Emergent Leadership in Self-managed Virtual Teams: A Replication

Full paper

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Abstract

Carte, Chidambaram, and Becker (2006) conducted a longitudinal study of 22 self-managed virtual teams to better understand the differences in leadership behaviors engaged in by high- versus low-performing teams. We conducted a methodological replication of their study to attempt to confirm its findings. Our data were collected in a different country (Sri Lanka versus US), using different subjects (MBA versus undergraduate students) grouped into 25 teams that were collocated (rather than geographically distributed) but still using a collaborative technology (CT), and engaged in different a task (judgement versus intellective) than the original study. These changes result in opportunities to determine the robustness of previous findings. Two of five hypotheses results were replicated, indicating that certain characteristics of high-performing technology-supported teams seem universal. However, the remaining differences between the studies point to the influence of task, culture, and geographic dispersion of members in determining effective leadership behaviors in self-managed computer-supported teams.

Keywords

Replication, virtual teams, leadership

Introduction

Carte, Chidambaram, and Becker (2006) argued that organizations are increasingly using distributed teams because such teams are made feasible by improvements in communication technologies (Kahai et al. 2004; Sarker et al. 2002), such teams are now common place (Misiolek and Heckman 2005), but an in-depth understanding of leadership behaviors in such teams is still lacking (Sarker et al. 2002; Zigurs 2003). They studied 22 geographically distributed teams, coded the messages exchanged for incidents of leadership behavior and drew conclusions about the leadership exhibited in high- versus low-performing teams. This paper has been cited in both the IS and management literature, but its findings have not been further tested.

In our study, we examined the same question addressed in Carte et al. (2006) in an attempt to confirm their findings. However, we made some changes to our design to examine the robustness of the previous findings. Our data were collected in a different country – Sri Lanka – in order to determine whether the previous behavior-related findings generalize across different cultures. The importance placed on, and effectiveness of, leader behaviors are contingent on culturally endorsed implicit theories of leadership (CILTs) of the broader social system (House et al. 1997). Further, our teams were MBA students with significant experience, enabling us to determine if previous findings apply only to novice team members or whether experienced team members also exhibit similar behaviors. In addition, our study used team members who were co-located, but using a collaborative technology (CT), enabling us to determine whether the previous findings were a product of geographic dispersion or CT use (i.e., virtual teams versus computer-supported teams). Finally, our study utilized a series of non-cumulative case studies compared to a single cumulative technology development assignment used in Carte et al., 2006. However, we tested the same hypotheses, used the same collaborative technology, and replicated their coding methods. As such, our study is a methodological replication of this previous work.

Previous Results

Utilizing the Leaderplex Model (see Figure 1), Carte et al. (2006) coded and counted the number of times each team engaged in 8 key leadership behaviors. They found that high performing teams engaged in more leadership behaviors, with significant differences in the number of monitoring and performing behaviors in high- versus low-performing teams (i.e., high performing teams engaged in more of these behaviors).
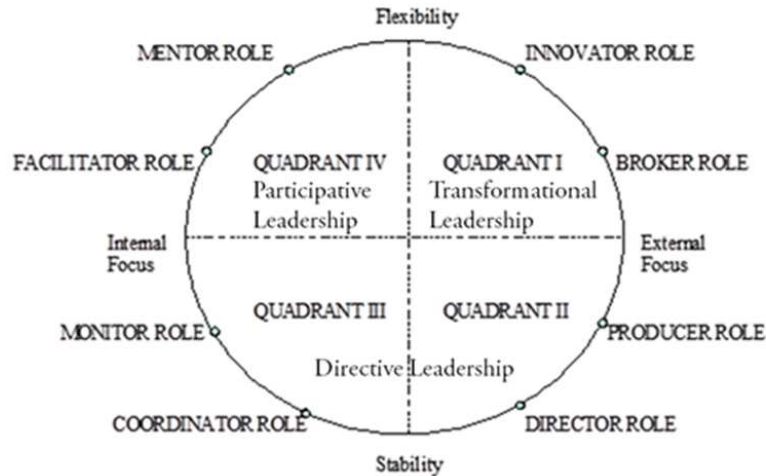
Figure 1: Leaderplex Model Adapted from Denison, Hooijberg, and Quinn (1995)

Further, they investigated shared (e.g., enactment of leadership behavior by all or most of a team) versus concentrated leadership (depth of leadership by each individual team member) and found that high-performing teams engaged in more shared monitoring behavior and concentrated producer behavior than low performing teams. Finally, the role of time was investigated and the results suggest that leadership performed earlier in a team's life impacts performance more than behaviors engaged in later in their life.

