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Team Dynamics in Virtual, Partially Distributed Teams: Optimal Role Fulfillment

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ABSTRACT

In this study, we explored team roles in virtual, partially distributed teams, or vPDTs (teams with at least one co-located subgroup and at least two subgroups that are geographically dispersed but that collaborate virtually). Past research on virtual teams emphasizes the importance of team dynamics. We argue that the following three roles are particularly important for high functioning virtual teams: Project Coordinator, Implementer and Completer-Finisher. We hypothesized that the highest performing vPDTs will have 1) a single Project Coordinator for each subgroup, 2) multiple Implementers within the team, and 3) fewer Completer-Finishers within the team. A sample of 28 vPDTs with members working on two different continents provides support for the second and third hypothesized relationships, but not the first.

Keywords: Partially distributed teams, virtual, roles

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1. Introduction

It is now quite commonplace for teams to be geographically dispersed. With a wide variety of communication options available, dispersed teams are increasingly common in both large and small organizations (Maznevski & Chudoba, 2000; Hertel, Geister, & Konradt, 2005, O'Leary & Cummings, 2007). These teams can take a variety of forms, from a team that works together regularly to an ad hoc team formed for a specific project, and from teams whose members are spread across the globe to teams whose members are located in the same building. Thus far, most research focus has been on methods to enhance the effectiveness of fully virtual teams (e.g. Fransen, Kirschner and Erkens, 2011; Haines, 2014), or on the role of trust (e.g. Peñarroja et al., 2015) or other moderators such as collaborative behaviors (e.g. Serçe et al., 2011) in building virtual team effectiveness.

One particular and increasingly important form of virtual teams is the partially distributed team that interacts both virtually and face-to-face (vPDT). A vPDT is a hybrid of virtual and co-located face-to-face teams that has at least one co-located subgroup and at least two geographically-dispersed subgroups (Huang & Ocker, 2006; Plotnick, Hiltz, Ocker, & Rosson, 2008); in other words, vPDTs consist of some members being co-located, while others are geographically dispersed. Virtual PDTs are utilized in all types of fields, including software development (Plotnick et al., 2008), education (Ocker, Huang, Benbunan-Fitch, & Hiltz, 2009), and military settings (Yammarino, Mumford, Connelly, & Dionne, 2010). Our particular focus is on the form and effects of team role composition on team performance in informal, temporally and geographically dispersed vPDTs that have a limited life cycle.

In order to understand how managerial teams work most effectively based on team role composition, Belbin (1981) developed eight (and later revised to nine) roles that he indicated were critical to high performing teams. See Table 1 for a description of these most commonly

researched eight roles. While there has been some criticism about the discriminant validity of these team roles, they are widely used in research and in the workforce to understand how team composition is related to high-performing teams (Aritzeta, Swailes & Senior, 2007; Belbin, 2004, 2010; Blenkinsop & Maddison, 2007; Fisher, MacRosson, & Wong, 1998; Senior, 1998). Although Belbin's team roles have mostly been used with management teams, arguments have been made that it can be used 'irrespective of the level of the organization' (Fisher, Hunter, & MacRosson, 2002, p.15). Thus, although we do not test the validity of Belbin's team roles in this particular setting, we adopt this framework as a starting point to add structure to our understanding of team roles in vPDTs, our first goal of this study.

The second goal of the study is to identify if specific combinations of team roles within our virtual PDTs are associated with better outcomes compared to other combinations.

Insert Table 1 about here

Leadership is widely recognized as a key factor in team effectiveness. Virtual teams generally do have leadership, but the leadership roles within these teams often take a different form from that of traditional teams. For example, leaders of virtual teams tend to distinguish themselves in logistical coordination rather than by providing expertise (Yoo & Alavi, 2004), and behaviors generally adopted by the traditional leader are often distributed amongst the team (Yoo & Alavi, 2004). When there is no single leader, the roles that individuals adopt in teams may be more critical to a team's performance since certain tasks and roles must be fulfilled to reach desired outcomes (Delery & Shaw, 2001). For this reason, in virtual teams

working on a short-duration task, it is important to understand the roles that all team members adopt in order to perform at high standards.

The structure of vPDTs has the potential to create some unique challenges. Hinds and Bailey (2003) explored how the geographical dispersion faultline can incite team-level conflict in distributed teams, and Jarvenpaa, Knoll, and Leidner (1998) acknowledged the significance of trust in global virtual teams. Issues such as conflict and trust are likely to be further impacted by the in-group/out-group effect that is exacerbated in vPDT settings (Huang & Ocker, 2006). So what is particularly distinguishing about vPDT settings? Prior research has observed that distributed teams have the tendency to establish subgroup identities based on their location due to the increased interaction and information sharing that occurs (Bos et al. 2004; Armstrong & Cole, 2002; Cramton, 2002; Buchan, Croson, & Dawes, 2002). As a result, local subgroup members may tend to view other local subgroup members much more favorably than distant "other" subgroup members (Webster & Wong, 2008). The merging of computer-mediated communication (CMC) and co-presence also raises interesting issues from the perspective of the CMC literature that has traditionally relied on anonymity and reduced social cues (but not identity) to explain media-specific effects (Joinson, 2003). Therefore, we assert that virtual PDTs, in contrast with more general virtual teams, may likely have some unique characteristics that warrant investigation.

What we do not yet know, and thus investigate in this study, is the more effective *form* that the vPDT ought to take and the critical roles to be fulfilled by the team. Because vPDTs are a hybrid of virtual and face-to-face interaction, we suspect that roles that may be important in other sorts of teams are not as important here, but rather may vary to better meet functional needs in the particular context of a vPDT. In particular, we wish to investigate the more effective configuration of team members that fulfill the various roles in a vPDT with a limited life cycle. To do so, we first discuss virtual leadership and Belbin's team role research. Next,

based on research about vPDTs, we develop hypotheses about the optimal role composition in vPDTs working on a short-term project for driving team performance. We then test these hypotheses with data from a study of 28 vPDTs located in the United States and the United Kingdom.

2. Theoretical Development

2.1. Leadership in Virtual Teams

One of the roles generally considered important in teams is leadership. Leadership effectiveness is a topic that has been explored to a great extent in traditional environments (e.g., Fleishman et al., 1991; House & Mitchell, 1974; Stogdill, 1948); however, with some noteworthy exceptions (Jarvenpaa et al., 1998; Huang et al., 2010; Kayworth & Leidner 2002; Malhotra, Majchrzak, & Rosen, 2007, Hertel et al., 2005), comparatively little has been done to explore what effective leadership looks like in a virtual team, with much of the literature assuming that online interaction leads to greater identification with a social identity, and increasingly prototypical behavior (e.g. Postmes et al., 2000). For that matter, little has been done to define what form leadership in general takes in a virtual team. This may be because there are many different types of virtual settings (Bell & Kozlowski, 2002; O'Leary & Mortensen, 2010). For example, there might be groups that meet sometimes face-to-face, but other times virtually. There may be other groups that have never met face-to-face and only interact virtually. Because there is not just one type of virtual team, describing a best approach for effective virtual team leadership poses a challenge. Since our interest here is in the vPDT with a limited life cycle, we look to the research on virtual teams as well as research conducted on Belbin's team roles.

Bell and Kozlowski (2002) theorized that leadership in virtual teams must serve two basic functions: team task management and team development. However, they also noted that in the most prototypical virtual teams, task management-related leadership behaviors are the

most important behaviors for team effectiveness. They describe prototypical virtual teams as those that are temporally dispersed, have a discrete (limited) lifecycle, and span organizational and cultural boundaries. Cogliser, Gardner, Gavin, and Broberg (2012) found that task-oriented leadership was the main driver of virtual team performance. Similarly, task-oriented behavior on the part of the team, rather than any sort of team development behavior, was found to be particularly important by Jarvenpaa et al. (1998) in a short-duration virtual task. Although attempts have been made to pair up Belbin's team roles with task and relationship roles, thus far, it has unfortunately proven to be an unacceptable model fit (Fisher, Hunter, & MacRosson, 2001). Thus, while we know that task-oriented behavior appears to be important, the form (the roles and behaviors) of team members remains open to investigation.

2.2. Understanding Virtual Teams

2.2.1. Team Roles

The virtual teams under investigation in this study can be categorized more specifically as a task force/group. Task groups are more multi-skilled and temporary (ad hoc), quickly forming to address a problem and then quickly adjourning afterwards. Thus, we consider the relevant literature on team roles in other ad hoc, short term task groups.

None of the Belbin roles fit the profile of leadership in this short-duration task with a vPDT. We wanted to capture the activities of organizing the task rather than engaging in any sort of team building or development because of the nature of this task. The *Project Coordinator* is not a role that was considered in Belbin's role classification, but Belbin did include several leadership-oriented roles such as Coordinator and Shaper. These roles include a social "team development" component of leadership that was not entirely relevant in this short-term team project. Belbin's roles were conceptualized with the idea of traditional teams. Because of this, we considered the role of Project Coordinator important to investigate.

The Project Coordinator is the closest to the "traditional" concept of directive leadership in which the leader(s) takes initiative and ownership of the project, sets initial structure, and keeps ideas moving through the process. This role was based on a study by Balthazard, Waldman, and Warren (2009) that described how leadership can emerge in a virtual team when a would-be leader displays expected leadership behavior. Their findings, which analyzed 4-5 member virtual and F2F teams comprised of undergraduate business students, suggested that the amount, complexity, and frequency of written communication in a virtual team were important in determining leadership. In a study of senior government executives who were working in a virtual team-training environment, Yoo and Alavi (2004) provided some evidence of the importance of written communication by analyzing email messages written by emergent leaders and non-leaders in a US federal government agency. Results indicated that emergent leaders sent more and longer email messages than non-leaders. Not only were these messages longer, they were more task focused. They found that leaders in ad hoc virtual teams adopted the roles of initiator, scheduler, and integrator.

