

A conceptual model to improve performance in virtual teams

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Background: The vast improvement in communication technologies and sophisticated project management tools, methods and techniques has allowed geographically and culturally diverse groups to operate and function in a virtual environment. To succeed in this virtual environment where time and space are becoming increasingly irrelevant, organisations must define new ways of implementing initiatives. This virtual environment phenomenon has brought about the formation of virtual project teams that allow organisations to harness the skills and know-how of the best resources, irrespective of their location.

Objectives: The aim of this article was to investigate performance criteria and develop a conceptual model which can be applied to enhance the success of virtual project teams. There are no clear guidelines of the performance criteria in managing virtual project teams.

Method: A qualitative research methodology was used in this article. The purpose of content analysis was to explore the literature to understand the concept of performance in virtual project teams and to summarise the findings of the literature reviewed.

Results: The research identified a set of performance criteria for the virtual project teams as follows: leadership, trust, communication, team cooperation, reliability, motivation, comfort and social interaction. These were used to conceptualise the model.

Conclusion: The conceptual model can be used in a holistic way to determine the overall performance of the virtual project team, but each factor can be analysed individually to determine the impact on the overall performance. The knowledge of performance criteria for virtual project teams could aid project managers in enhancing the success of these teams and taking a different approach to better manage and coordinate them.

Introduction

The globalisation of business and markets, as well as the development of information and communication technologies (ICT), are growing rapidly. This has resulted in the emergence of virtual project teams, also referred to as global project teams (Anantamula & Thomas 2010; Hertel, Geister & Konradt 2005; Kirkman *et al.* 2004; Ludden & Ledwith 2014). Virtual project teams have increased global competitiveness as well as investments in several types of projects in manufacturing, telecommunications, information technology, engineering, financial services and construction, and are used as a means of enhancing team performance (Gordon & Curlee 2011; Ludden & Ledwith 2014; Nader, Shamsuddin & Zahari 2009).

Virtual project teams provide organisations with an 'unprecedented level of flexibility and responsiveness' (Powell, Piccoli & Ives 2004). This flexibility allows organisations and project managers to harness the skills and know-how of the best resources, irrespective of their location (Geber 2008; Gordon & Curlee 2011). Virtual project teams are embracing various technologies to reduce travel and accommodation costs, decrease project time schedules and improve time for decision-making by the team (Duarte & Snyder 2006; Geber 2008; Gordon & Curlee 2011). Studies by Dubé and Paré (2001), Gordon and Curlee (2011), and Ludden, Ledwith and Lee-Kelly (2012) concur that the use of technology allows for almost instantaneous communication in virtual project teams.

There is growing interest in virtual project teams, but little discussion of the factors that contribute to their performance (Anantamula & Thomas 2010). Literature reveals that more research is needed to explore the various ways to enhance the performance of virtual project teams (Anantamula & Thomas 2010; El-Tayeh, Gil & Freeman 2008; Gordon & Curlee 2011; Idrus, Husin & Sodangi 2011; Nader *et al.* 2009). Previous research on virtual project teams has focused on

general team performance, team outputs and outcomes (Krasnikov & Jayachandran 2008). Studies by Sosik and Jung (2002) only indicate aspects of team performance, such as decision quality and the length of time to reach a decision, quality of the team products and creativity. Team members' satisfaction and experience whilst working on specific projects were examined by Powell *et al.* (2004). Dube and Marnewick (2012) investigated and established the building blocks of virtual project teams to be communication, trust, leadership and social needs. Further studies by Almahmoud, Doloi and Panuwatwanich (2012) identified the relationship between project performance and project delivery using the project's key performance indicators. Nader *et al.* (2009) in their study indicate that there is a need to provide the performance criteria and types of activities for virtual project teams to enhance their performance. Pinar *et al.* (2014) point out that there is a gap in literature in terms of the performance and ultimate success of virtual project teams. This article addresses this gap by examining the key performance factors which can be applied to enhance the success of virtual project teams.

It is important for project managers and those managing virtual project teams to understand how virtual project teams work and function. The success of the virtual project team is based on the performance of each team member as well as the overall performance of the team (Gordon & Curlee 2011; Ludden & Ledwith 2014). The knowledge or awareness of performance factors for virtual project teams could help project managers to enhance the success of a project implemented by a virtual team.

The first section of this article focuses on the research method used for this study. The second section deals with the conceptual model for virtual project teams, several definitions of virtual project teams and the role these teams play in today's business. Thirdly, the concepts of performance are defined and individual performance, team performance, project team performance and virtual project teams are explored. The characteristics of performance and different levels of performance measurements are discussed. The final section concludes with the vital performance criteria required to enhance the performance of virtual project teams, as well as future research possibilities. The research methodology is discussed in the next section.