Methods

The sample for this study comprised 132 students (male=85, female=47) newly enrolled in a premier MBA program in Sri Lanka (as such participants had little to no previous interactions but expected future interaction as they progressed through the program). The program attracts high-quality, experienced managers and all courses are taught in the evening to accommodate the students' fulltime employment while completing their MBA. Each subject was assigned to one of 25 teams; 18 five-member teams and 7 six-member teams. A demographical comparison of our participants versus Carte et. al, (2006) is provided in Table 1.

Variable	Carte et. al, 2006 Mean (SD)	Current study Mean (SD)
Age in years	22.7 (4.60)	30.8 (4.8)
Gender	Male=83; Female=24	Male=84, Female=47

Table 1: Comparison of Demographics

During their Introduction to MIS course the teams were asked to complete four case write-ups over eight weeks with the deliverables equally spaced two weeks apart. An initial survey was administered to collect demographic data. Consistent with Carte et al. (2006), each team had a shared workspace in *Yahoo! Groups*, accessible only to team members and the instructor. While these teams were collocated and part of a cohort that interacted in face-to-face classes, they were asked to complete the assignment using only *Yahoo! Groups*. As such, all team communication regarding the case write-up was expected to be visible in the discussion threads on *Yahoo!Groups*. We asked the participants to what extent the tasks were

completed using *Yahoo! Groups* and they reported that they used the collaborative technology for the majority of their interactions[1]. Further, the content of the messages suggested that the bulk of the case writing occurred using the tool. A summary of the methodological choices across the original study and this replication are summarized in Table 2.

	New Study	Carte, et al. (2006)
Task	Case Writing (less cumulative / less dependence between tasks)	Tech Development (cumulative)
Sample	MBA's	Undergraduates
Context	Collocated (eliminates anonymity as an explanation)	Virtual/Distributed
Location/Culture	Sri Lanka	USA

Table 2: Study Characteristics

Leadership Behaviors

The communication exchanges within each team on *Yahoo! Groups* were archived and coded. Similar to Carte, et al. (2006), our measures of leadership behaviors were coded by examining each message for incidents of leadership behaviors – again, an individual message could contain multiple behaviors. In all, 2,742 messages were exchanged and subsequently coded. Coding was conducted by two coders – one male and one female – and inter-rater agreement was sufficient with a Cohen's Kappa above .80. The ratings of the first coder were used. Each of the eight leadership behaviors were represented by the total number of times each individual demonstrated the behavior within each of the four time periods. Concentrated leadership behavior was calculated by dividing leadership behavior counts by the number of individuals in the team who engaged in it, and shared behaviors was calculated by multiplying the number of times a certain behavior was engaged by the percentage of team member who engaged in it. This was identical to Carte et al. (2006).

Results

Consistent with Carte et al. (2006), we split our sample into high and low performing teams (using the mean of the overall team performance as the breakpoint) and evaluated each of the original hypotheses via one-tailed t-tests. Our results are compared to the results found in Carte et al. (2006) in Table 3.

Hypothesis	Carte, et al. (2006)	New Study
H1: The communication exchanges among high-performing teams will be characterized by a greater number of actual leadership behaviors compared to low-performing teams.	**Supported**, overall behavior counts were significantly higher for high-performing teams (p-value = .03).	Not supported (p-value = .112)

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[1] The participants were asked what percentage of their team's interactions occurred using phone calls, face-to-face meetings, and/or impromptu meetings. Respondents indicated that their teams used these alternative channels for less than 10% of their interactions and more than 90% of interactions took place over *Yahoo! Groups*.