The roles of initiator and scheduler map to our concept of a Project Coordinator because they reflect the activities of taking initiative and providing direction. The initiator is seen as someone who first communicates with the team and initiates structure-oriented behaviors, such as suggesting the first tasks for the group and suggesting how or when the group ought to communicate. Once there is initial agreement about how the group will function, the scheduler engages in activities such as setting up meetings and on-going communications with team members. Similarly, in a study of college seniors in a virtual class working in ad hoc task groups of 5-6 individuals, Misiolek and Heckman (2005) identified a single procedural or task coordination role in which a person schedules the work and creates processes for the work to be completed. Likewise, in another study of undergraduate students assigned to work on a semester-long project in 4-5 member virtual teams across three

universities, Carte, Chidambaram, and Becker (2006) identified a Monitor role in which the individual distributed information and ideas and provided continuity and stability by owning the process. Distributed groups may exert extra effort in sharing information because of the perceived disadvantage that they have. In fact interactions have been found to be higher among mixed teams, compared to collocated teams (McLeod, 2013). Therefore it is particularly important to have a Project Coordinator that can guide and structure these frequent interactions. Thus, the role of Project Coordinator is marked by taking initiative, coordinating tasks, and facilitating information flow. Note that we have not included team development activities in this description due to the short duration of the task (as previously mentioned).

A few studies have identified key team roles besides a Project Coordinator role that, when fulfilled, are associated with strong performance outcomes in virtual teams. In their study of university students, Carte, Chidambaram, and Becker (2006) identified a Producer role in which the individual seeks closure, motivates goal-oriented tasks, and takes responsibility for task completion. Given the focus of wikis in this study, we were also interested in how team roles were influenced by wiki use. In a study of corporate wiki users, Majchrzak et al. (2006) identified two key roles: Adders introduced new content to the wiki and Synthesizers focused on integrating and reorganizing content. Researchers investigating a virtual class of college seniors identified substantive task contribution roles as those that actually accomplish the team's tasks including idea generation, evaluation, integration, and synthesis (Misiolek & Heckman, 2005).

While the specific behaviors for each role vary according to the particular study, there appears to be a good deal of overlap and, to some degree, consensus about the roles. For this reason, although we evaluate the representation of each of Belbin's roles, we focus our hypotheses on the *Implementer* and *Completer-Finisher* roles which behaviorally map onto team roles discussed in prior research on virtual teams. We describe each of these roles

(Implementer and Completer-Finisher) in sections 2.5 and 2.6 along with supporting research. Table 2 summarizes this research under the relevant role headings.

Insert Table 2 about here

2.2.2. Belbin Psychometric Qualities

Studies that investigate the psychometric qualities of the Belbin roles have been conducted with mixed results. Poor reliability and poor convergent and discriminant validity have been reported for the self-perception inventory (SPI) (Broucek & Randell, 1996; Fisher, MacRosson, & Sharp, 1996; Furnham, Steele, & Pendleton, 1993). Aritzeta, Swailes, and Senior (2007) found adequate convergent validity for the SPI, but found strong associations and cross-loadings between some of the team roles. They did find substantial evidence for construct validity of the model when considering perceptions of self and others. Because of this, various configurations of these roles and ways of assessing roles have been established.

Over time, these roles have undergone additions, reframing, and renaming. For example, Belbin's roles started out with eight (Belbin, 1993) and later increased to nine (Belbin, 2010). These personality-based roles are clustered around action-oriented roles, people-oriented roles, and thinking/problem-solving-oriented roles. Interestingly, four of Belbin's eight roles seem to correspond to the NEO-PI-R five factors personality (Big 5) (Costa & McCrae, 1985, 1989, 1992): Resource Investigator with Extraversion, Plant with Openness, Team worker with Agreeableness, and Shaper with Neuroticism (Fisher, et al., 2001). Turel and Zhang (2010) found evidence that virtual team personality composition was important for team performance, and Cogliser et al. (2012) found that personality-driven (particularly agreeableness) task-oriented leadership lead to higher team performance. Given the robust individual level relationship between conscientiousness and performance (Barrick &

Mount, 1991), we surmised that conscientiousness might account for variance explained beyond emergent leadership and team roles.

2.2.3. Belbin Role Assessment

There are three modes of Belbin role assessment that are described in the literature. First, there is the Observer Assessment Sheet, which is a peer-rater checklist with 72 adjectives filled out by people who know the individual (4 teammates) (Belbin, 2014). Next there is the Self-Perception Inventory survey consisting of eight sentences describing a specific situation, followed by 10 choices of behavior in that situation. Nine reflect the target team role and one is socially desirable. Respondents then divide 10 points between these choices. Belbin has stated that this is insufficient when used alone (Belbin, 2004). Lastly, there is the Belbin behavior checklist developed by Fisher et al. (2001). This checklist has also been used by Davies and Kanaki (2006) to understand interpersonal characteristics associated with team roles. In this study, the Belbin behavior checklist was used to determine team role styles because the other two modes of assessment were not appropriate. The Observer Assessment would not be appropriate because teammates in different locations did not know each other well enough to rate one another. The Self-Perception Inventory has been shown to be unreliable when used on its own and is better when used with the Observer Assessment Sheet. Therefore, we used the Belbin behavior checklist to assess team roles for this study. See Table 3 for roles and descriptions. For reference, in older versions of Belbin's roles, the Implementer role was called Company Worker.

Prior research has demonstrated that not all roles are equally common. For example, in a study of UK Ministry of Defense managers, nearly half were Company Workers, but Completer-Finishers and Plants were underrepresented. In fact, half of the respondents scored these lowest (Blenkinsop & Maddison, 2007). In contrast, the most frequently occurring team roles among a study of 352 junior and middle managers are Implementer, Completer-Finisher,

and Specialist. The most frequently occurring roles for a study of 46 full time management students are Team Worker and Completer-Finisher (Senior, 1998).

While Belbin originally indicated that a balance of all eight roles was important for a team to function at a high level, later work has indicated that these eight roles are not distinct and some of these roles may be paired together instead. Under this role pairings classification, Implementer and Completer-Finisher are considered managers/workers (Belbin, 1981). To further investigate this, Senior (1998) looked at the factor structure of Belbin's roles. The results indicated that there were at most seven roles and perhaps only six. In this work, Senior described the Implementer and Completer-Finisher roles as "doing" roles. We argue that these "doing" roles are easier and most appropriate to observe through a wiki dialogue such as the one used in the current study. Even though the Shaper role could be considered, along with Implementer and Completer-Finisher, to be action oriented roles, fulfillment of this role was too infrequent to consider in our analysis. This is likely because the Shaper role includes a team development component, which was not a focal point for the team in such a short duration task. According to the lifecycle model presented by Hertel et al. (2005), team development is the fourth phase that virtual teams progress through. Jarvenpaa et al. (1998) investigated temporary teams working together on an eight-week project and found very little evidence of teams reaching this phase.

It can be surmised that there is less of a need for leadership roles like Coordinators and Shapers, and thinking roles like Plants and Monitor Evaluators, than the doing roles like Implementers and Completer-Finishers (Senior, 1998). We anticipate that this would be particularly true in a short term, virtual task, where "doing" is of the essence. Although all of Belbin's roles were rated in our study, nearly all participants scored as Team Worker and the numbers of individuals fulfilling many of the other roles were too small to include in our data analysis. In fact, the Implementer and Completer-Finisher roles were the only two roles

(besides the Team Worker role which nearly everyone fulfilled and thus allowed no comparison between high and low performing teams) that were occupied on a regular basis in this study. Thus, Implementer and Completer-Finisher were used in the data analysis for this study.

Insert Table 3 about here

2.3. Subgroups

Given that this paper focuses on partially distributed teams, we explore the impact that the subgroups literature has on our study. Subgroups can be defined as a "subset of team members that are each characterized by a unique form or degree of interdependence" (Carton & Cummings, 2012, p. 441). In our case, the key degree of interdependence is the geographical dispersion between the two subgroups of each vPDT. Carton and Cummings (2012) proposed that subgroups can be characterized by three distinct factors: identity, resources, and knowledge. The identity and knowledge-based distinctions are particularly relevant for our vPDTs as these distinctions can inform some of the implications discussed later on in this paper.

The geographical and cultural variations within each vPDT reinforce the identity-based subgroup distinction (Cramton & Hinds, 2005). This is supported by social identity theory (Tajfel & Turner, 1986), which suggests that subgroups are likely to form when the members share a common identity (but see Postmes et al., 2000, in terms of the impact of CMC on social identity). Furthermore, the cultural similarity within each collocated subgroup may help

mitigate process losses within the subgroup, but could have an opposing effect across subgroups.

The knowledge-based subgroup distinction suggests that the diversity in knowledge content, information processing, and perspectives may also influence vPDT effectiveness. While having this distinction can be beneficial in that collaboration between subgroups can result in more creative problem-solving outcomes (Mannix & Neale, 2005), subgroup members may be more likely to gravitate to other subgroup members due to the common ground that exists within the subgroup (Hertzum, 2008).

Working within subgroups can be a challenge because members must balance the duality of managing the internal dependencies and aforementioned subgroup distinctions that exist within each subgroup, while adhering to the common goal of the entire work team (Kozlowski & Bell, 2003). For instance, in teams with geographically-based subgroups, O'Leary and Mortensen (2010) found that members had weaker identification with the superordinate team and also had more coordination problems. In other research that investigates how subgroups affect distributed collaboration, Cramton and Hinds (2005) identified factors that are likely to promote (ethnocentric mentality) as well as mitigate (cross-national intergroup learning) fracturing between subgroups of internationally distributed teams. While the subgroup literature indicates that it might be more challenging for seamless cohesion and collaboration to occur within vPDTs, employing social categorization to increase the salience of the superordinate group is an effective way to mitigate these challenges (Hornsey & Hogg, 2000).

