn can lead to lower familiarity, a lack of strong connection and bonding and potentially less knowledge-sharing (Handy 1995; Hinds and Mortenson 2005: Hinds and Weisband 2003).

Global Virtual Teamwork

Virtual working can alter traditional views of teamwork and if the risks are not addressed, performance may be impaired. Team development research is characterised by several assumptions regarding critical elements within developing a high-performing team. One is that 'team members are co-located or are within a reasonable distance to support frequent person-to-person contact' (Ireland 2004:127). Considering that the global virtual team has limited, if any, face-to-face contact, this suggests that the absence of co-location will negatively affect team performance. Whilst some research concludes that a virtual team produces better results (Gibson and Cohen 2003) and other findings suggest that it is the complexity of the global virtual team and their tasks that leads to them performing less effectively than co-located. (Straus and McGrath 1994).

Some commentators have indicated that virtual teams can outperform traditional co-located groups. An extensive study of 80 software development teams with programmers from the United States, South America, Europe, and Asia has established that virtual teams can lead to increased efficiency and better business results, but only if they are managed proactively to maximize the potential benefits while minimizing the disadvantages (Siebdrat et al. 2009). The key elements of success included establishing processes at the beginning of the task, communicating less and keeping conflicts focused on the task Working across time zones (and even across different cultures and languages) does not necessarily result in a drop in performance. Indeed, it can lead to increased efficiency and better business results if the dispersion is managed such that it becomes a valuable advantage, rather than a crippling liability (Ferrazzi 2012). In order to become an effective and high-performing team the global virtual team must adhere to the basic generic conditions of team performance. These conditions are: clearly defined tasks and objectives; an appropriate composition of skills; appropriate and developed roles; conflict management; performance management processes and effective communication (Maznevski 2008). In order to achieve high performance, teams must then develop certain additional characteristics: building respect and trust; engaging in innovative processes; and the management of team boundaries (Maznevski 2008).

In a framework to analyse team-working (Sundstrom et al. 1990), team effectiveness is comprised of two elements, team performance and team viability. Team performance is

results-driven and concerned with meeting the expectations of those outside the group. Team viability provides a social dimension and is connected with the ability for the team to co-operate and work effectively. Indicators of team viability include the degree of group cohesion, shared purpose and level of commitment. This conceptualisation of team-working also suggests that the organisational context, the team's boundaries and team development are variables contributing to team effectiveness.

Team effectiveness can be more intensely influenced when there is a higher degree of technological dependency and geographical dispersion (Gibson and Cohen 2003). However, whilst there may be other barriers, the very nature of the composition of the global virtual team allows greater potential for high-performance through expertise and knowledge when there are limited restrictive boundaries (Maznevski 2008). Global virtual team effectiveness is based not only upon reaching the desired level of performance by achieving the objectives, but also on the team's viability—the capability of team members to work together co-operatively (Barrick et al. 1998; Sundstrom et al. 1990). Communication processes are the key underlying mechanisms for building relationships and trust (Gibson and Manuel 2003).

Common values and norms are developed through continued interaction, and shared understanding is critical in developing trust within the team and in turn improving its effectiveness (Hinds and Weisband 2003). However, the global virtual team context potentially allows only a limited range of communication. The capability of building social relationships is not hindered by computer-mediated communication, only the rate at which it happens (Walther 1995) and thus team viability is not compromised through a limited range of communication methods.

Methodology and Research Design

The approach is that of key informant interviews which gave rich insight into managing and working within global virtual teams and in particular enabled the exploration of the relationship between communication and effectiveness.

The Corporate Context

The informant organisation is Pharmagiant (pseudonym), a UK multinational pharmaceutical company and the unit of analysis is five different teams within this. Divided into seven product category divisions, this study is located in the vaccines Division. The key informant for the research was the UK Procurement director and Global Category Manager who is a member of all of the teams in this research.