H2: The communication exchanges among high-performing teams will be characterized by a higher incidence of directive leadership behaviors compared to low-performing teams.	**Partially supported**, producer (p-value < .01) and monitor behaviors (p-value = .07) were significantly higher for high-performing teams.	Not supported (p-value = .190). Delving into individual directive leadership behaviors reveals no significant differences, either. The only leadership behavior to produce a significant difference was Broker (p-value = .012), which is a transformational leadership behavior, and that was likely due to the very small number of instances of broker behavior exhibited.
H3a: The communication exchanges among high-performing teams will be characterized by a higher incidence of shared leadership behaviors compared to low-performing teams.	**Supported**, overall shared behaviors were higher for high-performing teams (p-value - .05). Among specific behaviors, shared monitor behavior was significantly higher among high-performing teams (p-value = .06).	Not supported overall (p-value = .299), but **supported for two specific behaviors**: Shared Broker (p-value = .009) and Shared Producer (p-value = .046).
H3b: The communication exchanges among high-performing teams will be characterized by a higher incidence of concentrated leadership behavior compared to low-performing teams.	**Supported**, overall concentrated behaviors were higher for high-performing teams (p-value = .02). Among specific behaviors, concentrated producer behavior (p-value < .01) was significantly higher among high-performing teams.	**Supported**, overall concentrated behaviors were higher for high-performing teams (p-value = .0005). Among specific behaviors, concentrated producer (p-value = .037), concentrated coordinator (p-value = .042), concentrated monitor (p-value = .026), and concentrated mentor (p-value = .031) behaviors were significantly higher among high-performing teams.
H4: Leadership behavior exhibited early in the team's lifecycle will be associated with team performance while leadership behaviors exhibited later will not.	**Partially supported**, shared monitor and concentrated producer behaviors exhibited early were significantly different among high- and low-performing teams, later behaviors were not.	**Partially supported**, innovator (overall, shared, and concentrated), broker (overall, shared, and concentrated), producer (overall, shared, and concentrated),and monitor (overall, shared, and concentrated) behaviors exhibited early were significantly different among high- and low-performing teams, while later concentrated behaviors were not (only Broker in Time 2, Monitor in Time 3, and Mentor in Time 4 were significantly different). Shared behaviors, on the other hand, might point to a "middle-game" for the teams: Shared Innovator, Broker, Producer, and Monitor were significantly different in Time 1; Shared Broker and Coordinator were significantly different in Times 2 and 3; Shared Producer and Mentor were

			significantly different in Time 4.

<div align="center">**Table 3: Comparison of Findings**</div>

It is worth noting that only two of the five hypothesis results were replicated. However, two of the three results that weren't replicated concerned hypotheses focused on overall, rather than specific leadership behaviors, and they were not time-based. In order to better unpack the role of time and specific leadership behaviors, we present Carte et al.'s (2006) findings in Table 4 and our results in Table 5, using a quadrant format that mirrors the Leaderplex model.