In their study comparing traditional and virtual teams, Webster and Wong (2008) noted that co-located subgroup members in vPDTs reported more favorable perceptions of their fellow subgroup members than of the distant members from the other subgroup. Similarly, Bos et al. (2006) referenced what they called "collocation blindness" in which individuals tended to

favor members of their own subgroup, even when they knew that a member of the other sub-group had greater relevant expertise. Ocker et al. (2011) described three different characteristics that tend to exacerbate this so-called "in-group" effect. The characteristics – all of which are common to temporally dispersed vPDTs – include geographic distance, temporal distance, and cultural distance (including both organizational and national culture). As the distance increases in each of the categories, so too does the preference for one's own in-group.

2.4. Project Coordinator

One way to mitigate this in-group effect would be to have a Project Coordinator in each subgroup location. Although the in-group effect itself would not likely diminish, its negative effects could be reduced as each subgroup's Project Coordinator could represent his or her respective subgroup's interests in deciding what goals to pursue and how to do the work. In effect, although the in-group effect may remain, "out-group" discrimination effects would be mitigated with each subgroup having a Project Coordinator with power to influence the team's work. For the Project Coordinator role, we surmise that a highly effective form will be one specific Project Coordinator for each subgroup location. Traditional teams adopt a more conventional working schedule, whereas virtual teams, given their geographic and temporal dispersion, are able to adopt a more variable working pattern. As a result of this working style, it is more appropriate for multiple individuals to have decision-making power than for one individual to have authority or decision making power. Moreover, multiple individuals with decision-making power within the same subgroup may also be detrimental to the team's success. Thus, we propose the following hypothesis:

H1a: In partially distributed teams, teams with a Project Coordinator in each subgroup location will outperform teams with a single overall Project Coordinator.

H1b: In partially distributed teams, teams with a Project Coordinator in each subgroup will outperform those with more than one Project Coordinator in each subgroup location.

2.5. Implementer

According to the Belbin checklist, the Implementer role contributes to team functioning by turning "ideas into actions" and organizing "work that needs to be done" (Belbin, 2014). In a study of corporate wiki users, Majchrzak et al. (2006) described the critical role of wiki Adders as those who added or suggested new content and ideas. Thus, similar to the role of Implementer, this role involves proactive effort to suggest, evaluate, refine, and execute new ideas, and not simply compliant execution of another's orders.

We anticipate that having multiple Implementers would be helpful in a short-duration virtual task. In knowledge work, ideas from multiple people are necessary to generate a creative idea when working interdependently on a task. In fact, a study of high-tech research and development processes concluded that flow, creativity, and shared leadership were linked (Pearce, 2004). Virtual PDTs are typically formed for knowledge work, as other types of work (e.g., building a tangible product) would be much more efficient with a co-located face-to-face team. A study by Sosa (2011) found that social ties that transmit a broad set of knowledge domains facilitate creative idea generation if exchanges are frequently occurring, as is often the case in teams with a limited life cycle. Further, a study by Bakker, Boros, Kenis, and Oerlemans (2013) investigated the role of time frame and dynamics in creative project teams. In their experiment, 267 managers were assigned to creative project teams with different time frames for their projects. Their findings indicate that teams presented with a shorter time frame focused on the present, were less immersed in their task, and were more focused on getting the work done and reaching the clearly visible end point. They also tended to rely on heuristic

information processing. All this indicates a lack of depth of involvement in projects with a

shorter duration. When there is less depth of involvement, more Implementers would likely be

needed in order to fill in the information and expertise required to develop a strong project.

Finally, evidence suggests that communication in temporary teams tends to be primarily task

focused (Jarvenpaa et al., 1998). These occurrences are not necessarily confined to a particular

subgroup, nor do they necessarily require exchanges across sub-groups. For the Implementer

role, we surmise that the optimal form will be several Implementers on the team. Thus:

H2: In partially distributed teams, teams with more members fulfilling the Implementer

role perform better than teams with fewer members fulfilling the Implementer role.

2.6. Completer-Finisher

The Completer-Finisher role contributes to team efforts through a painstaking attention

to detail and a conscientious effort to identify and address errors (Belbin, 2014). Studies of

virtual teams have identified this role as being important to high performance levels. Yoo and

Alavi's (2004) study described an important team role as one who compiled others' work,

edited it, and served as the "final checkpoint" before deliverables were submitted. This

person(s) collects and combines others' work into a coherent deliverable with a careful

attention to detail. Likewise, Misiolek and Heckman (2005) identified integration and synthesis

of individual teamwork as a key role. Majchrzak et al. (2006) found that users who synthesize

others' work for task completion were critical to success. Finally, Carte et al. (2006) identified

a role in virtual teams in which leader(s) take responsibility for task completion by ensuring

that team members meet goals and by bringing closure to the teams. Thus, the Completer-

Finisher summarizes and refines the work of Implementers into a polished and coherent

deliverable.

Research on project management indicates that leaders require different skill sets across the planning and implementation phases of projects (Gomes, Yasin, & Small, 2012). This research of public sector project managers showed that organizational and technical skills were important during project planning, and managerial, leadership, and people skills were more important during implementation. Certain stages of a project require input from many people, while other stages of a project require immense coordination and management of ideas. This pattern was observed in the study of temporary teams by Jarvenpaa et al. (1998). In this study, participants stepped into roles as the need arose. These roles tended to be action-oriented such as organizing, writing code, etc. There was generally only one person organizing work at a time rather than multiple individuals. This was also observed in a study conducted with a project team designing and implementing a large IT system, where researchers investigated the processes of integrating distributed knowledge (Newell, Tansley, & Huang, 2004). We surmise that the optimal form will be fewer Completer-Finishers for the entire team.

H3: In partially distributed teams, teams with fewer members fulfilling the Completer-Finisher role have higher levels of performance than teams with more members fulfilling the Completer-Finisher role.

Insert Figure 1 about here

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3. Methodology

3.1. Sample

Consistent with prior early-stage research on virtual teams (e.g., Carte et al., 2006; Cogliser et al., 2012; Ocker et al., 2011), we studied the interactions among members (n = 152) of vPDTs (n = 28) organized for an undergraduate business class project. The team members were geographically dispersed between two universities (one in the US and one in the UK) in order to encourage virtual communications. First, the course faculty members formed teams of approximately six students. Students were placed into teams with roughly three UK students in a Human Resource Management class and three US students in an Organizational Behavior class (13 teams had 6 members, 14 teams had five members, and one team had 4 members). Our sample was made up of undergraduate students, and for most students this was their first introduction to Human Resources or Organizational Behavior topics. Although all students participated in the wiki to write the coursework paper (see below), only 57.9% of students responded to the optional study survey questions. Thus, we are unable to provide complete demographic information, but informal observation confirms that the sample represented a "typical" undergraduate sample (i.e., roughly split between women and men, average age of around 20 years old, and limited work experience).

3.2. Project Task

For the project, students were tasked with providing a comprehensive solution to a manufacturing case. The case explored the challenges of retaining highly-skilled yet underpaid affectively-committed workers within an established multinational company during a period of economic uncertainty. The case observed that despite the slow economy and the decline in work levels, the ardent owner of the company expects to recover and has been exploring new alliances. Student teams needed to identify Organizational Behavior theories and Human Resource practices that are important in diagnosing the problem as well as provide any necessary customization of solutions given the multinational status of the company.

The project task was a significant component of the students' final grade and thus, was largely related to their course of study. Subsequently, students were very motivated to perform the task to the best of their abilities. This aligns with DeSanctis' (1988) suggestion that when students are engaged in relevant tasks that align with their experiences (for example, solving a complex case for an OB/HR class), concerns about using student respondents and generalizing to traditional work teams should be lessened (Carte et al., 2006).

3.3. Procedures

Students were asked to complete their written assignment for the class using a wiki to work together, share ideas, and post work. Students had approximately one month to complete this project. Participation in the assignment was a requisite of completing the course. No instructions were provided about leadership or team functioning, except that all team-wide communication was to take place on a team wiki. The teams were allowed to self-determine how they would structure the task and complete the assignment. Faculty were available to discuss the project, concerns, etc. with students at the beginning and end of each lecture. At the beginning of the assignment, teams were asked to develop and sign a team contract stating their requirements and expectations of team members. Team members also determined grade assignments in this document (i.e., all team members receive the same mark, or marks would be dependent upon team member reported contribution. Interestingly all teams determined that all team members should receive the same mark). In addition, co-located sub-group members were asked to record a short video of their own face-to-face conversations to share with the other sub-group. The purpose of this video was so the other subgroup could put faces and personalities with the wiki posts they read. Participation in the assignment of writing a paper was a requirement of the course; however, completing a follow-up survey to measure the covariate battery and additional questions was not required. Extra credit was given to those who completed these additional individual differences measures.

3.4. Measures

Covariates were included that were thought to have an effect on team roles, emergence of leadership, or task performance. The covariate battery included a Big 5 personality measure and questions of who emerged as the leader in the team (if someone indeed did), and other alternate forms of communication that were used besides the wiki. Objective measures were assessed including word counts and frequency of interaction (e.g. postings, responses to a post, page creations).

Team roles were assessed using an analysis of all the wiki transcripts by three trained raters using the Belbin behavior checklist. Examples of each role may be found in the Appendices. Agreeableness and conscientiousness, as part of the Big 5 measure, were assessed by the voluntary post-activity survey because they have been found to have an effect on leadership in virtual teams. Voluntary team member ratings had a response rate of 57.9% (n = 88), and all teams except one had at least three respondents per team. All variables were assessed at the team level of analysis.