The Procurement and Supply Chain departments within the division are then further divided into categories. The participant splits his time between two roles: UK Procurement Director and Global Category Manager. As UK Procurement Director, the participant is responsible for Procurement activity at the UK site, and is part of both a site senior management team, and a divisional procurement team. The site management team is locally based and is cross-functional, whereas the divisional procurement management team is global but all members work within the same function. The role of Global Category Manager involves the management of a specific category, and he manages this category for all divisions across the business. Therefore he has contact with employees from all functions, tends to work with procurement professionals.

The participant directly manages a team of eight co-located procurement employees, responsible for procurement at the UK site. However as he travels frequently, the participant must manage the co-located team remotely. The participant has been involved in a number of projects that utilise global virtual teams; involved both as a contributor as well as project leader. However, when leading the projects the participant has no direct line management authority for the project team members. The participant is also part of a divisional procurement team in which his peers are dispersed throughout Europe and the US. The leader of the divisional procurement team is based in Europe, and thus the participant himself is managed remotely in this role.

Thus the participant offered a number of perspectives related to global virtual team working:

(1) Working within, and leading global virtual project teams with no direct management responsibility for the members;
(2) Being part of a global virtual divisional procurement team with a remote leader;
(3) Being part of a co-located cross-functional senior management team.
(4) Managing a co-located procurement team;
(5) Remotely managing the co-located procurement team on a temporary basis when travelling;

The objective of the study is to investigate the relationship between a limited range of communication and effectiveness. Thus our research question is: how is team effectiveness affected by the available range of communication methods? The hypothesis derived to test this was: a limited range of communication methods has a negative impact on the effectiveness of a global virtual team.

Effectiveness was defined as the team's viability and performance—the viability of the team is subjective and based upon the perspective of the participant, whist performance is an objective measure.

Whilst the use of a single organisation may ordinarily present distorted results (Yin 1994); the participant offers a number of different perspectives and allows for comparisons between differing types of teams. In effect, we are able to understand five different team structures through a common participant, facilitating experience-based comparison. Using a respondent with multiple perspectives offers a more controlled environment, as each organisation will have unique characteristics and resources available to them.

Data Collection and Analysis

Data was collected using a staged approach whereby a combination of styles was used within the interview (Saunders et al. 2007). The participant was first asked a predetermined set of questions. A semi-structured approach in order to explore the responses followed this structured interview. The sub-groups were treated as separate interviews with the exception of the global virtual divisional team and co-located site management team, which were dealt with together.

All interviews with the participant were audio-recorded and transcribed soon after the interview. The data was analysed through the use of a pattern matching technique. Pattern matching comprised the comparison of an observed pattern with an expected pattern. In this study the expected pattern was: where a limited range of communication is available, there will be a lower level of effectiveness within the team.

Levels of Virtualness—Dispersion Dimensions

In order to analyse and interpret the findings, we used dispersion dimensions: *organisational*, *cultural*, *spatial* and *temporal* (Shin 2005) in order to address the proposed hypothesis Using these categories allows for comparison of the extent to which the team's level of 'virtualness' impacts the team's effectiveness.

Based on the four dimension categories, the participant's different sub-groups were analysed to determine their degree of virtualness. Organisational dispersion is defined as the degree to which members work across organisational boundaries (Shin 2005: 332); we have interpreted this to include functional boundaries in addition to organisations outside Pharmagiant. Each sub-group was considered against each dimension and Fig. 1 presents the level of dispersion for each sub-group.

Research Findings

This section presents the experiences of participation in each of the different team profiles, summarising the participant perceptions and feelings followed by the pattern matching analysis. The final sub-sections describe the techniques used to build and manage teams in the different configurations. Subsequent sections present a discussion and interpretation of the results.

Operating in Different Team Structures

The experiences of working in and managing five different team types with the different profiles of dispersion dimensions (Fig. 1) are described in turn. These narratives reflect the experiences and situation interpretations of the manager/participant and as such are summaries of the themes that emerged from analysing of the interviews.