GDN DATA	QUADRANT IV								QUADRANT I							
Behavior	**FACILITATOR**				**MENTORING**				**INNOVATOR**				**BROKER**			
OVERALL	Time1	Time2	Time3	Time4	Time1	Time 2	Time 3	Time4	Time1	Time2	Time3	Time4	Time1	Time 2	Time 3	Time4
p-value (1-tailed)	**0.01**	0.20	0.23	*0.09*	0.28	0.18	0.21	0.42	0.37	0.29	0.25	0.46	0.46	0.49	0.27	0.44
Mean low performers	3.67	4.67	6.42	*7.33*	0.25	0.75	0.58	0.25	0.83	0.58	0.33	0.33	1.33	1.92	2.58	2.25
Mean high performers	6.10	5.80	5.20	*4.80*	0.40	0.40	0.40	0.30	0.70	0.40	0.20	0.30	1.40	1.90	3.40	2.40
CONCENTRATED LEADERSHIP																
p-value (1-tailed)	**0.05**	**0.03**	0.49	0.26	0.40	0.25	0.21	0.25	0.37	0.46	0.25	0.46	0.33	0.42	**0.03**	0.38
Mean low performers	**1.67**	**1.71**	2.10	2.59	0.25	0.63	0.58	0.17	0.58	0.38	0.33	0.33	0.93	0.98	**0.91**	1.21
Mean high performers	**2.76**	**2.38**	2.11	2.13	0.30	0.40	0.40	0.30	0.50	0.40	0.20	0.30	0.80	1.07	**1.62**	1.40
SHARED LEADERSHIP																
p-value (1-tailed)	**0.06**	0.40	0.16	*0.07*	0.21	0.14	0.25	0.38	0.34	0.16	0.28	0.46	0.29	0.38	0.48	0.36
Mean low performers	1.98	2.94	4.62	*4.47*	0.05	0.21	0.12	0.08	0.30	0.20	0.07	0.07	0.49	0.97	1.84	0.88
Mean high performers	3.21	3.25	2.88	*2.51*	0.12	0.08	0.09	0.06	0.23	0.08	0.05	0.06	0.76	0.79	1.77	1.06
Behavior	**MONITOR**				**COORDINATOR**				**DIRECTOR**				**PRODUCER**			
OVERALL	Time1	Time2	Time3	Time4	Time1	Time 2	Time 3	Time4	Time1	Time2	Time3	Time4	Time1	Time 2	Time 3	Time4
p-value (1-tailed)	**0.01**	**0.03**	0.40	0.46	0.48	0.37	0.11	0.45	0.22	0.23	0.33	**0.07**	**0.01**	**0.01**	0.29	0.20
Mean low performers	**4.67**	**6.17**	7.00	6.33	3.25	3.00	2.17	3.25	2.08	1.67	1.25	**0.75**	**7.33**	**9.33**	13.00	12.75
Mean high performers	**7.20**	**9.30**	6.60	6.50	3.20	2.60	3.60	3.10	2.60	1.40	1.50	**1.60**	**14.00**	**20.60**	14.60	15.70
CONCENTRATED LEADERSHIP																
p-value (1-tailed)	**0.08**	**0.08**	0.18	0.27	0.29	0.36	0.13	0.49	0.29	0.17	0.41	0.30	**0.04**	**0.00**	**0.08**	0.31
Mean low performers	**1.68**	**1.92**	2.28	2.44	1.08	1.30	1.29	1.61	1.26	1.33	0.90	0.75	**2.49**	**2.65**	**3.27**	3.86
Mean high performers	**2.06**	**2.53**	1.96	2.16	1.32	1.15	1.92	1.60	1.40	1.05	0.83	0.93	**4.06**	**5.84**	**4.07**	4.31
SHARED LEADERSHIP																
p-value (1-tailed)	**0.04**	**0.04**	0.41	0.49	0.18	0.27	0.12	0.45	0.25	0.42	0.24	**0.06**	**0.00**	**0.02**	0.43	0.15
Mean low performers	**3.25**	**4.52**	5.17	4.13	2.31	1.84	0.82	1.48	0.87	0.47	0.44	**0.15**	**5.60**	**7.23**	10.80	8.94
Mean high performers	**5.45**	**7.38**	4.80	4.18	1.39	1.15	1.62	1.58	1.30	0.44	0.68	**0.77**	**10.14**	**15.86**	11.30	11.85
	QUADRANT III								QUADRANT II							
Legend: Bold = significant relationship; Italics = significant in opposite of hypothesized direction / uninterpretable																

<div align="center">**Table 4: Carte, et al. (2006) Results**</div>

Discussion

In this study we performed a methodological replication of Carte et al. (2006). Utilizing the same measures but altering the study design we attempted to understand to what extent the previous findings are robust. We found support for two of the five hypotheses previously proposed and partially supported. Fundamentally, three out of four hypotheses that focused on overall counts were not replicated; hypotheses focused on concentrated leadership, specific behaviors, and time produced more consistent results across the two studies.

Overall Leadership Behaviors

Hypothesis 1 suggested that the overall number of leadership behaviors would be higher in high-performing teams. Although our high performing teams did engage in more leadership behaviors, it did not rise to a level of statistical significance. This may be due to one difference in our study compared to Carte et al. (2006); our teams were not distributed. Team members are more likely to assume leadership

functions and responsibilities if they feel empowered to do so. Team empowerment is defined as increased task motivation due to team members' collective, positive assessments of their organizational tasks (Kirkman and Rosen 1999) and there is empirical evidence to suggest that technology-supported teams are more capable of taking self-corrective actions to improve team processes the more virtual they are (i.e., the less they meet face-to-face) (Kirkman et al. 2004). This suggests that our collocated teams may have felt less empowered to assume (rather than being appointed to) a leadership role. It may warrant further study to determine if it is the geographic distribution of teams that facilitates emergent leadership behaviors – rather than computer mediation.