Research methodology

A qualitative research approach was used in this article. This approach assists researchers in discovering and understanding more about a topic or phenomenon, people's experiences and the expression of their perspectives (Johnson & Onwuegbuzie 2004; Morgan 2014; Mouton 2011). It further examines the set of people or situations being studied in greater detail and depth, on a small chosen scale (Morgan 2014; Mouton 2011). The purpose of content analysis is to explore the research to understand, in this case, the concept of performance in virtual project teams and to summarise the findings of the literature reviewed. The following process was used:

- Create a list of key search terms. Key terms are derived from the research topic and include synonyms.
- Identify the source for primary searches. The identification of relevant articles was carried out using online databases such as ACM Digital Library (ACMDL), IEEE Xplore and ScienceDirect.
- Inclusion and exclusion criteria were developed to narrow the amount of research articles.

The literature suggests that there are several factors that have an impact on the improvement of performance in virtual project teams (Almahmoud *et al.* 2012; Gordon & Curlee 2011; Ludden & Ledwith 2014; Olivier 2009; Richardson *et al.* 2012; Sridhar *et al.* 2007). A coding frame was used to categorise and analyse the results of the selected performance criteria adopted in this research, which were later used to conceptualise the model. The model demonstrates an understanding of theories and concepts that are relevant to this research (Asher 2013) and provides the simplicity and clarity of the research problem (Olivier 2009). It also allows the researcher to understand and view certain aspects being studied and to ignore other aspects (Anfara & Mertz 2006).

Literature review

Authors have used several definitions for virtual project teams. The literature reveals that virtual project teams are often formed to overcome temporal geographic dispersion (Drouin, Bourgault & Gervais 2010; Jarvenpaa & Leidner 1999; Ludden *et al.* 2012; Nidiffer & Dolan 2005; Staples & Zhao 2006). Studies by Settle-Murphy (2013) state that virtual project teams consists of one or more of its members working apart from the others and not having much face-to-face interaction on a daily basis. Wise (2013) notes that virtual project team members may work in the same building for years without meeting or discovering one another, but are using technology for collaboration.

The degree of geographic dispersion or offshore teams within a virtual project team can vary from having one member in a different location from the rest of the team, to having each member located in a different country (Wise 2013). Virtual project teams play an increasingly important role in organisations to reach beyond traditional boundaries (Geber 2008). Some of the boundaries include geographic dispersion and time (Drouin *et al.* 2010), multiple organisational cultural values which consider religion (Anantamula & Thomas 2010; Dinsmore & Cabanis-Brewin 2014; Pauleen & Yoong 2001) as well as language and communication (Gordon & Curlee 2011; Jarvenpaa & Leidner 1999; Kirkman & Mathieu 2007; Ludden *et al.* 2012; Pinar *et al.* 2014). Technology is an important aspect in virtual project teams as team members use it to coordinate and execute team activities. They place considerable value on their usage for information transfer and feedback, as well as for virtual interaction.

According to Peters and Manz (2007), Wise (2013) and Ludden and Ledwith (2014), virtual project teams foster an extensive use of technology that enables geographically

dispersed members to coordinate their individual efforts and inputs. Gordon and Curlee (2011) and Wise (2013) concur that virtual project team members rely on technology for communication and infrequent meetings and are empowered to make project decisions. The study on the characteristics of virtual project teams by Ludden *et al.* (2012) outlines the following as typologies of the virtual project team: temporal, geographic, cultural, social, political, team membership, communication technology and task complexity. A set of standard measures was developed by Ludden and Ledwith (2014) to investigate the impact each of them has on the performance of virtual project teams. The research outcome indicates that teams rely heavily on technology for communication and that members report to a team leader with a reputable track record. Team members are fully aware of the cultural differences, communication challenges and temporal geographic dispersion in terms of execution of project activities. This, however, does not impact negatively on team performance (Ludden & Ledwith 2014).

In the next section the general concept of performance is explored in traditional as well as virtual project teams.

Performance

The main purpose of this section is to explore the different types of performance measurements in organisations. Performance is a vital component for the success of both virtual and traditional teams (Pinar *et al.* 2014). Performance is an act of doing something which focuses on monitoring the progress and accomplishment of the activities through measurable parameters (Meyer, Roodt & Robbins 2011). These measurable parameters are passed down to each individual in the project team. Swanepoel *et al.* (2011) define performance as the outcome of work activities which should be measurable. Performance is defined as the 'effectiveness, efficiency, development, satisfaction, innovation and quality' leading to accomplishment of activities (Ali, Mahat & Zairi 2006; Katou 2008). Performance is generally related to the achievement of quantified goals or desired outputs (Armstrong 2007). According to the Guide to the Project Management Body of Knowledge (PMI 2014), performance within a project context is defined as observations and measurements identified during the project, e.g. the technical performance measures, actual expended cost, actual duration and percentage of work physically completed.