3.5. Rater training

First the raters read descriptions of and discussed the roles that they would be rating to ensure a shared understanding of each of the items. Next each rater assessed the roles displayed by two teams after reading through all the wiki pages related to that team. Wiki pages typically had 25-50 posts per team, and post themselves ranged in length from 50-500 words. Raters recorded their perceptions of the role being expressed for each individual on a scale of 1 to 5. Ratings were provided based on the overall impression toward each individual on the team. Raters began by reading through all passages written by one individual and then rated them for all of Belbin's roles using the role descriptions and the revised Belbin behavior checklist (Fisher et al., 2001). They then moved through each team member following the same process. Passages were presented in context so the rater could see the reaction of others. Raters were

blind to the performance of the teams. After rating two team members independently, raters gathered to compare scores and perceptions. There was a high convergence in perceptions, thus raters continued to rate 10% of all individuals in the sample. The interclass correlation coefficient (ICC) obtained in this 10% sample was acceptable at an appropriate level (ICC = .75)

3.6. Project Coordinator Ratings

Rater perceptions of Project Coordinator leadership was assessed by raters and student participants. The results were highly correlated at .78 ($p < .01$). After reading through the wiki material for each individual, raters indicated to what extent that person took on leadership characteristics in terms of directing or influencing the team. Raters recorded frequency and length of postings as evidence of "traditional" leadership as reflected in the Project Coordinator role. The number of unique persons holding a Project Coordinator role was determined by student ratings indicating whom they thought the leader was on their team. Each person that was indicated as a leader by at least one team member was included in the sum total number of leaders per team. Student participant perceptions of who adopted leadership roles were used for data analysis.

3.7. Performance

The dependent variable of performance was assessed by the overall team grade on the project as assigned by the instructors of the courses. Grades were based on the standard UK grading scale and were all completed by one individual and checked for agreement by a second individual. In addition to this, an external examiner was engaged to evaluate the equity of marking for this assessment. Grades on this project ranged from 38 to 72. On a US grading scale this would equate to ranging from an F to an A.

3.8. Big 5

Participants completed the Big Five Index (BFI) measure of personality (John,

Donahue, & Kentle, 1991; John, Naumann, & Soto, 2008) to assess the personality traits of

neuroticism, extroversion, openness, agreeableness, and conscientiousness. In this measure,

participants are presented with 44 items such as "I see myself as someone who is original,

comes up with new ideas." Participants rated these items on a 1-5 Likert scale. Validity

evidence can be found in Rammstedt and John (2007). The reliabilities of this assessment using

Cronbach's alpha were neuroticism $\alpha = .81$, extroversion $\alpha = .87$, openness $\alpha = .74$,

agreeableness $\alpha = .75$, and conscientiousness $\alpha = .67$. Agreeableness and conscientiousness

were then aggregated to the team level of analysis. In previous studies, agreeableness and

conscientiousness were found to be positively related to task and social dimensions of leader

emergence, respectively. It was also found that aggregated task-oriented emergent leadership

behaviors predicted virtual team performance (Cogliser et al., 2012). For these reasons, we

included the BFI in our study.

3.9. Analysis

Given that our primary focus was on team-level processes (role composition of the

teams and individuals' enactment of those roles), we tested the model at the team level of

analysis using stepwise regression. Next, we briefly explain the rationale and process for

determining team level variables, and we do so by referring to Kozlowski and Klein's (2000)

typology of team level variable emergence.

First, team-level agreeableness and conscientiousness (covariates) were computed by

averaging individual-level assessments at the team level of analysis. This type of level shift is

best represented by a pooled unconstrained composition variable (Kozlowski & Klein, 2000) in

which the overall team-level variable may be influenced by just one or two individuals (for

example, even one highly agreeable or conscientious person may drive the overall team

conscientiousness). For agreeableness and conscientiousness, within group variation is

considered to be an error (please note that we use the average levels of agreeableness and conscientiousness in our analysis, but using aggregate variables yields essentially the same results).

Next, we created dummy variables to reflect the number of Project Coordinators present on the team. We wanted to look at the number of Project Coordinators as a categorical variable because we did not want to assume that three leaders were better than two, for instance. Because a plurality of full teams had two Project Coordinators, we used this as our comparison. It is important to note that each and every team with two Project Coordinators was configured such that there was one Project Coordinator in each subgroup. Thus, we created two dummy variables. The first dummy variable compared groups with one Project Coordinator to those with two Project Coordinators. The second dummy variable compared groups with three Project Coordinators to those with two Project Coordinators.

The variables of defined roles of Implementers and Completer-Finishers represent a variance-based compilation model (Kozlowski & Klein, 2000) because that model reflects the dispersion of the extent to which a particular individual fulfills these respective roles. Thus, we are interested in the pattern of the makeup of the team. We assessed the extent to which the roles of Implementer and Completer-Finisher (vis-à-vis sharing the roles equally) were fulfilled by multiple people by computing the standard skew of each variable, respectively, within each team. Such a procedure has been used in prior research (Stewart, Fulmer, & Barrick, 2005) as a proxy for the degree to which a particular group role is shared among many people (indicated by a higher negative skew) or fewer people (indicated by a higher positive skew).

Finally, team performance was assessed at the team level of analysis and would be considered a convergent composition variable under the Kozlowski and Klein (2000) typology because there is a single "expert" score for each team. The course leaders came to a consensus for the grades given to each team.

After computing the team level variables, we analyzed the model using step-wise regression. We chose this method because a single indicator represents each variable, thus mitigating the need to test separate measurement and theoretical models. More importantly, we were interested in examining the incremental contribution of the three respective roles.

4. Results

Means, standard deviations, and correlations for team level variables are shown in Table 4. We used step-wise regression with two-tailed tests to test the team level hypotheses (H1a, H1b, H2, and H3).

Insert Table 4 about here

Preliminary correlation analysis revealed that only conscientiousness was a significant covariate. Thus, in Step 1 we entered the level of conscientiousness (as rated by team members themselves) as a covariate ($b = .45$, $p < .03$). In Step 2, we entered the variables, one Project Coordinator compared to two, and three Project Coordinators compared to two. Results show that one Project Coordinator compared to two ($b = -.06$, ns) and three Project Coordinators compared to two ($b = -.02$, ns) did not account for additional variance explained beyond conscientiousness. Thus, H1a and H1b were not supported. In Step 3, we entered the variables representing the degree to which the roles of Implementer and Completer-Finisher are vested in a particular person. Results show that Implementer ($b = -.40$, $p < .03$) and Completer-Finisher ($b = .36$, $p < .05$) accounted for an additional variance explained of 26% while controlling for conscientiousness, thus indicating support for H2 (that more Implementers on a team lead to higher performance outcomes), and for H3 (that fewer Completer-Finishers on a team lead to

higher performance outcomes). The overall variance explained by the model was a rather robust 46%. Results can be seen in Table 5.

Insert Table 5 about here

4.1. Supplemental Data Analysis

Given the results of the step-wise regression that fulfilling the roles of Implementer (more people) and Completer-Finisher (fewer people) leads to higher performance, we desired to focus more closely on the relationship of these two variables with performance. Specifically, we wanted to investigate whether there was a particular combination of these two roles that is optimal for performance. To do so, we used the following polynomial equation to regress performance on Implementer and Completer-Finisher:

$$Z = b_0 + b_1X + b_2Y + b_3X^2 + b_4XY + b_5Y^2 + e$$

Where Z is performance, X is the skew of Completer-Finisher, Y is the skew of Implementer, and x^2, xy, and y^2 are the three quadratic terms formed from X and Y. In polynomial regression, if the variance explained by the polynomial regression equation is significantly different from zero, then the beta coefficients can be used to graph the response surface and to test specific aspects of the surface (Edwards, 1994). Specifically, we test the slope ($a_1 = b_1 + b_2$) and curvature ($a_2 = b_3 + b_4 + b_5$) of the surface graph along the line of congruence (X = Y), and the slope ($a_3 = b_1 - b_2$) and curvature ($a_4 = b_3 - b_4 + b_5$) of the surface graph along the line of incongruence (X = -Y).

An examination of Figure 2 shows that having fewer members in the Completer-Finisher role is the dominant driver of higher performance. However, the highest point on the graph is at the right side around the middle of the wall, thus indicating that fulfilling the role of

Implementer by a moderate number of members might also play a role with respect to leadership. The significant and positive slope along the line of perfect congruence (X = Y), indicated by a_1 in Table 6, combined with the non-significance of the curvature of this same line, indicated by a_2 in Table 6, show there is a generally linear relationship between the skew of Completer-Finisher and performance (see Shanock, Baran, Gentry, Pattison, and Heggestad (2010) for a more detailed explanation of graph interpretation). We also note that the overall model is only marginally significant, but does explain a good amount of variance (~36%).

Insert Table 6 about here

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5. Discussion

5.1. Findings

Our findings indicated that the fulfillment of the Implementer and Completer-Finisher roles is critical to high performance in virtual PDTs. Interestingly, it was important to have several people fulfilling the Implementer role but fewer people fulfilling the Completer-Finisher role. These roles fulfill two distinct types of activities. The role of Implementer is necessary in creative tasks where ideas need to be generated by multiple individuals. Therefore it appears there must be people on the team who can turn these ideas into action. This is a task-oriented "doing" sort of role. The role of Completer-Finisher is also a task-oriented "doing" sort of role. An individual in this role is actually "getting his or her hands dirty" with the work rather than just telling others on the team what to do or how to do it. It appears that giving direction or making decisions is not sufficient in a vPDT. One must pull all the loose ends of the product or deliverable together in a cohesive way in order to have a successful outcome. These findings are in line with the conclusions drawn from the Bakker et al. (2013) research

about time frames and project teams and how it is important for project managers of short time-frame projects to focus on "the now." The results are also consistent with the emerging approach of studies of online groups that have taken a role-orientated approach to understanding patterns of behavior and interaction (e.g. Jahnke, 2010; Welser et al., 2011). The results are also in line with the Yoo and Alavi (2004) study demonstrating the importance of task-oriented behavior in virtual environments and support long-standing results about the importance of task-oriented leadership behavior more generally (Hollander, 1960; Hollander, 1961a; Hollander, 1961b; Regula & Julian; 1973; Sorrentino & Boutillier, 1975). Indeed, the results develop this approach by noting that not only can people be associated to a role within a virtual team, but also that the presence of certain combinations of roles within a vPDT is associated with more successful outcomes.