Global Virtual Project Team

There was enjoyment in working with people that originated from a range of backgrounds and perspectives; however, he felt these differences could also become barriers and challenges. Cultural differences were outlined in the context of differences of meaning and approach, and also in differences in communication and commitment.

It was asserted that face-to-face communication should be utilised as much as possible, however it was recognised that this was not always easy. Teleconferencing was preferred as a method of communication because of its convenience and availability to all members. It was important to communicate regularly and schedule regular meetings, preferably weekly or bi-weekly.

Misunderstandings and misinterpretations occur frequently, but this can be overcome through a mixed methods approach to communicating—verbal, face-to-face and written. Due to the nature of the projects, the effectiveness of the team has been variable; some results have far exceeded the objectives whereas others have never been concluded. The most successful projects had occurred where the project commenced with an initial face-to-face meeting, supported by periodical face-to-face meetings and regular teleconferences. However there was a feeling that this may not alter the overall achievement of the objective, but makes for a better quality of delivery that is likely to be more sustainable.

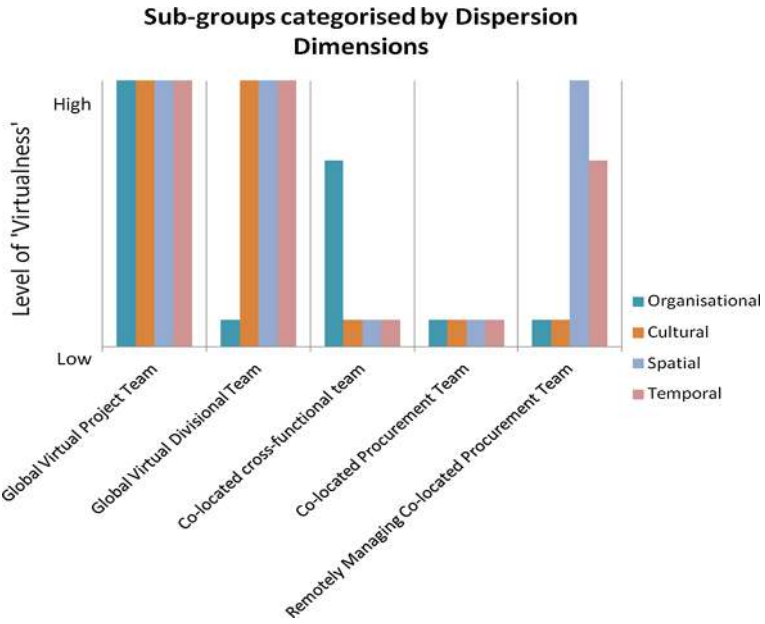

Fig. 1 Sub-groups categorised by dispersion dimensions

The level of trust, co-operation and shared understanding within the project teams was experienced as variable, however if members of the group had previously worked with each other than these levels increased.

Global Virtual Divisional Team and Co-located Site Management Team

Whilst the different backgrounds and perspectives that are found within the global virtual divisional team were enjoyable, being led by a remote manager can be a challenge. Though the divisional team has a weekly team teleconference and additionally, the remote manager often has individual conversations with the country heads. This has led to inconsistent messages being communicated.

There was a greater level of trust and co-operation within the global virtual divisional team than the co-located site management team, but this was felt to be due to the functional differences and competing priorities rather than team relationships. However, within the global virtual divisional team there was a high frequency of misunderstanding or misinterpretations. This was attributed this to a lack of written communication and little face-to-face contact; the team have only met on two occasions in 18 months. However, individual alliances have formed within the team and this can sometimes lead to mixed messages occurring from the fragmented communications resulting from these alliances.

In the co-located site management team, the communication issues stemmed from competing functional objectives and activities, and these could be easily rectified, as it was easier to meet face-to-face when other problems could also be dealt with at the same time.