The literature has revealed that the concept of performance is used in many different ways for evaluating the success of a project (Idrus *et al.* 2011; Ludden & Ledwith 2014). It is further stated that the term 'performance' is defined differently depending on the context in which it is used. Basically, performance is used to measure the effectiveness of project activities. It is a yardstick to measure, evaluate or judge how well an individual or team has done to accomplish the required result, as noted by Zigon (2000). The performance of virtual project teams might be improved because there is a wider selection of professionals and skilled team members from a diverse pool, and not only from the local market

(Goncalves 2005). Virtual project team members improve performance by saving time which could be lost due to physical interferences and interruptions in traditional teams (Ludden & Ledwith 2014).

Workplace performance is increasingly being affected by the use of technology in either a positive or negative way (Gallouj & Djellal 2011). Performance in both traditional and virtual project teams is improved when team members have access to a variety of knowledge bases, electronic resources and information (Kirkman & Mathieu 2007; Ludden & Ledwith 2014). Virtual project team productivity is increased as commuting time is reduced (Smith 2014). The time spent on travelling and commuting can be used effectively and efficiently towards project work (Curlee 2008). Virtual project team members are not bound to a physical location and working hours experienced by traditional team members. Working on a virtual project team eliminates unnecessary stress on the individual of being an expatriate. Expatriates also end up being a tremendous expense for the organisation in terms of communication, accommodation, travel, physical and psychological needs of those working in a foreign region or country (Dinsmore & Cabanis-Brewin 2014; Sridhar *et al.* 2007). Technology facilitates the effective sharing of information among team members and has a way of drawing members together and enables them to collaborate and work more effectively (Kirkman & Mathieu 2007; Ludden & Ledwith 2014).

Three levels of performance form the basis of the coding frame. Performance measurement levels are put in place to assess individual, team and overall project performance (Armstrong 2007).

Individual performance

An individual working on any specified task strives to work independently and is accountable for successfully completing the assigned task (Holmes 2012). The assigned task provides individuals with the motivation and direction necessary for their growth and success (Rouillard 2003). Individual performance is measured against the set goals and objectives of the project team to determine whether an individual can achieve them. The project team's goals and objectives, in turn, are aligned with organisational values, vision and purpose (Buys 2010; PMI 2013). Research by Omoredé, Thorgren and Wincent (2013) and Latham and Locke (2006) reveals that the individual member's performance is strongest when they perceive goals as very important and are committed to the attainable goals. Performance measurement is based also on past results achieved versus the current results obtained, to determine whether there is significant improvement. An individual's performance then means getting the desired results from the given task an individual is working on. This is best achieved by understanding and managing the performance within the agreed standards and framework of the planned objectives and competence requirements (Armstrong 2007). The project manager should clearly outline the individual's competence requirements

and objectives and set the standards for measuring the individual's performance. The project manager should further give guidelines to evaluate how individuals contribute to the overall team or project performance and how often the accomplishments are to be reviewed.

Research by Holmes (2012) notes that individual performance is boosted if project managers make them feel important, value the individual's work, discuss ways of performance improvement and encourage and appreciate any efforts made by each member. The performance dialogue between an individual team member and the project manager should be an ongoing process. This allows for free interactions and assists the project managers in identifying some of the performance areas which might need improvement and corrections. Basically, an individual is responsible for their performance as this has a bearing on the outcome of project results. Good performers are always in pursuit of improving their results and correcting their shortcomings.

Team performance

Team performance is when members work together to achieve the team's goals and objectives (Kirkman & Mathieu 2007; PMI 2013; Schwalbe 2014) and this involves collaboration and interaction among team members (Bedwell *et al.* 2009). Studies by Kirkman *et al.* (2004) define team performance as activities which allow team members to obtain and process information leading to the successful completion of the project. Team members have to work together to synchronise the team goals and objectives. The team goals have to be defined for the members to know the purpose of the team's existence. Team performance also requires the participation of members in agreeing with one another to make quality decisions (Paul & McDaniel 2004) and team members must then be fully satisfied with the accomplishment of the task or project results. Team performance is therefore improved when members completely trust one another, as lack of trust leads to failure (Armstrong 2007). The effective participation and cooperation of all team members boosts team morale and increases team performance. The performance of the team can only be achieved through the cooperation and participation of individual team members. Duarte (2002) and Wise (2013) suggest that coordination and collaboration ensure that the members build and maintain trust in one another and are best achieved through reliable performance, integrity and concern for one another. Hence, performance should be measured at both the team and individual levels.