Second, our hypothesis that low (H1a: one overall Project Coordinator) or high (H1b: more than one Project Coordinator in each subgroup) fulfillment of the Project Coordinator role would negatively affect performance was not supported. This may suggest that the role of leadership as we think of it in a traditional team does not matter in the same way in a vPDT. Instead, what is most important is fulfillment of specific roles. Perhaps this was because the duration of the task was relatively short (one month). This allowed individuals to understand the need to be task focused rather than looking for someone to engage in "traditional" sorts of leadership activities, like guidance and motivation. The task was fairly straightforward and all team members had essentially the same knowledge of what to do. The teams were motivated to perform well on the task in order to earn a high grade on their assignment. We also note that another contributing cause to these non-significant results might be an overlap between the Project Coordinator and Completer-Finisher roles. It is very likely that the Completer-Finisher role also includes some traditional coordinating efforts as the Completer-Finisher pulls together

various sub-tasks from the group members. Indeed, post-hoc analysis showed that the zero order correlation between Project Coordinator and Complete-Finisher was .50 (p <. 05).

Although having one Project Coordinator in each location was the norm, perhaps it might not be the most effective configuration for team performance. Perhaps having multiple Project Coordinators brings division to the vPDT rather than unity, based on what we know from the subgroup literature. Because there were relatively few teams with anything but two Project Coordinators (one in each location), we cannot draw further conclusions here, but this is an area for further investigation. It is the fulfillment of Implementer and Completer-Finisher roles rather than project coordination in a traditional sense that seems to be important for performance in partially-distributed virtual teams.

More generally, this study adds to our understanding of vPDTs in a student population, who in a few years time will become our workforce. This therefore provides a glimpse into the attitudes, behaviors, and approaches to work that will soon enter the workplace. The strategies formed in their post-secondary educational experiences for achieving success will likely find their way into the working world. Studying those that are a few years away from entering the workforce in a full-time capacity allows us to predict how the workforce may be influenced in years to come.

5.2. Limitations

This study provides a significant contribution to our understanding of vPDTs, roles, and leadership. However, we should address some limitations. First, because data was collected from a specific type of virtual team (PDT), this study has limitations in terms of generalizability to all virtual teams (e.g., those that form naturally, those existing for a long period of time, etc.). This particular team project was fairly short in duration at one month; however, we can learn about virtual teams that are formed for specific projects taking place over a finite period of time. Further some research does distinguish between temporary

distributed teams and on-going distributed teams showing that different leadership, trust-building, and norms are needed for a temporary vs. an on-going team (Saunders & Ahuja, 2006). Therefore results should be generalized with caution.

Second, while participants were asked to conduct all communications on the wiki, there is a chance that they did not follow this request. In particular the individuals that were located within the same country had separate face-to-face meetings. However, we requested that the complete group only meet on the wiki. Because interactions have been found to be higher among mixed teams, compared to collocated teams (McLeod, 2013), a wiki allowed us to capture communications amongst the whole group. It is particularly likely that other forms of communication occurred with the sub-groups that shared a location – either in the UK or US. Indeed, this type of mixed communication is a hallmark of a vPDT. For all teams, however, use of the wiki was required in order to complete the assignment with their colleagues "across the pond." Looking at the data, a fair number of students reported using text messages to arrange meetings with subgroups. Because of this finding, we anticipate that they would have also reported other forms of alternative communication methods. The data indicated that the use of these alternative methods was fairly minimal.

Next, although students were encouraged to complete a covariate battery, only a subset of students completed the measures. Therefore, there is a risk that this subset of students had some underlying similarity (e.g., higher levels of conscientiousness) that could distinguish them from other students. Although not all students completed the covariate battery, the majority of students (57.9%) did, with all but one team having at least three respondents. We acknowledge that we are assuming that team level indicators of both variables, but especially conscientiousness, are accurately represented by this subsample of students. We included conscientiousness as a control variable because it is an established and plausible driver of team performance. We surmise that students who were conscientiousness enough to drive overall

team performance were also conscientiousness enough to complete the optional survey at the completion of the project.

Finally, while the form of the vPDTs was consistent with workplace vPDTs, we acknowledge that the use of undergraduate students may limit the generalizability of the results. For example the motivating mechanism for task engagement may be different for a class project compared to a work situation. However, we feel that there is overlap in motivation to complete a class assignment and perform well at work. Hence, these individuals will transfer these skills and work approaches as they enter the workforce. Additionally as virtual collaboration continues to become even more widespread, facilitated through platforms such as Dropbox and Google Docs, we suspect that young adults will be the primary users of virtual collaboration. An advantage of this study is that participants worked on a real task rather than a fictional one, which boosts its ecological validity. It is also noteworthy that prior studies have contributed to our understanding of virtual team collaboration through their investigations within university classroom settings (e.g. Misiolek & Heckman, 2005; Carte et al., 2006). Even with these potential limitations, there are significant contributions to be gained from this study.

5.3. Future Research

While this study allowed us to have a greater understanding of how vPDTs obtain higher levels of performance, there is still much to be learned. First, we need to explore whether this holds true for other types of virtual teams (e.g., teams where members have met but are generally geographically dispersed). It would be valuable to conduct longer-term studies in a variety of settings. For instance, could the long term health of a virtual community be measured by examining the roles adopted by members within the community?

This study has also raised some interesting questions about the importance of the "traditional" role of the leader in virtual teams (here represented by Project Coordinator). Nascent research on virtual teams has indicated that the frequency of communication (usually

written in emails, blog posts, etc.) is a good predictor of leader emergence (Balthazard et al., 2009; Carte et al., 2006; Figl & Saunders, 2011; Yoo & Alavi, 2004), as was the case with the Project Coordinator. Role fulfillment of the Implementer and Completer-Finisher roles seems to be critical to team performance. Future studies are needed to further investigate this dynamic. Using a qualitative lens to engage content analysis would offer additional insight into a team member's contribution to the team.

This study has provided a valuable contribution to our understanding of vPDTs with respect to team role fulfillment. Although this study illuminated the significance of team dynamics and task execution within partially distributed teams, we have only begun to understand the complex nature of team roles in a vPDT. As such teams become more widespread, though, further investigation is likely to reap important dividends.

6. References

Aritzeta, A., Swailes, S., & Senior, B. (2007). Belbin's team role model: Development, validity and applications for team building. *Journal of Management Studies, 44*, 96-118.

Armstrong, D. J., & Cole, P. (2002). Managing distances and differences in geographically distributed work groups. In *Distributed work: New ways of working across distance using technology (P. Hinds & S. Kiesler, Eds.)*, MIT Press, 167-186.

Bakker, R. M., Boros, S., Kenis, P., & Oerlemans, L.A.G. (2013). It's only temporary: time frame and dynamics of creative project teams. *British Journal of Management, 24*, 383-397.

Balthazard, P. A., Waldman, D.A., & Warren, J.E. (2009). Predictors of the emergence of transformational leadership in virtual decision teams. *The Leadership Quarterly, 20*, 651-663.

Barrick, M. R. & Mount, M.K. (1991). The Big Five personality dimensions and job performance: A meta-analysis. *Personnel Psychology, 44*, 1–26.

Belbin, R. M. (1981). *Management teams: Why they succeed or fail.* London: Heinemann.

Belbin, R.M. (1993). Team roles at work. London: Butterworth-Heinemann.

Belbin, R. M. (2004). *Management teams: Why they succeed or fail.* 2nd ed. London:

Heinemann.

Belbin, R. M. (2010). *Management teams: Why they succeed or fail.* 3rd ed. London:

Heinemann.

Belbin, R. M. (2014). Method, reliability & validity, statistics & research: A comprehensive

review of Belbin team roles. www.belbin.com.

Bell, B. S. & Kozlowski, S.W.J. (2002). A typology of virtual teams: Implications for effective

leadership. *Group & Organization Management, 27,* 14-49.

Blenkinsop, N. & Maddison, A. (2007). Team roles and team performance in defence

acquisition. *Journal of Management Development, 26,* 667-682.

Bos, N., Olson, J.S., Nan, N., Shami, N.S., Hoch, S., & Johnston, E. (2006). Collocation

blindness in partially distributed groups: Is there a downside to being collocated?

Proceedings of the Computer Human Interaction – CHI, 1313-1321.

Broucek, W. G., & Randell, G. (1996). An assessment of the construct validity of the Belbin

self-perception inventory and observer assessment from the perspective of the five-

factor model. *Journal of Occupational & Organizational Psychology, 69,* 389-405.

Buchan, N. R., Croson, R. T., & Dawes, R. M. (2002). Swift Neighbors and Persistent

Strangers: A Cross- Cultural Investigation of Trust and Reciprocity in Social

Exchange. *American Journal of Sociology*, *108*, 168-206.

Carte, T., Chidambaram, L., & Becker, A. (2006). Emergent leadership in self-managed teams:

A longitudinal study of concentrated and shared leadership behaviors. *Group Decision*

and Negotiation, 15, 323-343.

Carton, A. M., & Cummings, J. N. (2012). A theory of subgroups in work teams. *Academy of Management Review*, *37*(3), 441-470.