Managing a Co-located Procurement Team

Managing the co-located procurement team was enjoyable because of the direct reporting in the structure, allowing for team development along with the management of performance and personnel issues. However, this in itself was one of the challenges of managing the team: the management of the team is a time commitment per se. There was a natural informality present in the co-located group, which can lead to less documentation of actions and responsibilities; there are fewer structured review meetings as a team which can lead to actions not being fulfilled on schedule. However, there was a higher level of trust because the delivery and output of the team is visible, as is the behaviour of the team members. In particular body language was mentioned as a way to be able to see how someone is feeling. There was a greater level of shared understanding, as there is much more exposure to member's activities and results. However, in terms of co-operating as a team, whilst there is a greater level of co-operation, there is also a risk of greater level of social interaction leading to less formality and potentially less achievement.

There were less misinterpretations and a higher level of successful communication because of the opportunity to check that communication has been understood, and also to easily resolve any problems. The team over-performed upon their objectives one factor that influenced this effectiveness of the team was the clarity of objectives allowing the whole team to also take responsibility for the target. As the direct manager for the team members, it is easier to control this and ensure the team members work to their objectives. Overall, it was the co-located procurement team that was felt to be the most effective.

Remotely Managing the Co-located Procurement Team

Remotely managing the team after experience of face-to-face contact can be a challenge, but this is offset by the relationships already established. However, where there is a time zone difference, the delay that occurs through communicating asynchronously makes for less effective communication. The biggest challenge was that instant feedback is eradicated. The timeliness of responses can be another challenge, when previous instant communication was the norm. Whilst email is an easy form of communication, it can also lead to more misunderstandings. It comes down to the leader or sender of the communication to be clear about what needs to be completed and within what timeframe.

Whilst trust, co-operation and shared understanding were slightly reduced, this was not to the major detriment of the team, instead a natural reaction it is not possible to know what is truly happening when you are absent. When away for more than a day, maintaining the discipline of regular teleconferences in place of the normal face-to-face daily meeting was helpful. This change in communication methods did not have an effect upon the team's overall performance or viability.

Matching the Communication Methods in the Global Virtual Team Work With the Emerging Pattern

After reflecting on the findings, we found that there was an expected pattern that can be characterised as follows:

> Where a limited range of communication is available, there will be a lower level of effectiveness within the team.

So in the next section, we analyse in detail this expected pattern against the observed patterns that arose from the interviews, where the expected and the observed patterns do not match, it results in a disconfirmation of the hypothesis. Effectiveness, we argue, can be defined as performance as well as team viability.

Global Virtual Project Team

At any one time there can be as many as 30 projects in progress, often these will be sub-elements of a wider project. The projects differ in size and purpose and the results are variable, some will not come to a conclusion and others will over-deliver on objectives. However, it is the completion of the major project that is the primary objective. Therefore if the major project is completed, even though only a third of all secondary projects were finished, this was deemed acceptable. Indeed, it was not possible to know if all sub-projects come to fruition, only an overview of the main project is realistic and if this is the case, the smaller projects are also deemed successful.

However the team viability seems to have not achieved the desired level, there is often a conflict of objectives. Allowable time commitment to a project can be a major barrier to the performance of the project and, overall, time commitment, communication and prioritisation barriers, it could be contended that team viability was not fully achieved. Therefore overall team effectiveness was negatively affected. The global virtual project team have a limited range of communication methods, and face-to-face communication is often minimal or lacking entirely. Differences in time zones can mean that asynchronous communication often occurs. Thus with a limited range of communication methods and a lower level of effectiveness in the team due to low team viability, there is an indication that the observed pattern matches the expected pattern.

Global Virtual Divisional Team

The global virtual procurement team achieved savings of between 10 and 20 % in the previous year, which was a considerable overachievement and significantly higher than the procurement departments within the other divisions of the company. Their performance does not seem to be affected by the distance between members.

The members of the team all have differing priorities and challenges. Whilst the overall divisional procurement team objective is to achieve a savings target, the individual members also have their own country savings target, and, for example, the UK savings target feeds into the overall divisional target. Therefore, there may be cases where a supplier will deliver to three countries in Europe though the supplier is likely to have a differing significance in terms of total spend in each individual country. Therefore the supplier will represent more or less importance to the individual country Heads of Procurement. These differing priorities can present a challenge as support is not always forthcoming from the countries where the importance of the supplier is lower relative to other team countries. The divisional Procurement Director does not appear to offer the support or leadership that is always needed by the team. The standards and framework for communication have not been set and therefore the team does not often communicate effectively.