SRI LANKA DATA	QUADRANT IV								QUADRANT I							
Behavior	**FACILITATOR**				**MENTORING**				**INNOVATOR**				**BROKER**			
OVERALL	Time1	Time2	Time3	Time4	Time1	Time 2	Time 3	Time4	Time1	Time2	Time3	Time4	Time1	Time 2	Time 3	Time4
p-value (1-tailed)	0.36	0.23	0.31	0.46	0.20	0.47	0.33	**0.09**	**0.04**	0.17	0.17	N/A	**0.00**	**0.02**	0.19	0.39
Mean low performers	2.36	1.36	1.27	0.73	2.18	1.27	0.73	**0.36**	**0.00**	0.00	0.09	0.00	**0.18**	**0.27**	1.27	0.36
Mean high performers	2.69	1.77	1.46	0.69	1.69	1.31	0.92	**0.85**	**0.23**	0.15	0.00	0.00	**1.08**	**1.00**	1.69	0.31
CONCENTRATED LEADERSHIP																
p-value (1-tailed)	0.18	0.22	0.18	0.47	0.22	0.46	0.48	**0.08**	**0.04**	0.17	0.17	N/A	**0.00**	**0.01**	0.44	0.39
Mean low performers	1.17	0.82	0.94	0.64	1.21	1.00	0.64	**0.27**	0.00	0.00	0.09	0.00	**0.09**	**0.18**	1.09	0.36
Mean high performers	1.46	1.00	1.15	0.62	1.00	1.04	0.62	**0.58**	**0.23**	0.15	0.00	0.00	**1.00**	**0.81**	1.04	0.31
SHARED LEADERSHIP																
p-value (1-tailed)	0.44	0.43	0.44	0.39	0.23	0.42	0.22	**0.08**	**0.04**	0.17	0.17	N/A	**0.05**	**0.08**	**0.06**	0.39
Mean low performers	0.98	0.56	0.36	0.17	0.77	0.38	0.15	**0.09**	0.00	0.00	0.02	0.00	**0.07**	**0.09**	**0.28**	0.06
Mean high performers	1.06	0.62	0.39	0.15	0.59	0.33	0.26	**0.24**	**0.05**	0.03	0.00	0.00	**0.23**	**0.26**	**0.61**	0.05
Behavior	**MONITOR**				**COORDINATOR**				**DIRECTOR**				**PRODUCER**			
OVERALL	Time1	Time2	Time3	Time4	Time1	Time 2	Time 3	Time4	Time1	Time2	Time3	Time4	Time1	Time 2	Time 3	Time4
p-value (1-tailed)	**0.05**	0.39	0.27	0.30	0.33	0.16	**0.07**	0.24	0.49	0.24	0.22	0.25	**0.02**	0.40	0.31	**0.06**
Mean low performers	**3.09**	3.73	1.55	1.18	3.64	2.27	**1.45**	2.00	2.91	2.91	2.64	1.64	**2.64**	1.82	1.73	**0.82**
Mean high performers	**4.69**	3.46	1.85	1.46	4.23	3.00	**2.46**	1.54	2.92	2.31	1.85	1.15	**4.38**	2.00	2.00	**1.54**
CONCENTRATED LEADERSHIP																
p-value (1-tailed)	**0.10**	0.38	**0.09**	0.40	0.16	0.45	0.48	0.42	0.45	0.15	0.26	0.28	**0.01**	0.11	0.24	0.22
Mean low performers	**1.27**	1.53	**0.86**	0.76	1.32	1.36	1.09	1.02	1.26	1.13	0.99	0.85	**1.29**	0.82	0.91	0.64
Mean high performers	**1.68**	1.46	**1.19**	0.82	1.63	1.32	1.08	0.96	1.22	1.49	1.27	0.69	**1.84**	1.21	1.04	0.79
SHARED LEADERSHIP																
p-value (1-tailed)	**0.07**	0.37	0.31	0.38	0.42	**0.07**	**0.02**	0.25	0.47	*0.08*	*0.08*	0.20	**0.05**	0.44	0.23	**0.05**
Mean low performers	**1.50**	1.98	0.53	0.45	2.09	**0.82**	**0.43**	0.85	1.44	*1.56*	*1.66*	0.94	**1.15**	0.83	0.61	**0.22**
Mean high performers	**2.85**	1.73	0.66	0.53	2.28	**1.43**	**1.18**	0.59	1.40	*0.76*	*0.57*	0.38	**2.31**	0.77	0.91	**0.73**
	QUADRANT III								QUADRANT II							
Legend: Bold = significant relationship; Italics = significant in opposite of hypothesized direction / uninterpretable																