Cogliser, C. C., Gardner, W.L., Gavin, M.B., & Broberg, J.C. (2012). Big five personality factors and leader emergence in virtual teams: Relationships with team trustworthiness, member performance contributions, and team performance. *Group & Organization Management, 37*, 752-784.

Costa, P. T. Jr., & McCrae, R. R. (1985). The NEP Personality Inventory Manual. Odessa, FL: Psychological Assessment Resources.

Costa, P. T. Jr., & McCrae, R. R. (1989). The NEO-PI/NEO-FFI Manual Supplement. Odessa, FL: Psychological Assessment Resources.

Costa, P. T. Jr., & McCrae, R. R. (1992). Revised NEO Personality Inventory (NEO-PI-R) and NEO Five-Factor Inventory (NEO-FFI) Professional Manual. Odessa, FL: Psychological Assessment Resources.

Cramton, C. D. (2002). Attribution in distributed work groups. In *Distributed work: New ways of working across distance using technology (P. Hinds & S. Kiesler, Eds.)*, MIT Press, 191-212.

Cramton, C. D., & Hinds, P. J. (2005). Subgroup dynamics in internationally distributed teams: Ethnocentrism or cross-national learning? In B. M. Straw and R. M. Kramer (eds.) *Research in Organizational Behavior: An Annual Series of Analytical Essays and Critical Reviews Vol. 26*, pp. 231-263. Oxford, UK: JAI Press.

Davies, M. F. & Kanaki, E. (2006). Interpersonal characteristics associated with different team roles in work groups. *Journal of Managerial Psychology, 21,* 638-650.

Delery, J. E. & Shaw, J.D. (2001). The strategic management of people in work organizations: Review, synthesis, and extension. In G. R. Ferris (ed.), *Research in Personnel and Human Resource Management Vol. 20*, pp. 167-197. Stamford, CT: JAI Press.

DeSanctis, G. (1988). Small Group Research in Information Systems: Theory and Method, *Paper presented at the Harvard Colloquium on Experimental Research in Information Systems.*

Edwards, J. R. (1994). Regression analysis as an alternative to difference scores. *Journal of Management*, *20*(3), 683-689.

Figl, K. & Saunders, C. (2011). Team climate and media choice in virtual teams. *AIS Transactions on Human-Computer Interaction, 3,* 189-213.

Fisher, S. G., Hunter, T. A., MacRosson, W. D. K. (2001). A validation study of Belbin's team roles. *European Journal of Work and Organizational Psychology, 10,* 121-144.

Fisher, S. G., Hunter, T. A., and Macrosson, W. D. (2002). Belbin's team role theory: for non-managers also? *Journal of Occupational and Organizational Psychology, 66,* 245-257.

Fisher, S. G., MacRosson, W.D.K., & Sharp, G. (1996). Further evidence concerning the Belbin team-role self-perception inventory. *Personnel Review, 25,* 61-67.

Fisher, S. G., MacRosson, W. D. K., & Wong, J. (1998). Cognitive style and team role performance. *Journal of Managerial Psychology, 13,* 544-557.

Fleishman, E. A., Mumford, M.D., Zaccaro, S.J., Levin, K.Y., Korotkin, A.L., & Hein, M.B. (1991). Taxonomic efforts in the description of leader behavior: A synthesis and functional interpretation. *The Leadership Quarterly, 2*, 245-287.

Furnham, A., Steele, H., & Pendleton, D. (1993). A psychometric assessment of the Belbin team-role self-perception inventory. *Journal of Occupational & Organizational Psychology, 66,* 245-257.

Fransen, J., Kirschner, P. A., & Erkens, G. (2011). Mediating team effectiveness in the context of collaborative learning: The importance of team and task awareness. *Computers in Human Behavior*, *27*(3), 1103-1113

Gomes, C. F., Yasin, M.M., & Small, M.H. (2012). Discerning interrelationships among the knowledge, competencies, and roles of project managers in the planning and implementation of public sector projects. *International Journal of Public Administration, 35*, 315-328.

Haines, R. (2014). Group development in virtual teams: An experimental reexamination. *Computers in Human Behavior*, *39*, 213-222

Hertel, G. T., Geister, S., & Konradt, U. (2005). Managing virtual teams: A review of current empirical research. *Human Resource Management Review, 15*, 69-95.

Hertzum, M. (2008). Collaborative information seeking: The combined activity of information seeking and collaborative grounding. *Information Processing & Management*, *44*(2), 957-962.

Hinds, P. J., & Bailey, D. E. (2003). Out of sight, out of sync: Understanding conflict in distributed teams. *Organization Science*, *14*, 615-632.

Hollander, E.P. (1960). Competence and conformity in the acceptance of influence. *Journal of Abnormal and Social Psychology, 61*, 365–369.

Hollander, E. P. (1961a). Emergent leadership and social influence. In L Pertrullo, B.M Bass (Eds.), Leadership and interpersonal behavior, Holt, Rinehart & Winston, New York.

Hollander, E. P. (1961b). Some effects of perceived status on responses to innovative behavior. *Journal of Abnormal and Social Psychology, 63,* 247–250.

Hornsey, M. J., & Hogg, M. A. (2000). Assimilation and diversity: An integrative model of subgroup relations. *Personality and Social Psychology Review*, *4*(2), 143-156.

House, R. J. & Mitchell, T.R. (1974). Path-goal theory of leadership. *Contemporary Business, 3*, 81-98.

Huang, H. & Ocker, R. (2006). Preliminary insights into the in-group/out-group effect in partially distributed teams: An analysis of participant reflection. SIGMIS CPR Conference Pomona, CA, April 13-15.

Huang, R., Kahai, S., & Jestice, R. (2010). The contingent effects of leadership on team collaboration in virtual teams. *Computers in Human Behavior*, *26*(5), 1098-1110

Jahnke, I. (2010). Dynamics of social roles in a knowledge management community. *Computers in Human Behavior*, *26*(4), 533-546.

Jarvenpaa, S. L., K. Knoll, D. & Leidner, D. E. (1998). Is anybody out there?: The antecedents of trust in global virtual teams. *Journal of Management Information Systems, 14*, 29–64.

John, O. P., Donahue, E.M. & Kentle, R.L. (1991). *The Big Five Inventory--Versions 4a and 54.* Berkeley, CA: University of California, Berkeley, Institute of Personality and Social Research.

John, O. P., Naumann, L.P., & Soto, C.J. (2008). Paradigm shift to the integrative Big Five trait taxonomy: History, measurement, and conceptual issues. In O. P. John, R. W. Robins, and L. A. Pervin (eds.), *Handbook of Personality: Theory and Research* pp. 114-158. New York: Guilford Press.

Joinson, A.N. (2003). Understanding the psychology of Internet behaviour: Virtual worlds, real lives. Basingstoke, Palgrave Macmillan.

Kayworth, T. R. & Leidner, D. E. (2002). Leadership effectiveness in global virtual teams. *Journal of Management Information Systems, 18,* 7-41.

Kozlowski, S. W. J., & Bell, B. S. (2003). Work groups and teams in organizations. *Handbook of Psychology*.

Kozlowski, S.W.J. & Klein, K.J. (2000). A multilevel approach to theory and research in organizations: contextual, temporal, and emergent processes. In K. J. Klein and S. W. J.

Kozlowski (eds.) *Multilevel Theory, Research, and Methods in Organizations: Foundations, Extensions, and New Directions*, pp. 3-90. San Francisco: Jossey-Bass.

Majchrzak, A., Wagner, C. & Yates, D. (2006). Corporate wiki users: Results of a survey. *WikiSym,* pp. 99-104.

Malhotra, A., Majchrzak, A., & Rosen, B. (2007). Leading virtual teams. *The Academy of Management Perspectives, 21*, 60-69.

Mannix, E., & Neale, M. A. (2005). What differences make a difference? The promise and reality of diverse teams in organizations. *Psychological science in the public interest*, *6*(2), 31-55.

Maznevski, M. L. & Chudoba, K. M. (2000). Bridging space over time: Global virtual team dynamics and effectiveness. *Organization Science, 11*, 473-492.

McLeod, P. L. (2013). Distributed people and distributed information: Vigilant decision-making in virtual teams. *Small Group Research, 44,* 627-657.

Misiolek, N. L. & Heckman, R. (2005). *Patterns of emergent leadership in virtual teams*. 2005 Hawaii International Conference on System Sciences (HICSS-38), Waikoloa, HI.

Newell, S., Tansley, C., & Huang, J. (2004). Social capital and knowledge integration in an ERP project team: The importance of bridging AND bonding. *British Journal of Management, 15,* S43-S5.

Ocker, R., Huang, H. Benbunan-Fich, R., & Hiltz, S.R. (2011). Leadership dynamics in partially distributed teams: An exploratory study of the effects of configuration and distance. *Group Decision and Negotiation, 20*, 273-292.

O'Leary, M. B. & Cummings, J. N. (2007). The spatial, temporal, and configurational characteristics of geographic dispersion in teams. *MIS Quarterly,* 31, 433-452.

O'Leary, M. B. & Mortensen, M. (2010). Go (con)figure: Subgroups, imbalance, and isolates in geographically dispersed teams. *Organization Science, 21*, 115-131.

Pearce, C. L. (2004). The future of leadership: Combining vertical and shared leadership to transform knowledge work. *Academy of Management Executive, 18,* 47-57.

Peñarroja, V., Orengo, V., Zornoza, A., & Hernández, A. (2013). The effects of virtuality level on task-related collaborative behaviors: The mediating role of team trust. *Computers in Human Behavior*, *29*(3), 967-974.

Plotnick, L., Ocker, R., Hiltz, S.R., & Rosson, M.B. (2008). *Leadership roles and communication issues in partially distributed emergency response software development teams: A pilot study.* Proceedings of the 41st Hawaii International Conference on System Sciences. IEEE.