With very little face-to-face communication, and irregular team communication, they are subject to a limited range of communication methods. Whilst the level of trust and co-operation was higher than that of the co-located site management team, their differing priorities and sometimes unwillingness to support each other when personal benefit is not present, signifies a lower level of team viability. Their capability to co-operate as a team is

hindered by inconsistent communication, differing priorities and the lack of leadership. Therefore the observed pattern is deemed to match the expected pattern.

Co-located Site Senior Management Team

The members of the co-located site senior management team are all part of their own independent functional teams as well as the site senior management team based in the North West. There is a fundamental goal for the site which is based on its production targets and ultimately its sales targets. However, these targets can often be in contradiction to the objectives of the functional team. These differing goals and objectives can compete against each other and lead to lesser trust and co-operation within the team. There is though, a feeling amongst the team members of shared understanding of their overall goal. The site performance has been good, it has over-performed. Nonetheless, the differing priorities and objectives that compete with member functional goals have an impact on trust and co-operation within the team which can lead to a lower level of effectiveness as optimum team viability cannot be reached.

The team communicates through a variety of methods; there are face-to-face meetings, as well as email and telephone communication, both between individual members as well as the full team. Being co-located allows the team access to the whole range of communication methods, including informal face-to-face communication. Overall though, whilst performance has met or exceeded targets, team viability is not fully achieved. As the team have access to a range of communication methods and are not constrained or limited in their choice, the expected pattern would be that the team should reach a higher level of effectiveness, however they do not. Therefore the observed pattern seems not to match this expected pattern.

Co-located Procurement Team

The eight co-located employees are all managed by the participant; all members are part of the procurement function. Their performance has over-exceeded their objectives over the last year, and to date they are on target to achieve their savings goal. Based upon all the sub-groups the participant is involved in, this has the highest level of trust, shared understanding and co-operation. Whilst there are challenges in managing the co-located team, these challenges are focussed around the development and nurturing of relationships and the natural informality that can be inevitable where face-to-face communication is prevalent. The team have a structured routine of communication that begins with a daily face-to-face meeting. As well as a mixture of face-to-face and email communication, both informal and formal exchanges, the team have use of the full range of communication methods. The effectiveness of the team is influenced by the ability and ease with which the objectives of the team can be reinforced. The team viability has reached a high level, the team has the ability to co-operate, and there is a high level of trust and shared understanding. The team has access to the range of communication methods and are working effectively, with high levels of performance and team viability. Therefore the observed pattern matches the expected pattern.

Remotely Managing Co-Located Procurement Team

Travel takes the participant, as team leader, away from the co-located procurement team for periods of between one day and two working weeks. This leads to communication

challenges, as the team is accustomed to communicating face-to-face or having the opportunity to discuss tasks in-depth. However, because the relationships are already present, is easier to manage this team remotely than a remote project with a team of indirect reports.

The frequency of absence from the team therefore the frequency of remote management do not appear to affect team performance. They still exceeded their annual objectives and savings goal. Whilst the levels of trust and shared understanding did, naturally, decrease slightly, this was not a major detriment. During leader absence, the team is subject to a limited range of communication methods though their effectiveness in levels of performance and team viability does not decrease over these travelling periods. Therefore the observed pattern does not match the expected pattern.

Pattern Matching Summary—Range of Communication Methods

The observed patterns from each of the sub-groups presented an interesting insight into the management and participation of co-located and global virtual teams. The expected pattern did match the observed pattern in some of the sub-groups, however failed to match all groups. Table 1 shows the results of the pattern matching analysis for all sub-groups.