Table 5: New Study Results

Directive Leadership

Hypothesis 2 argued that the directive leadership style – defined in terms of guiding participation and seeking compliance with directions for accomplishing assigned tasks (Bass et al. 1975; Kahai et al. 2004) – would provide the biggest differences in high- versus low-performing teams. While true for the Carte et al. (2006) study, our teams did not demonstrate this. Essentially, directive leadership implies that the leader plays an active role in problem solving and decision making and expects the team to be guided by his/her behavior. This difference in results may be attributable to the differences in culture between the US and Sri Lanka. House's cross-cultural leadership theory asserts that expected, accepted and effective leader behavior varies by cultures (House et al. 1997). One of the more well-known culture dimension frameworks is Hofstede's culture dimensions: power distance, individualism vs. collectivism, masculinity vs. femininity, uncertainty avoidance, and long vs. short term orientation (Hofstede, 1980). Using Hofstede's (1980) dimensions of national culture, Sri Lankan culture has been characterized as high on power distance, high on uncertainty avoidance, collectivist (rather than individualist) and nurturing (versus assertive) (Weathersby 1993). High power distance and uncertainty avoidance create resistance to empowerment and self-managed teams; collectivism facilitates empowerment as does the nurturing

dimension (Randolph and Sashkin 2002). However, more nurturing cultures can lead to a greater focus on team development and not enough on team performance. Hence, the heightened focus on directive leadership in the US sample but less in the Sri Lankan sample.

Another explanation for this finding may be related to task. Carte, et. al, (2006) argued that the linkage between directive leadership and performance may be moderated by task structure with more structured tasks producing a stronger directive leadership to performance relationship. Their task, a database development project, was more structured than ours. The database project task had phased deliverables that required more structure to complete both due to the dependencies of each deliverable and the technology focus.

Alternatively, one might argue that the strength of behaviors in Quadrant II by the US-based teams and Quadrant III by the Sri Lanka-based teams (while not statistically related to high-performance) may highlight a potential distinction of two different directive leadership behaviors (Carte et al. (2006) labeled both quadrants as directive leadership). The shared focus on stability in these quadrants relates the directive leader's desire to mesh internal team actions with external task requirements (Kahai et al. 2004). However, Quadrant II has been defined as *directive and goal oriented*, while Quadrant III was described as *conservative and cautious* (Quinn, 1984), consistent with other conceptualizations of directive leadership (c.f., Cruz et al. 1999; Kahai et al. 2004). Interestingly, both the US and Sri Lankan data reveal large amounts of directive leadership in the high-performing teams, the U.S. study saw more behaviors in Quadrant II, while the Sri Lanka study saw more behaviors in Quadrant III[2]. So this may be some validation of Quinn's (1984) descriptions of goal oriented directive leadership (U.S.) versus conservative and cautious directive leadership (Sri Lanka). It is worth noting, however, that both samples contained limited-term, project-focused teams. As such, this finding is clearly practical in nature – short term teams must engage in behavior that focuses on task accomplishment and compliance with their directive.