Postmes, T., Spears, R., & Lea, M. (2000). The formation of group norms in computer-mediated communication. *Human communication research*, *26*(3), 341-371.

Rammstedt, B. & John, O.P. (2007). Measuring personality in one minute or less: A 10-item short version of the Big Five Inventory in English and German. *Journal of Research in Personality, 41,* 203-212.

Regula, C. R. & Julian, J. W. (1973). The impact of quality and frequency of task contributions on perceived ability *The Journal of Social Psychology, 89,* 115–122.

Saunders, C. S. & Ahuja, M. K. (2006). Are all distributed teams the same? Differentiating between temporary and ongoing distributed teams. *Small Group Research, 37,* 662-700.

Senior, B. (1998). An empirically-based assessment of Belbin's team roles. *Human Resource Management Journal, 8,* 54-60.

Serçe, F. C., Swigger, K., Alpaslan, F. N., Brazile, R., Dafoulas, G., & Lopez, V. (2011). Online collaboration: Collaborative behavior patterns and factors affecting globally distributed team performance. *Computers in human behavior*, *27*(1), 490-503

Shanock, L. R., Baran, B. E., Gentry, W. A., Pattison, S. C., & Heggestad, E. D. (2010). Polynomial regression with response surface analysis, A powerful approach for

examining moderation and overcoming limitations of difference scores. *Journal of Business and Psychology*, *25*(4), 543-554.

Sorrentino, R. M. & Boutillier, R. G. (1975). The effect of quantity and quality of verbal interaction on ratings of leadership ability. *Journal of Experimental Social Psychology, 11* 403–411.

Sosa, M. E. (2011). Where do creative interactions come from? The role of tie content and social networks. *Organization Science, 22,* 1-21.

Stewart, G. L., Fulmer, I.S., & Barrick, M.R. (2005). An exploration of member roles as a multilevel linking mechanism for individual traits and team outcomes. *Personnel Psychology, 58,* 343–365.

Stogdill, R. M. (1948). Personal factors associated with leadership: A survey of the literature. *Journal of Psychology, 25*, 35-71.

Tajfel, H., & Turner, J.C. (1986). The social identity theory of intergroup behavior. *Psychology of Intergroup Relations. Nelson-Hall, Chicago*, 7-24.

Turel, O. & Zhang, Y. (2010). Does virtual team composition matter? Trait and problem-solving configuration effects on team performance. *Behaviour & Information Technology, 29,* 363-375.

Webster, J. & Wong, W.K.P. (2008). Comparing traditional and virtual group forms: Identity, communication and trust in naturally occurring project teams. *International Journal of Human Resource Management, 19,* 41-62.

Welser, H. T., Cosley, D., Kossinets, G., Lin, A., Dokshin, F., Gay, G., & Smith, M. (2011, February). Finding social roles in Wikipedia. In *Proceedings of the 2011 iConference* (pp. 122-129). ACM.

Yammarino, F. J., Mumford, M.D., Connelly, M.S., & Dionne, S.D. (2010). Leadership and team dynamics for dangerous military contexts. *Military Psychology, 22,* 15-41.

Yoo, Y. & Alavi, M. (2004). Emergent leadership in virtual teams: What do emergent leaders do? *Information and Organization, 14*, 27-58.

Table 1

Belbin team role descriptions

Belbin team role	Contribution	Allowable Weaknesses
Plant	Creative, imaginative, free-thinking. Generates ideas and solves difficult problems.	Ignores incidentals. Too preoccupied to communicate effectively.
Resource Investigator	Outgoing, enthusiastic, communicative. Explores opportunities and develops contacts.	Over-optimistic. Loses interest once initial enthusiasm has passed.
Coordinator	Mature, confident, identifies talent. Clarifies goals. Delegates effectively.	Can be seen as manipulative. Offloads own share of the work.
Shaper	Challenging, dynamic, thrives on pressure. Has the drive and courage to overcome obstacles.	Prone to provocation. Offends people's feelings.
Monitor Evaluator	Sober, strategic and discerning. Sees all options and judges accurately.	Lacks drive and ability to inspire others. Can be overly critical.
Teamworker	Co-operative, perceptive and diplomatic. Listens and averts friction.	Indecisive in crunch situations. Avoids confrontation.
Implementer	Practical, reliable, efficient. Turns ideas into actions and organizes work that needs to be done.	Somewhat inflexible. Slow to respond to new possibilities.
Completer Finisher	Painstaking, conscientious, anxious. Searches out errors. Polishes and perfects.	Inclined to worry unduly. Reluctant to delegate.

Belbin, 2014

Table 2

Comparison of important roles for leader emergence in vPDTs

	Project Coordinator	Implementer	Completer-Finisher
Source	-	-	-
Misiolek & Heckman, 2005	**Procedural (Task Coordination)** - Scheduling, creating processes	**Substantive Task Contribution** - Idea generation and evaluation	**Substantive Task Contribution** - Integration and synthesis
Carte et al., 2006	**Monitor** · Collects and distributes information · Provides continuity and stability	-	**Producer** · Seeks closure, motivates goal-oriented tasks · Takes responsibility for task completion
Yoo & Alavi, 2004	**Initiator** · Initiates contact, starts projects **Scheduler** · Suggests assignments and work processes	- -	**Integrator** · Compiled others' work, edited documents · Final "checkpoint" before deliverables sent out
Majchrzak et al., 2006	-	**Adder** · Adds or suggests new content	**Synthesizer** · Integrates ideas for task completion

Table 3

Belbin team role checklist

Belbin team role	Description
CF – completer-finisher	Thorough about a task; attentive to all details; finishes things; reluctant to let go until complete; nags others to finish on time; perfectionist; plans so that nothing gets overlooked
CO – coordinator	Delegates tasks and rallies team; makes firm decisions usually having consulted others; adaptive to changes; committed to goals and sees them being met; uses all team members making all play a role; draw out the potential from all members; recognizes talent and uses it
IM – implementers	Orderly and precise; sticks to rules;/ does not like change; organizes plans and actions; disciplined in approach; systematic in approach; tackles any tasks
ME – monitor-evaluator	Asks for all information; unenthusiastic and impartial about ideas; slow to make a decision; likes to think based on all facts; negative about plans
RI – resource investigator	Negotiates and liaises with outsiders; asks questions from others; opportunistic; thinks on feet; picks up on the ideas of others; sociable; inquisitive and curious; enthusiastic about tasks at the beginning
PL – plant	Thinks things through; tackles problems usually on own; proposes ideas and solutions; creative and imaginative; dominant with ideas
SH – shaper	Active in the need to achieve something; restless; likes to work without planning; challenges others or indecision in a team; argues; disturbs the balance; goads action from others; opportunist; often negative; impatient and often frustrated
TW – team worker	Listens to others and supports them; works with the awkward people; not forceful or demanding; diplomatic and balancing; averts conflict; communicates well with others

Fisher, Hunter, & MacRosson (2001)

Table 4

Means, Standard Deviations, Reliabilities and Correlations - Team Level of Analysis

	Variables	Mean	S.D.	1	2	3	4	5
1	Conscientiousness	3.76	0.25					
2	1 PC vs. 2 PC (dummy)	0.25	0.44	.05				
3	3 PC vs. 2 PC (dummy)	0.25	0.44	.32	-.33			
4	Implementer Skew	0	1.00	.09	.32	-.10		
5	Completer-Finisher Skew	0	1.00	.28	-.19	.24	-.04	
6	Performance	58.1	7.48	.45*	-.03	.14	-.33+	.45*

n = 28 PC = Project Coordinator

+ p <.10

*p >.01

Table 5

Stepwise regression predicting team performance

	Variable	β	$p \leq$	R^2	ΔR^2
Step 1				0.20	0.20**
	Conscientiousness (covariate)	0.45	0.05		
Step 2				0.20	0.00
	Conscientiousness (covariate)	0.46	0.05		
	One Proj. Coord. compared to two	-0.06	ns		
	Three Proj. Coord. compared to two	-0.02	ns		
Step 3				0.46	0.26**
	Conscientiousness (covariate)	0.49	0.05		
	One Proj. Coord. compared to two	0.12	ns		
	Three Proj. Coord. compared to two	-0.07	ns		
	Implementer Skew	-0.40	0.05		
	Completer-Finisher Skew	0.36	0.05		

β = standardized beta, p = p-value, R^2 = *R-squared for step*,

ΔR^2 = change in *R*-squared when predictor is added.**$p \leq .01$.