Pattern Matching Analysis—Dispersion Dimensions

As the expected pattern was not observed within all sub-groups, an alternative explanation will be sought using Shin's (2005) dispersion dimensions. This is in keeping with the application of the pattern matching technique (Yin 1994). The results were reviewed using the overall level of dispersion as an indication of the extent of 'virtualness'. The following expected pattern will be used in order to present an alternative explanation for team functionality:

> Where the sub-groups experience a higher level of dispersion or 'virtualness' within any of the dimensions, there will be a lower level of team effectiveness.
>
> This expected pattern will be analysed throughout the sub-groups (Fig. 1).

Global Virtual Project Team

The global project team has the highest level of 'virtualness' across all of the four dimensions. Through the previous analysis it was deduced that whilst performance was achieved, the team viability was not fully achieved, therefore the team did not reach a high level of effectiveness. Therefore the observed pattern matches the expected pattern.

Global Virtual Divisional Team

The global virtual divisional team are all part of the same organisation and function and therefore their organisational dimension represents a low level of 'virtualness'. However, as a global team, the temporal, cultural and spatial dimensions all achieve a high level of dispersion. The previous analysis deduced that the due to the low levels of team viability, the effectiveness of the team was not high despite phenomenal

Table 1 Summary of pattern matching analysis

Sub-group	Observed pattern = expected pattern
Global virtual project team	Yes
Global virtual divisional team	Yes
Co-located site management team	No
Co-located procurement team	Yes
Remotely managing co-located procurement team	No

overachievement of their objectives. Therefore the observed pattern matches the expected pattern.

Co-Located Site Management Team

With all members of the site management team located on the same site, there is a low level of temporal, cultural and spatial 'virtualness'. However, the level of organisational virtualness is high as they all belong to differing functions, though all members are part of the wider organisation of the UK Vaccines division and therefore have some goals in common.

Similar to the global virtual divisional team, despite exceeding overall objectives, team viability was not fully achieved and therefore overall team effectiveness was not reached. As the team has a fairly high level of organisational 'virtualness', the observed pattern matches the expected pattern.

Co-Located Procurement Team

All dimensions are at a low level of 'virtualness', and through previous analysis the team are working effectively as both performance and team viability is achieved. Therefore the observed pattern matches the expected pattern.

Remotely Managing the Co-Located Procurement Team

The organisational and cultural dimensions are not altered when the leader is absent and therefore managing the normally co-located team remotely. However, dependent upon the nature of the absence, the temporal dispersion may be affected as correspondence may be asynchronistic.

As the team effectiveness is not influenced by leader absence the observed pattern does not match the expected pattern, as regardless of where the leader is during their absence, there is always a high spatial dispersion.

Pattern Matching Analysis Summary—Dispersion Dimensions

Table 2 presents the pattern matching analysis based on 'virtualness' determined through dispersion dimensions (Shin 2005) as the main variable between sub-groups. Whilst the expected pattern has been observed more frequently than the previous analysis, remotely managing the normally co-located procurement team still presents an anomaly.

Table 2 Pattern Matching Analysis Summary – Dispersion Dimensions

Sub-group	Observed pattern = expected pattern
Global virtual project team	Yes
Global virtual divisional team	Yes
Co-located site management team	Yes
Co-located procurement team	Yes
Remotely managing the co-located procurement team	No

Techniques to Ensure Effectiveness

Discussion of each team situation included an exploration of the practical communication techniques that were utilised in order to build and manage effective teams.

Routine Communication

The main theme throughout all of the sub-groups was the need for routine and consistent communication. Within the context of a global virtual project team the need for regular face-to-face contact was felt. Although it was appreciated that this was not always possible but that it would make a difference even if the only face-to-face was to 'kick-off' the project. In order to promote effectiveness the frequency of communication is important, potentially more important than the method of communication.

Within the co-located procurement team, the ability to reconfirm the objectives of the team, especially at times where they are not performing against target developed overall effectiveness. Daily morning meetings were introduced in order to share key information, discuss issues and strategies and catch up as a team. During periods of remote management the need to maintain that regular communication when absent for more than one day was important this regularity maintains the team focus.