Team performance measurement should be clearly defined for the team and individual members, for them to be fully aware of team expectations. Top performance in teams is measured in terms of what they have achieved in meeting the team goals and objectives, through coordination and collaboration as a team, rather than considering individual needs and preferences. A set of clear descriptive performance criteria should be outlined, indicating the priorities of individual and team expectations and desired results. The

performance standards should identify the required team results and what each team member must do to produce and support the team's final results. Team performance measurement should be an ongoing and continuous process to give team members an indication of the team's progress.

Team performance is easier to achieve when all the team members are involved and communicating at the same level (Schwalbe 2014). Communication among team members should ensure that all team members are fully aware of who is performing and responsible for what tasks (Duarte 2002; Gordon & Curlee 2011) and hence they have to be totally engaged and productive to meet the team goals. The next section focuses on project team performance.

Project team performance

The project team's formation is temporary in nature. Team members come together for a defined period to work on a specific task and the team is disbanded after the project is completed or discontinued for various reasons (Duarte 2002; Schwalbe 2014; Wise 2013). A project team consists of individuals working independently on a specific task or several teams working on the same project but subdivided into smaller teams and they can be involved in several departments or projects (Duarte 2002). For example, in a software development project, one team could be solely responsible for data analysis; another team may consist of software developers and another team could be responsible for designing the system. All the team members work under the leadership of a project manager who assigns individual project team members to different tasks. Project performance and productivity are fully dependent on the individual as well as team effort.

The project team performance goals should be specific and aim to achieve the level of desired objectives of the project. The project manager should ensure that the team members have an overall clear understanding of the project team goals and priorities. Project team members' performance should surpass that of individuals as they are expected to work as a unit. Group effort leads to team members being more effective than working as individuals on any given project task.

Project managers should first clarify the project goals and success criteria before identifying which performance metrics are to be used for the team (Deru & Torcellini 2005). They should ensure that the performance measurement is meaningful and understood by all team members. All team members should have a copy of or access to the performance measurement document. The organisational goals should be easily converted into the desired standards of performance for the project. Project managers should continually measure, monitor and review the progress of projects to ensure that they are within the defined scope, time and budget, and that the quality of the product meets customer and organisational expectations (PMI 2013; Schwalbe 2014). A project manager can assign scorecards to team members to assist them in monitoring their individual performance on a project (Deru & Torcellini 2005).

Project team performance, among other things, is based on team spirit among the project team members and the project team meeting its goals and completing projects successfully. Project teams, if managed and coordinated properly, should aim at improving project performance by improving the performance of individuals and teams.

Performance measures provide the necessary data and information for project managers to make informed decisions. Bannan (2005), Dvir, Sadeh and Malch-Pines (2006) and Yazici (2009) suggest that the two constructs which are used to measure project performance are project efficiency and project effectiveness. Project efficiency means that the project was completed within the project constraints. Project effectiveness suggests that the customers were satisfied, the project met customer expectations and overall the team is satisfied with the outcome. The performance measures 'give a snapshot of team performance capabilities and track whether actual performance is progressing well, getting better or worse over time' (Government Management Accountability and Performance 2009).

Virtual project team performance

The performance of virtual project teams is improved because there is a wider selection of professionals and skilled team members from a diverse pool, and not only from the local market (Goncalves 2005; Ludden & Ledwith 2014; Wise 2013). The general consensus is that the members of a virtual project team are usually from multiple companies and many of them multitask across different teams (Ludden & Ledwith 2014; Nader *et al.* 2009). Research findings by Ludden and Ledwith (2014) are that the temporal and geographic dispersion does not have a negative impact on the virtual project team's performance.

Performance is improved in both traditional and virtual project teams when team members have access to a variety of knowledge bases, electronic resources and information. Even though the virtual project team members are remote and there is very low frequency of face-to-face communication, the technology enables members to collaborate and work effectively (Gordon & Curlee 2011; Ludden & Ledwith 2014; Sridhar *et al.* 2007). Technology facilitates the effective sharing of information among team members and has a way of drawing members together. Sivunen (2008) and Wise (2013) point out that active project managers who communicate effectively and take the initiative enhance virtual project team members' collaboration and good team performance.

The literature has revealed that virtual project team performance consists of three levels, i.e. individual, team and project performance. These three levels form the basis of the coding frame and each level is further analysed to determine the performance criteria of virtual project teams.