Transformative Leadership

It is also noteworthy that the high-performing Sri Lanka-based teams engaged in more Quadrant I behaviors than the US-based teams. The roles in Quadrant I focus on flexibility and external factors. Burns' (1978) described transformational leadership as inspiring commitment and sacrifice in each follower and seeking to engage "the full person of the follower". Transformational leadership has been operationalized with questions focused on (1) the task, (2) far-reaching contributions, and (3) importance of questioning assumptions and originality (Hoyt and Blascovich 2003). The behaviors in this quadrant (broker and innovator), focused on encouraging and facilitating change and maintaining external legitimacy. Again, this may be due to differences in culture – specifically the more nurturing element of the Sri Lankan culture.

Concentrated and Shared Leadership Behaviors

Hypotheses 3a and 3b were focused on concentrated (the number of times each individual team member engaged in a behavior) and shared (the number of team members who engaged in a behavior) leadership behaviors respectively. Carte et al. (2006) found support for both hypotheses. Our results do not support H3a (shared leadership behavior); we did find significant differences for some shared behaviors, namely broker and producer. Our results support H3b (concentrated leadership behaviors). Fundamentally, these results may be attributable to the differences in the task.

Prior work using the Leaderplex Model (Vilkinas and Cartan 2006) identified a two-factor solution that grouped facilitator, mentor and innovator as socially-oriented behaviors and broker, producer, director, coordinator and monitor as task-oriented behaviors. In both the previous study and our study, the preponderance of shared and concentrated leadership behaviors engaged in by high-performing teams were task-oriented. This is likely related to the time-constrained nature of the teams. However, our high-performing teams engaged in a much wider spectrum of task-oriented behaviors.

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[2] Shared director behavior (from Quadrant II) was also significant in the opposite of the direction hypothesized in Times 2 and 3. However, because the t-tests were conducted as 1-tailed (consistent with the original study) this result in not interpretable as a negative relationship.

The task in our study was far more interdependent. The previous study task, developing a database, had a "right answer." As such, it could have been completed (with enough time) by any one member alone. By definition, this makes it an intellective task (McGrath 1984; Straus 1999). In our study, the task required judgement (i.e., a case study that asks what the organization should do); as such, our high performing teams would have needed to engage in some consensus building. This makes it a judgement task requiring more interdependence (McGrath 1984; Straus 1999), and interdependent tasks rely more heavily on task-focused leadership (Burke et al. 2006).

Another explanation exists for the differences in results concerning H3a. The high-performing US-based teams in Carte et al.'s (2006) study exhibited significantly higher levels of shared monitor behavior, while the high-performing Sri Lanka-based teams exhibited higher levels of shared producer behavior. That is, the teams in our study showed less of an inclination to monitor and more of an inclination to produce. Given the collectivist, nurturing nature of the Sri Lankan culture, this might be generally indicative of a stronger sense of responsibility to the team in the Sri Lankan culture.

Impact of Time

Hypothesis 4 was focused on the question of when high-performing teams engage in leadership behaviors. Both studies support the importance of early leadership behavior. Our higher performing teams clearly demonstrated significant early leadership. Interestingly, they also demonstrated leadership later in their lifecycles in comparison to the previous study. One potential explanation for this is the nature of our teams. Because they are collocated, the duration of the project teams did not necessarily equate to the duration of their interaction. Some group development researchers have attempted to understand the temporal patterning of group interactions using a concept known as the "shadow of the future" (Axelrod 1984). The shadow of the future covers all expected future interaction and shared outcomes, with long shadows at the beginning of a team's lifecycle translating to greater effort and shrinking shadows as the endpoint approaches potentially leading to reduced efforts (Bouas and Arrow 1995). For virtual teams, previous research has suggested that the shadow of the future impacts team members' efforts to develop relational ties such that temporary VTs are less likely to do so than on-going VTs (Saunders and Ahuja 2006).

Time 1: The Beginning. The opening frame of both studies finds the high-performing teams engaging in specific behaviors, and the distribution (whether concentrated or shared) seems to have no impact on the importance of these behaviors. Two of these behaviors are shared between the two studies: producer and monitor, which are both associated with a directive theory of leadership. This is notable, because there is no other leadership behavior shared by the high-performing teams in both studies in any of the subsequent time periods. Therefore, the importance of directive leadership theory (or at least producer and monitor behaviors) early in the life of a team may well be universal.