The communication within the global virtual divisional team was often inconsistent, with different messages given to different members of the group by the leader. This often led to a high frequency of misunderstandings and misinterpretations. Whilst it was ultimately the responsibility of the team and the individuals within the team to ensure that effective communication takes place, it is the team leader's responsibility to set the standard, the expectations and the communication framework.

Clarity of Objectives

Similar to the need for routine communication, clarifying objectives influences the effectiveness of the team. Ensuring that the team has a continued focus on the overall objective and that the objective is reviewed throughout the year means that the whole team can fully understand when targets are not being met. This also allowed the team to assume responsibility for ensuring the objectives are met. They can then devise strategies together in order to get back on track if the team is underachieving.

Direct Reporting and Management

Ability to control the co-located team members' tasks led to more efficient working. Whilst this may not be something that the leader of a global virtual team is always able to, do, it was a factor that influenced the effectiveness of the group in this case.

The leader of a project can have a lack of command as a consequence of indirect management and there was a perceived lacked control over the prioritisation of tasks. When the individuals or departments see the project as a priority, and therefore allocate more time to it, there is a more effective team and successful outcome.

Discussion and Conclusions

Communication Methods and Team Effectiveness

The expected pattern matched only three of the observed patterns, the co-located site management team and the co-located procurement team being remotely managed defied the expected pattern. This was often due to our definition of effectiveness that included both performance and team viability. It was the team viability that lowered the overall effectiveness of the team. All teams experienced performance achievement, some teams even considerably over-achieving, however their ability to work co-operatively together did not match these performance attainments.

Examining the two elements of effectiveness separately, all teams achieved their performance goals or objectives. However it should be noted that the global virtual project team did not achieve upon some projects. In these instances, it was the sub-projects that were not realised even though the main project was completed successfully. However, the fact that all teams achieved their performance goals regardless of being co-located or working virtually concurs with previous research suggesting that in some tasks there are no differences between face-to-face and virtual groups (Straus and McGrath 1994). Our findings enhance this previous research, extending it to cover tasks of different levels of complexity and negotiation skills. Such skills have been found to be best completed using a rich medium of communication (Jarvenpaa and Leidner 1999), however the global virtual divisional team, who have met as a team on only two occasions and communicate mainly through email and teleconference, have considerably overachieved on their target.

The team viability was the reason for many of the team's failure to achieve a high level of effectiveness; this led to the expected pattern with three of the observed patterns, but was also the reason for the co-located management team patterns not corresponding. The co-located management team has access to the range of communication methods, and face-to-face communication is frequent. When compared with the global virtual divisional team however, there was a lower level of co-operation, trust and shared understanding. These findings contradict studies that conclude that face-to-face communication is irreplaceable in building trust (Jarvenpaa and Leidner 1999; O'Hara-Devereaux and Johansen 1994). This is explained by the differing, often conflicting, goals and objectives within the teams.

There was a mixed methods approach to communicating in all teams; e-mail is used as a tool to confirm the details and actions that have been discussed during a teleconference or face-to-face meeting. Therefore whilst there may be a lack of face-to-face communication in the global virtual teams, the teleconference will still provide social cues and behaviours, and the barriers and challenges that have been associated with computer-mediated communication (Cramton and Orvis 2003; Patrashkova-Volzdoska et al. 2003) are reduced.

It could be argued that communication is a major contributor in a team's effectiveness as it features as a significant component of any task. However, the methods of communication are not necessarily the reasons for a team not performing effectively, but instead it could be the lack of communication processes and standards that lead to a lower level of team effectiveness. The lack of consistent and routine communication or the process of communication, within the global virtual divisional team is a dominant factor in the team not achieving a high level of effectiveness. Process is one of the areas that a team must overcome in order to become effective (Hackman 1990), and effective communication is a basic condition for team performance (Maznevski 2008). The limited range of communication methods that were available to the co-located team when they were remotely managed did not affect their performance or team viability. Whilst there may have already been an established team relationship, the communication practices that were already in place were upheld. This is likely to be a factor in the team's continued effectiveness even when remotely managed.