Conceptual model

Although there are several factors that have a positive impact on the performance of virtual project teams, an analysis of the

literature suggests the following to be the performance factors to be implemented in virtual project teams: motivation and comfort of belonging to a team (individual performance), communication, trust, team cooperation, reliability of project information and social presence (team performance), good team leadership and project goals and objectives (team performance) (Dinsmore & Cabanis-Brewin 2014; Gordon & Curlee 2011; Ludden & Ledwith 2014; Rad & Levin 2006; Schwalbe 2014; Wise 2013). The analysis of the literature also suggests other factors, i.e. culture, organisational work environment, team size or membership, team values, team's performance reputation and personal behaviours, as some of the criteria which affect performance in both virtual and traditional teams (Dinsmore & Cabanis-Brewin 2014; Gordon & Curlee 2011; Ludden & Ledwith 2014; Omorede *et al.* 2013).

Figure 1 highlights the factors that contribute to the improvement of a virtual project team's performance.

Motivation of team member

Motivation is that level of excitement when one is working on a project activity at hand, or the drive which encourages team members to work in a virtual project team (Lurey & Raisinghani 2001; Sridhar *et al.* 2007). Peterson (2007) points out that motivation is internal to each team member, and encourages, inspires and stimulates individuals to accomplish their activities and goals. According to Lurey and Raisinghani (2001), performance level decreases when virtual project team members feel discouraged or challenged by the task at hand and improves when they are motivated. Motivation is one of the important factors as it affects team performance and productivity (Peterson 2007).

McGregor's Theory X assumes that team members are unsatisfied or dislike working and require constant supervision. Theory Y assumes that team members are self-motivated to

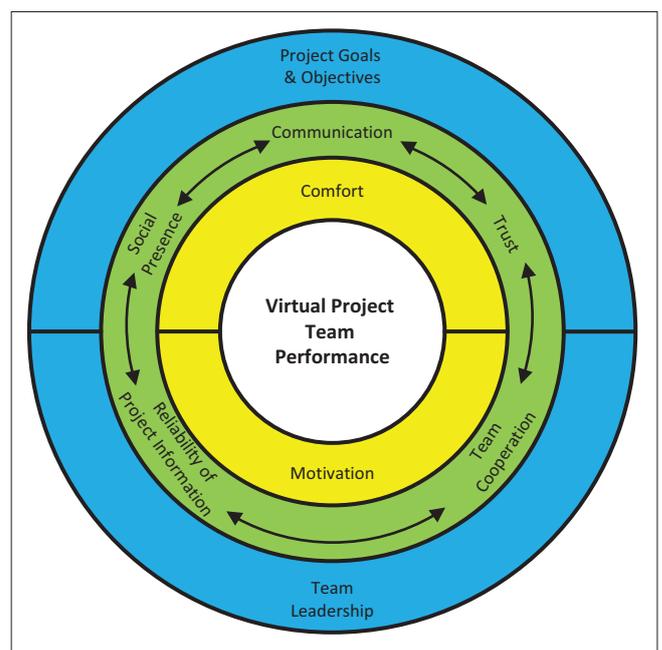


FIGURE 1: A conceptual model for improving performance in virtual project teams.

accomplish their project goals (Kerzner 2003). McClelland's affiliation motivation theory states that individual relationships are usually driven as team members are motivated to work, if the working environment is friendly and the members are willing to support project goals (Rad & Levin 2006; Schwalbe 2014). Herzberg's two-factor theory, known as the motivation-hygiene theory, explains hygiene factors as determining dissatisfaction among the team members and motivator factors as determining satisfaction. Maslow grouped the human needs into five categories where the lower needs are the physiological needs which take priority and dominate the behaviour of a human being, and the higher needs are self-actualisation needs where one develops into what a team member is capable of becoming (Anfara & Mertz 2006).

The literature indicates that an effective project manager motivates workers to take responsibility for their job performance and to produce superior results. Project managers should understand the importance of the individuality of team members, foster motivation and take the time to understand what motivates each team member (Peterson 2007; Rad & Levin 2006). Project managers should give rewards to well-performing and deserving team members, whilst motivation should be given to those who have become too slack in their performance, and positive attitudes towards project activities should be encouraged (Peterson 2007). The benefits of constantly monitoring and measuring performance in virtual project teams are that the project deliverables are improved and a wider adoption of the products is promoted (Deru & Torcellini 2005).