Table 6

Polynomial Regressions of Performance on Skew of Implementer and Completer-Finisher Roles

Outcome Variable:	Performance	
	Estimate	SE
Constant	58.77**	2.06
Leader self-rating of identity (b_1)	3.44*	1.30
Collective endorsement of identity (other-rating) (b_2)	-1.50	1.45
Leader self squared (b_3)	.98	1.10
Leader self X collective endorsement (b_4)	-.10	1.28
Collective endorsement squared (b_5)	-1.70	1.36
R^2	.36†	
Surface tests		
$a_1 = b_1 + b_2$	4.94*	1.90
$a_2 = b_3 + b_4 + b_5$	-.62	2.01
$a_3 = b_1 - b_2$	1.94	2.04
$a_4 = b_3 - b_4 + b_5$	-.82	2.25

† p<.10; *p<.05; **p < .01
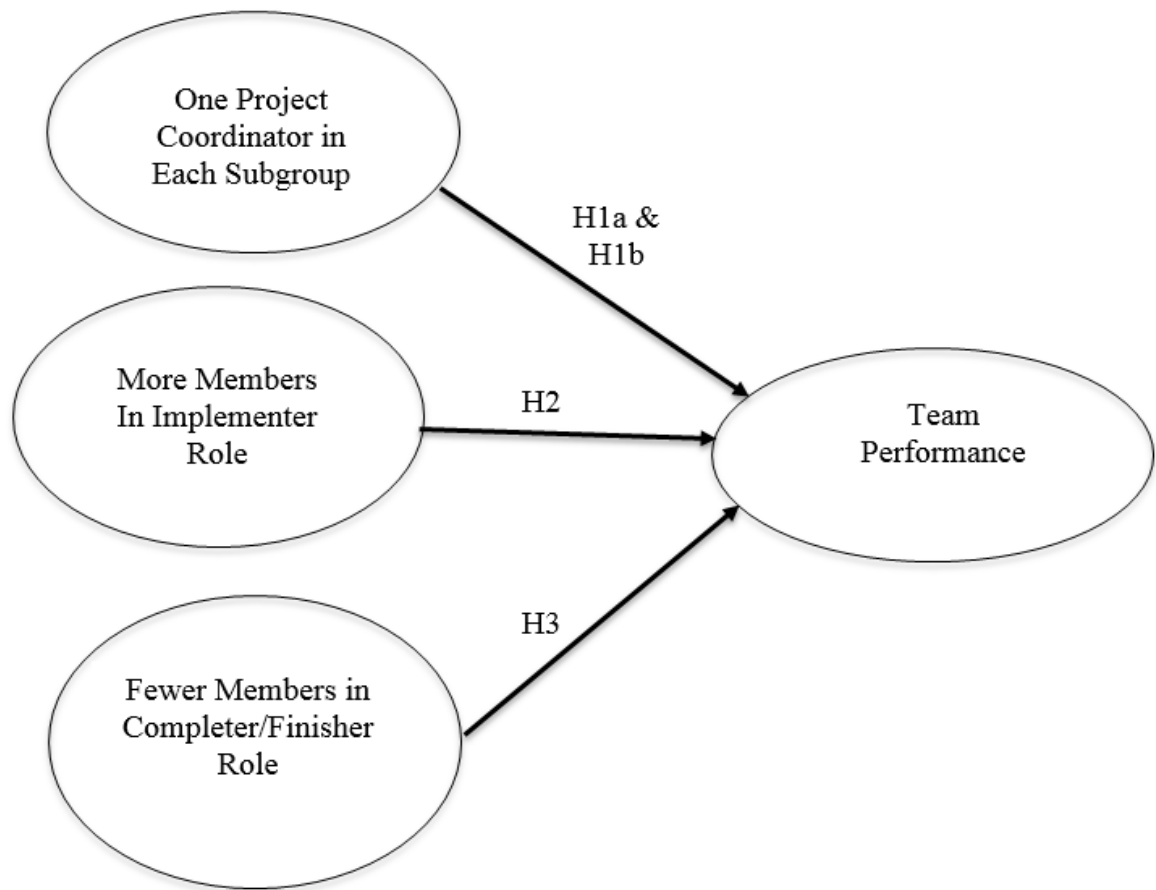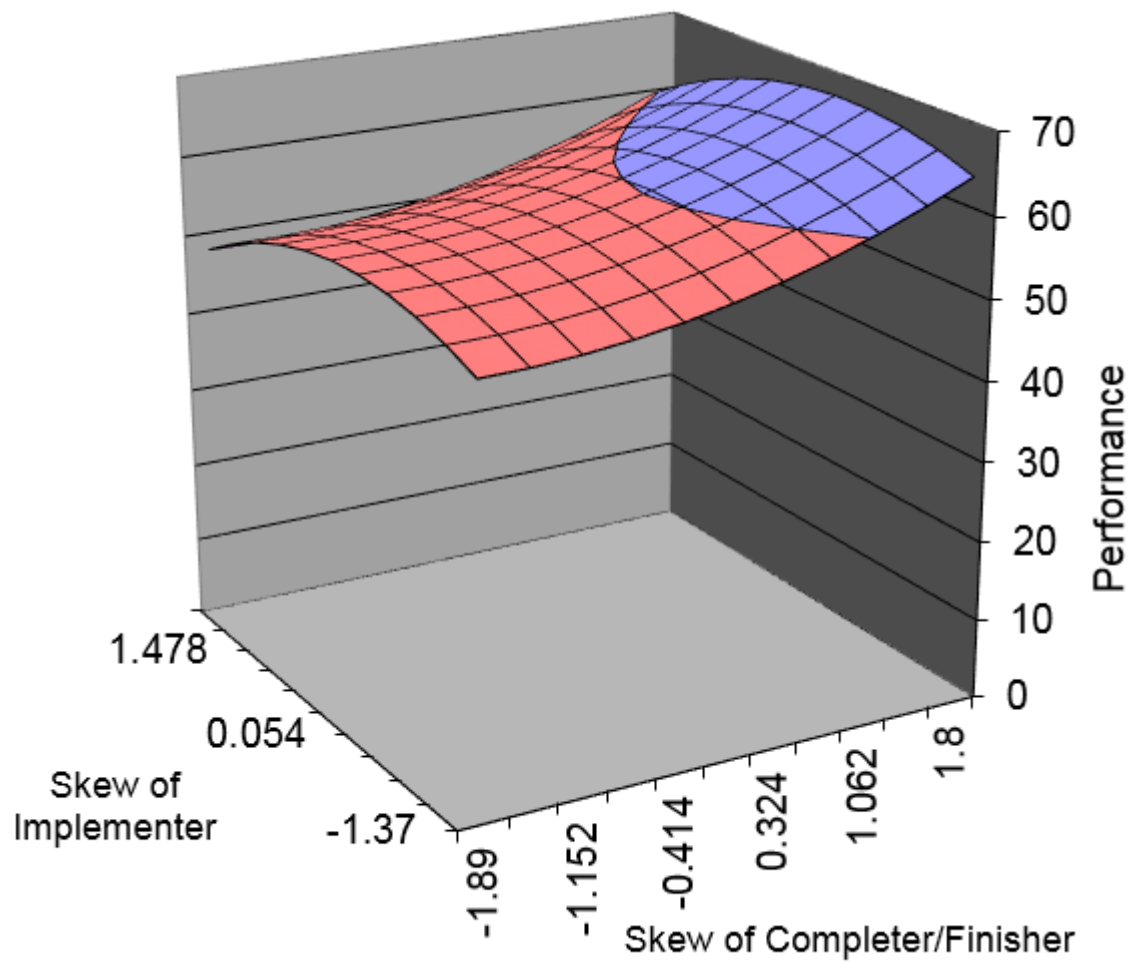
Figure 1
Proposed Hypothetical Model

Figure 2
Response surface graphs depicting the relationships between skew of Implementer and Completer-Finisher roles and performance

Appendix A

Example of Project Coordinator

Ideas for discussion topics for essay and evaluation:

1. Ways to reduce the influence of economic uncertainty on business performance.
2. Ways to reward and keep staff motivated without the increase in wages.
3. How to increase work ethic, and inspire the workers to remain at Sanchez and Sons. I.e. research projects, innovations (In preparation for when the economic market recovers – big player in the field)
4. Changing of structure? Flat structure change…
5. Modernising the company yet keeping the reputation as an 'old' business. Advantages of websites, and e-commerce.
6. Ways to establish the Liverpool based firm. Newer frim only been established for 10 years.
7. Communication problems between UK and USA; this needs to be as efficient as possible; waste of time; waste of money.

- Split payments for exmployess. Usual pay 50,000 a year. To ensure commitment to company, 1st year 40,000, 2nd year (when ecomony has improved 70000 in the second year) An incentive to earn more money over the two years. Also, reduces cash flow problems in the 1st year.

- Maybe another businessmen to be introduced to the business. Input of cash. Less cash flow problem.

- As the manager, exaggerate the new alliances, expanding of business. Excitement. Optimisim within the work force.

- Employee contracts. Sustainablity. Positives and Negatives.

We will also need to look into the differences between the US and UK. Cultures/Populations. Therefore same solutions may not be the possible.

Hope your all good :D :D

Appendix B

Example of Implementer

Hi,

I really like your idea L, I hadn't thought of that.

I also had a couple of ideas.

The question is asking about how we retain the skilled workers without going broke. So we need to keep the workers happy and satisfied enough to feel like they want to remain working throughout the recession and the following upturn again. 'Without going broke' rules out being able to offer any kind of monetary reward (ie. bonuses/ wage increases). So instead we need to increase the employees satisfaction another way, or at least make them feel reassured, valued and needed. It sounds as though sanchez already has a close working relationship with his emplyees (flat structure, sanchez involved in lots of decisions, frequent contact with managers, passionate about its success) so I think this fact needs to be re-iterated and put across to the employees. Sanchez needs to be honest, so the employees need to feel like they can trust him, because they will no doubt notice the decline in business activity, and start questioning what their future is.

Secondly, I really like L's point above. something needs to be offered so they wont feel like they have to turn to a different company. i had thought of slightly different, but along the same lines. What if Sanchez offers the employees unpaid time off. From a timeframe of say 1 month-2 years, it would decrease the burden of the wage payments by a significant margin. It could be advertised as a golden opportunity for employees to take some time off work to complete a life ambition, spend some time with family, travel... etc and they still have a guarenteed job at the end. Obviously if there was a large amount of interest in this, the time off would have to be spread around a certain peiod of time (i.e. so that not all managers were off on the first month!)

What do you think?

Appendix C

Example of Completer-Finisher

Hey everyone,

I have posted a compiled version of the report in a uniform format. I have also converted it all into formal UK English. Please go through it and edit as much as possible (the sooner the better!). Be sure to make it noticeable as well please so we can (dis)agree with each other's opinions. When going through the report, please help look for topics that may overlap or should be moved into other sections to help with the report's fluidity. I am having an issue attaching the Word doc to this wiki unfortunately, so just trust me when I say it looks good. I need an image of your College emblem and your course title to add onto the title page please.

Kind Regards,

- K