Dispersion Dimensions and Team Effectiveness

The findings from the alternative pattern matching analysis based on dispersion (level of virtualness) suggests that it is often the differing goals and objectives that can cause a lack of team's viability. Whilst communication plays a factor in achieving performance, the level of dispersion in any of the dimensions: cultural, temporal, spatial or organisational, could be an important influence on team effectiveness.

Communication and Effectiveness

The core objective of this paper is to examine how a limited range of communication methods can impact upon a global virtual team's effectiveness.

Testing the related hypothesis using the initial pattern matching exercise revealed that whilst a global virtual team may be subject to greater challenges, it does not appear that it is the range of communication methods that impacts upon the team's effectiveness. Instead, there is a need for consistent and routine communication; this can then develop the team's psychological traits, potentially leading to a more effective team.

The limited range of communication methods that are available to the co-located team when they are remotely managed did not negatively impact upon their effectiveness. The whole range of communication methods that is available to the co-located management team did not lead to a higher level of effective working. However, within the global virtual divisional team, the lack of consistent and routine communication forced a high level of misunderstanding and misinterpretation. This mixed communication also led to individual alliances within the team, increasing the risk of inconsistent communication. However these alliances demonstrate that it is possible to develop relationships within a global virtual team supporting previous research (Walther 1995, 1997).

Conclusions and Further Research

Overall, the findings indicate that communication may be a contributor to team effectiveness, though the limited range of communication methods was not necessarily the main factor that affected this. This was emphasised by a comparison of the co-located management team and the global virtual divisional team. The global virtual divisional team

performance was considerably over-target despite having a limited range of available communication methods. The global virtual team also had a higher level of trust and co–operation. Furthermore, while the global virtual divisional team overachieved on their performance targets, they had a fairly low level of team viability. This could be attributed to the leadership and management of the team and irregular communication.

The global virtual project team demonstrated a similar outcome, their performance was satisfactory, but they had a low level capability of working together. Maintenance of routine communication was important and following up teleconferences with a written summary and action plan served to counteract any cultural or language problems.

The co-located team was deemed the most effective, their performance was either on target or overachieved, and the team was capable of working together. There was a slight negative impact on the trust and shared understanding of the team when it was managed remotely. Though this was insignificant and temporary remote management did not appear to negatively impact on team effectiveness. Routine, frequent and face-to-face communication along with reiteration of team objectives were important factors for co-located teams. Face-to-face communication also allowed for some informal exchanges, and this contributed to the higher level of team viability.

In the organisational teams, a low level of team viability was often the reason for the team not working effectively overall despite achieving high performance. A clear barrier to team viability was the differing, and often competing, priorities and objectives between the members. This barrier was present not only within a cross-functional team, where it would be expected, but also within the global virtual divisional team. Having personal country targets in addition to a global procurement target, appeared to impact upon team viability, and ability to co-operate with one another in this team structure.

Further analysis indicated that the level of dispersion of the team impacted upon the team's effectiveness though the team could become effective despite high dispersion in any of the categories. The research indicates that the impact of a high level of organisational dispersion may have a greater impact upon effectiveness than other dimensions, competing priorities and objectives appeared to have an impact upon team viability. This organisation dimension lends itself to an interesting future research agenda. Our findings will help managers and leaders to develop strategies that ensure high-performing teams that are effective overall in terms of their viability, which creates sustainable, stable team environments. Communication is significant factor within a team: consistent, regular communication and clarification of goals and objectives exercised by both the leader and members of the team enhance its effectiveness. Finally, we were fortunate to identify a key respondent with multiple roles, which enabled reflection of the differences and challenges of each. These insights set a research agenda to confirm these challenges in those with more focussed discrete roles. Especially interesting would be to investigate this area further using a dyadic approach in order to understand different perspectives of each type of relationship.

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