Comfort of belonging to a team

The comfort of team members has been identified as one of the benefits of working in a virtual environment. Sridhar *et al.* (2007) and Dinsmore and Cabanis-Brewin (2014) define comfort as an element which gives a team member a sense of ease of working in a virtual environment. Team members feel comfortable and enjoy working without being inconvenienced by distance, time or cultural challenges. Lurey and Raisinghani (2001) in their study built a model for measuring this comfort to benefit virtual project team members. They identified that once team members are in their comfort zone it is much easier for them to interact with one another. Team members' comfort level has been observed to increase team performance and effectiveness of virtual project teams.

Once the factors are in place that enable an individual virtual team member to perform, then the focus of attention moves to the factors that contribute to the virtual team's performance.

Communication

The rapid development of communication technologies has made it possible for people from different parts of the world to collaborate in virtual project teams. This development has created a global platform that allows team members to work together, compete, invest and share knowledge (Friedman 2005; Gordon & Curlee 2011; Ludden & Ledwith 2014).

According to Settle-Murphy (2013), when establishing the virtual project team, the use of communication technology should be the first consideration by project managers and not the last.

According to Iacono and Weisband (1997) communication is a social interaction and attention of two or more people. Communication is basically the transfer of information between a sender or receiver, and the sender or receiver could be either a person or device. The exchange of information among people could be through gestures, body language, songs or words. The information exchange using devices is by means of documents, videos, emails, blogs, forums, text messages, voice messages and other electronic devices.

Communication is the backbone of a project team's effectiveness and has indisputably played a pivotal role in virtual project teams which make use of technology to facilitate communication and coordinate tasks required to achieve the desired team goals and deliverables (Duarte & Snyder 2006; Gordon & Curlee 2011; Settle-Murphy 2013; Wise 2013). Performance in both traditional and virtual project teams is measured by how information is disseminated in a timely manner and appropriately generated, shared and stored for future use (Goncalves 2005; Schwalbe 2014; Wise 2013). The information should be accessible to all virtual project team members. Project managers in a virtual environment must be particularly sensitive to interpersonal communication and cultural dynamics among the team members (Dinsmore & Cabanis-Brewin 2014; Gordon & Curlee 2011; Lepsinger & DeRosa 2011). On the other hand, the virtual project team has the benefit of team members learning the cultures of other countries' team members and improving their relationships (Ludden & Ledwith 2014; Rad & Levin 2006). Project managers should monitor the communication among team members to avoid messages that could be construed negatively and that could have a negative impact on the team's performance. They need to communicate regularly with team members and keep them informed of the progress of the project at hand.

Project managers who communicate effectively and take the initiative to communicate with team members enhance team members' collaboration as well as the overall team performance, as pointed out by Sivunen (2008). In order to lead virtual project team members efficiently and for team members to perform effectively, the project manager should consistently communicate with virtual project team members and initiate discussions with them (Ludden & Ledwith 2014; Richardson *et al.* 2012).

How virtual project team members communicate with one another affects the overall team performance and outcome, as decisions can be made much easier and the flow of information and feedback is prompt (Duarte 2002; Settle-Murphy 2013; Wise 2013). The literature review established that to improve performance in virtual project teams, the quality, frequency, feedback and reliability of project information communicated have to be measured. Effective communication among team members leads to trust.

Trustworthiness

Trust has been identified as the foundation of interpersonal cooperation in organisations (McAllister 1995). It is considered to be a very critical component in virtual project teams mainly because the members are geographically dispersed and 'lack shared social-context and face-to-face interaction' which is considered by many researchers 'as irreplaceable for building trust and repairing shattered trust' (Gordon & Curlee 2011; Jarvenpaa & Leidner 1999; Rad & Levin 2006; Wise 2013). Young and Tseng (2008) define trust as a factor which may support or hinder the effectiveness of knowledge sharing in both traditional and virtual project teams.

Project managers of both virtual and traditional project teams need to support the team members in good and bad times by speaking positively about their performance in public, as well as the quality of the virtual project team's product. Negative comments from a project manager might destroy all the positive contributions from team members and also dampen the good team spirit and performance, and inadvertently endanger the project manager's trust in the members. The project manager and team members must ensure that their actions, behaviours or words are consistent with the team's defined values and expectations (Dinsmore & Cabanis-Brewin 2014; Duarte 2002; Wise 2013).

The team members should trust the project manager enough to be able to give feedback and guidance whenever possible. Team members who trust one another find it much easier to accept one another's ideas, share information openly and ultimately boost the team performance (Gordon & Curlee 2011; Schwalbe 2014; Wise 2013). The team members gain more confidence and trust based on the good track record of a project manager's success story of delivering projects on time and within budget and meeting the customer's expectations.