In addition to these shared behaviors, there are also unique behaviors distinguishing the high-performing teams in both studies. In the U.S. study, high-performing teams engaged in a significantly higher number of facilitator behaviors, which are associated with participative leadership theory. In the Sri Lanka study, on the other hand, high-performing teams engaged in a significantly higher number of innovator and broker behaviors, both of which are associated with transformational leadership theory.

Time 2: Middle Game. In the second time frame of both studies, the distribution of leadership comes into play for the high-performing teams. Let's first consider the U.S. study. In Time 1, the high-performing teams were marked by a significantly higher number of producer, monitor, and facilitator behaviors, and this was true regardless of the distribution; whether shared, concentrated, or based on overall behavior count, in each case these three leadership behaviors were exhibited at a higher level by the high-performing teams. In Time 2, however, some separation appears: high performing teams still engaged in higher numbers of producer and monitor behavior (regardless of distribution), but the facilitator behavior which showed up in all distributions in Time 1 is now only significantly different from low-performing teams when concentrated.

The importance of the leadership distribution also had an impact on the high-performing teams in the Sri Lanka study. In Time 1, these teams were marked by a significantly higher number of producer, monitor, innovator, and broker behaviors, and this was true regardless of the distribution. In Time 2, however, these teams engaged in higher numbers of broker behavior (regardless of distribution), but also in a

higher amount of shared coordinator behavior, as well as a lower amount of shared director behavior. It also seems worth noting that of the four leadership behaviors that marked high-performing teams from this study in Time 1, only one remains significantly different in Time 2: broker.

Time 3: Middle Game – Continued. In the third time frame for each study, the distribution of leadership behaviors continues to impact the results. In the U.S. study, high-performing teams were not marked by significantly higher counts of any particular leadership behavior, nor by higher amounts of any shared leadership behavior. They were, however, marked by higher amounts of concentrated producer (a holdover from previous time periods) and broker (new in this time period) behaviors.

In the Sri Lanka study, high-performing teams were marked by higher counts of coordinator behavior, concentrated monitor behavior, shared broker behavior, and shared coordinator behavior. As in time 2, these teams were also marked by lower counts of shared director behavior.

Time 4: End Game (Race to the Finish / Shadow of the Future). In the final time frame, there appears to be a shift in leadership behaviors amongst high-performing teams in both studies. In the U.S. study, no concentrated leadership behaviors were higher for these teams; they were instead marked by higher levels of director behavior (count and shared) and lower levels of facilitator behavior (count and shared).

In the Sri Lanka study, high-performing teams were marked by higher levels of producer behavior (count and shared) and, for the first time, mentoring behavior (regardless of distribution). The shift in leadership behaviors exhibited by high-performing teams in both studies may well have been brought on by a team mentality of racing toward the finish line. That is, these teams were well aware that they would not be working together as teams in the future, so they may have been inclined to behave differently than they would otherwise.

Conclusion

Carte et al. (2006) developed a good first step toward understanding emergent leadership and its role in team performance for geographically distributed teams engaging in computer mediated communication. Our results suggest that a few of their findings appear to be robust across very different contexts. High-performing teams in both studies were marked by higher incidences of concentrated leadership behaviors than low-performing teams. It seems to be important that teams have an established leader. Additionally, high-performing teams in both studies engaged in more instances of producer and monitor behaviors early on that low-performing teams, regardless of the distribution of these behaviors amongst members. Thus, some characteristics of high-performing virtual teams seem to hold true regardless of the context.

However, our results also suggest that some of Carte et al.'s (2006) findings are very context specific. The fact that our teams were collocated seemed to reduce the dependence of their performance on the overall number of leadership behaviors exhibited. Further, the judgement tasks that our teams were given seemed to reduce the importance of shared leadership behaviors to overall team performance. Finally, the Sri Lankan culture appeared to influence the style of leadership engaged in by members of high-performing teams, most notably through an increased use of transformational leadership.

Our study demonstrates that in addition to the mode of communication (i.e., face-to-face versus computer mediated) the dispersion of team members (i.e., distributed versus collocated), task, and culture all seem to impact the nature of effective leadership behaviors. This both suggests the need for and paves the way for a more nuanced understanding of emergent leadership behaviors in self-managed virtual teams.

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