Trust among virtual project team members is vital as it enables the teams to perform effectively and efficiently. A lack of trust contributes towards teams' failure to complete desired goals (Gordon & Curlee 2011; Greiner & Metes 2005; Hansteen-Izora & Stone 2002). In a virtual project team, knowledge sharing is a very important aspect both to the project manager and team members, as it creates the foundation of trust. As a result, the perception of integrity complements the perception of performance among team members (Duarte 2002; Rad & Levin 2006; Wise 2013). Team members should be trusted to keep their word when they promise to do project-related tasks, as some projects have derailed because of a breakdown of trust (Wise 2013). Measurement of trust in virtual project teams depends on the level of the task and how members perform and complete the project despite being isolated by distance. This means that the higher the level of trust among team members, the better the team performance (Ba & Pavlou 2002; Rad & Levin 2006; Wise 2013). The level of trust is also based on how members are organised, creative and cooperative towards the assigned task (Gordon & Curlee 2011). Trust in virtual project teams improves with frequent communication and team cooperation.

Team cooperation

Team cooperation is a vital aspect of virtual project team performance. The study by Cohen and Bailey (1997) found that team cooperation is a vital factor for motivating the effectiveness of project teams and trust among team members. Balthazard, Potter and Warren (2004) state that team cooperation is how close virtual team members are to one another and their level of commitment to the team to work together to complete the assigned project activities and achieve the desired project goals.

When virtual project teams are formed, team cooperation is low. It improves over time and as virtual project team members interact and exchange project-related information (Chidambaram 1996; Wise 2013). Thereafter the bond among team members grows stronger. Team cooperativeness results in higher levels of team communication and performance. Balthazar *et al.* (2004) developed a model for measuring the effectiveness of virtual project team cooperation which was later used as a measure of virtual project team performance. Trust is the primary factor leading to team cooperativeness among team members and the team must be capable of managing and collaborating the project activities in a highly organised manner (Rad & Levin 2006; Wise 2013). The study by Driskell, Radtke and Salas (2003) established that performance in both normal and virtual project teams improves with team cooperation, but is most significant in virtual project teams as it has an impact on team commitment. Technological mediation also plays a vital role in team performance.

Reliability of project information

Reliability of project information is another factor that contributes to virtual project team performance. The information being communicated among the team members should be verifiable and consistent (Jarvenpaa & Leidner 1999; Ludden & Ledwith 2014). It should be free from error or bias from one member to another and should be an accurate representation of what it is intended to be (Gordon & Curlee 2011). Performance is improved when there is transparency in a virtual project team and all members have access to all the important information and documents. The usefulness of information aids as a performance improvement measure. This assists the team member in understanding the task at hand, what the project expectations are and how to obtain better results on the project. The reliability performance measure in projects ensures that the measurement is free from error.

Social presence

Social presence is 'the moment-by-moment awareness of the copresence of another sentient being accompanied by a sense of engagement with the other' (Biocca, Harms & Burgoon 2001:2). It is based on the team members' emotional closeness, mutual understanding and how they relate to one another at a social level. Audio, text messages and video conferencing

increase the experience of emotional closeness among virtual project team members. The social presence in a virtual project team gives the team members a feeling that they are in joint communicative interaction.

The project manager should clearly establish early enough the common language to be used by team members across the functional, cultural, organisational and geographic boundaries, and members should be able to communicate in the agreed-upon language (Koster 2010). It is critical for all members to be able to use present-day communication technology and have adequate technical competencies to perform their tasks well.

In virtual project teams, the process of improving trust among team members is usually through communication and connection of virtual project team members. The social interactions are vital for building trust among the team members and stakeholders. Most organisations make this process effective by allowing team members to engage in social networks that are project relevant. Some organisational intranets could be another valuable and efficient technique to bring team members together. This could be done by allowing personal details to be made available to the rest of the team members as a way of encouraging interaction among members by uploading employees' details, family photos, curriculum vitae, skills and hobbies, and anything of interest.

Virtual project team members improve their performance through the social desirability of the team members to make their team and leader look good. Team members should be open and have a positive attitude towards one another (Yammarino *et al.* 2005).

The five factors that contribute to the performance of the virtual project team are interdependent. Communication leads to trust. Trust leads to the sharing of information which in turn leads to a member's social presence. The team member's social presence also has a positive impact on trust which leads to improved communication.

Teams, however, function and perform within the context of a project.

Team leadership

Leading virtual project teams sets some expectations for project managers to be more skilled in various aspects and to discharge several responsibilities (Gordon & Curlee 2011; Kaboli, Tabari & Kaboli 2006; Settle-Murphy 2013). Virtual project team leadership is the most important factor that ensures high team performance because of execution of the project processes which ultimately lead to the success of the project team (Rad & Levin 2006; Wise 2013). Past experience on other successful projects gives the project manager an added advantage in that team members depend on him or her. The competence of a good project manager contributes to the trust the team members place in him or her, to be fair to all team members and to not show any favouritism (Settle-

Murphy 2013). It is also important for the project manager to seek and obtain the necessary resources required by the virtual project team members to assist with improving team performance.

Project managers should set goals, make project plans visible to all team members and be open to request changes (Jassawalla & Sashittal 2000; Wise 2013). They should stand up for their convictions and display integrity by doing the right things in the best interest of the team at all times (Duarte 2002; Rad & Levin 2006; Settle-Murphy 2013). Project managers should be effective leaders and be able to stick to the set team goals, the best practices of the organisation and the code of ethics.

Project managers need to be aware of the diversity and complexity of virtual project teams in terms of differences in their context as they have to deal with several diverse stakeholders, different infrastructures, different international languages, cultural values and political factors (Dinsmore & Cabanis-Brewin 2014; Koster 2010; Yazici 2009).

An effective project manager communicates with the team members effectively and takes into consideration their opinions without being biased. The success of a project depends on the project manager's leadership competencies and not on the technological tools. Project managers act as the catalyst between the team and individual members and should be aware of the team's feelings and be considerate (Goncalves 2005). When it comes to building and maintaining team cooperation, the same principles used in traditional leadership roles are equally effective for virtual project teams. The project managers should always lead by example and embrace the team members' interest first; in that way they win the team's confidence and trust.

Project goals and objectives

Project managers should have a clear vision of the project and effectively communicate the vision to the team with passion (Gordon & Curlee 2011; Kaboli *et al.* 2006). They must be able to develop the strategies and define ways of achieving them. Project managers carry the responsibility of selecting and motivating the right team, establishing the team goals and objectives, building trust among members and preparing the team members to participate positively in a virtual team project.

Team goals and objectives vary from one organisation to another based on the nature of the project requirements, urgency and sophistication of the project (Koelmans 2004), and these should be outlined in the project charter. Customers desire the projects to be delivered within the shortest time and at the lowest cost. Koster (2010) notes that commitment to the virtual project team goals can pose a challenge to members if projects have a lengthy duration. According to Cabrera, Collins and Salgado (2006), the project manager's integrity, competence, dutifulness and self-discipline result in team members doing what is expected of them to achieve the desired goals.

The team's needs and objectives must be clearly named and defined to make it easy for members to improve team performance (Gordon & Curlee 2011; Schwalbe 2014). The set goals should ultimately be the driving force towards improving the team performance. Ellis-Christensen (2003) points out that team members should focus mainly on the right project activities to accomplish and drive towards good project goals. The team should have a clearly defined purpose and team mission. Rad and Levin (2006) concur that the objectives and goals of the virtual project team should be established in a team charter in detail. The same objectives outlined in the team charter should be used as a basis for measuring and reviewing the individual or virtual team's success and performance. Project managers should clearly communicate the project goals and objectives to the team members.

Conclusion

This article focused on determining the factors that influence the performance of virtual project teams and determining the significant performance criteria. The qualitative content analysis of literature has also established that what is true in terms of performance assessment and measurement in traditional teams is also true for virtual project teams (Gibson & Cohen 2003). Performance measurements should be used as criteria for assessing the value and effectiveness of virtual project teams.

The main objectives of this research were achieved, namely defining the general individual performance, team performance, project team performance and virtual project team. Different levels of performance measurements were identified as individual performance, team performance and project team performance. The research further investigated how performance is measured in virtual project teams and the performance criteria for the virtual project teams were identified as leadership, trust, communication, team cooperation, reliability, motivation, comfort and social interaction.

Project managers can use the conceptual model in various ways, based on the needs of the organisation and the project itself. The first is to focus on each of the three performance levels and ensure that each level's performance criteria are in place and understood. The performance criteria must be aligned with the organisational vision and strategies. The second way of using the model is to understand what factors contribute to each performance level. If, for example, a project manager determines that the virtual team is not performing, then the reasons can be investigated. This investigation will reveal which factor is either not present or needs attention. The project manager can thus use the conceptual model to determine gaps in either the three performance levels or within the contributing factors. The conceptual model can be used in a holistic way to determine the overall performance of the virtual team, but each factor can be analysed individually to determine the impact on the overall performance.

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Competing interests

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Authors' contributions

S.D. was responsible for the model design and C.M. was responsible for the final article.

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