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Impact of self-leadership and shared leadership on the performance of virtual R&D teams

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ABSTRACT

Managing geographically dispersed R&D teams remains a complex task. Contemporary leadership styles in global virtual teams is a pertinent—yet, unexplored—research topic, which can help achieve greater workplace effectiveness. The purpose of this study is to analyze the effects of self and shared leadership on the performance of virtual R&D teams. Trust, potency, and commitment mediate the influence of the interplay of self and shared leadership and the performance of virtual R&D teams. The results show that self-oriented leaders need potency and commitment to extract higher performance levels from virtual R&D teams. In addition, trust is a necessary construct to achieve shared leadership through self-leadership. The findings enrich the literature on leadership and virtual teams. They have practical implications for managers and firms implementing intra and/or inter-organizational arrangements within virtual R&D teams.

1. Introduction

R&D teams are increasingly becoming virtual (Fernandez & Jawadi, 2015). Increased competition has led international organizations, especially those entailing inter-firm networks and knowledge-intensive R&D programs (Del Giudice & Maggioni, 2014), to extensively use virtual teams, to achieve competitive advantage and resource efficiency (Ebrahim, 2015). For instance, 94% of the world's 1000 largest innovators conduct R&D programs on a global scale (Jaruzelski, Schwartz, & Staack, 2015).

ICT is used to conduct R&D activities at any place irrespective of the firms' locations, international partnerships, and knowledge practices (Jaruzelski et al., 2015). Collaboration among R&D teams based in different places alleviate the challenges of R&D internationalization (Hurtado-Torres, Aragón-Correa, & Ortiz-de-Mandojana, 2018). Virtual R&D teams involve a high level of virtual presence, with all team members working from various locations and mostly communicating via computer-mediated technologies (Orhan, 2017). They were initiated to attract, access, and use global talent pools (Ebrahim, 2015). Virtual structures have become a viable option (Pangil & Chan, 2014), thanks to the emergence of new technologies, fostering extensive, lateral and cost-effective collaborations (Del Giudice, Della Peruta, & Maggioni, 2015), greater flexibility in organizations, and changes in corporate work life. Global virtual teams are sources of productivity, global knowledge, and best practice transfers (Pinjani & Palvia, 2013).

R&D teams conventionally consist of members who work together, are located in proximity, have frequent face-to-face communication, and coordinate their activities (Xiong, Chang, Scuotto, Shi, & Paoloni, 2019). However, the ICT boom reduced the need for firms to collocate R&D projects. Managing geographically dispersed R&D teams is a complex task due to differences in the roles and responsibilities of members, approaches to coordination, and performance assessments (Ambos, Ambos, Eich, & Puck, 2016). Building trust, fostering a team spirit, and encouraging tacit knowledge transfer are some of the challenges when managing global R&D teams (Pangil & Chan, 2014).

In virtual R&D team settings, digital and virtual tools can nurture proximities, but with some limitations. Virtual teams have a lower performance compared to face-to-face teams, especially for knowledge-intensive tasks. The features of the virtual context – dispersion of individuals, no physical proximity, ICT interfaces – challenge the way relationships among teams are managed (Fernandez & Jawadi, 2015). Difficulties in executing creative ideas can be observed because of issues

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in virtual interactions related to concealing potential knowledge hiding (Xiong et al., 2019). Global virtual teams face several issues due to geographic barriers, time, language, cultural differences, and interpersonal relationships (Pinjani & Palvia, 2013), challenging their leadership and performance. Nevertheless, research on how the organization and tasks of global R&D teams influence their performance remain scarce (Hurtado-Torres et al., 2018).

Past studies have explored global teams from the perspectives of distance (Ambos & Håkanson, 2014) and configuration (Ambos et al., 2016). Some analyzed the effect of diversity of global virtual teams on mutual trust (Pangil & Chan, 2014), knowledge sharing and flows (Behrend & Erwee, 2009), effectiveness of teams (Pinjani & Palvia, 2013), and on enabling prior knowledge (Batarseh, Usher, & Daspit, 2017). Leadership, work structure, and communication are some of the major factors leading to high-quality relationship-building in virtual R&D teams and improvement in team performance (Fernandez & Jawadi, 2015).

Research suggests that leadership approach cannot be "one-size-fits-all" and it is contingent on situations, environments, and organizations (Singh, Del Giudice, Tarba, & De Bernardi, 2019). Past research examined the roles of inspirational, transactional, and transformational leaders in virtual team setting and their impact on performance (Huang, Kahai, & Jestice, 2010). Shared leadership and self-leadership (Bligh, Pearce, & Kohles, 2006) received increasing attention as novel approaches for analyzing teams. Self-leaders lead themselves to accomplish tasks, and shared leaders step forward or backward depending on the situation, seeking enhanced team performance (Manz et al., 2013; Stewart, Courtright, & Manz, 2011).

Most studies on novel leadership approaches are conceptual in nature. Hoch and Dulebohn (2017) explored the role of team personality compositions as predictors of emergent and shared leadership and their impact on virtual team performance. Liao (2017) suggested a theoretical model exploring the influence of task and relationship-oriented leadership behavior on processes and outcomes in virtual teams. Zhu, Liao, Yam, and Johnson (2018) proposed a conceptual framework integrating global virtual team performance, shared leadership, and trust. To the extent of our knowledge, only the study by Hoch and Kozlowski (2014) used a field sample of virtual teams and emphasized the positive impact of shared leadership on virtual team performance. In summary, there is much that remains to be explored about the effectiveness of leadership approaches in global virtual R&D teams.

This paper addresses the call to advance the studies on leadership and its central role in the functioning of global virtual R&D teams (Mockaitis, Zander, & De Cieri, 2018; Gilson, Maynard, Jones Young, Vartiainen, & Hakonen, 2015). Specifically, this study investigates the influence of self and shared leadership on the performance of virtual R&D teams in response to the call for further studies on shared leadership (Singh et al., 2019) and other leadership approaches in virtual team setting (Hoch & Kozlowski, 2014). Additionally, using a survey on a field sample of real-world virtual R&D teams, it advances the understanding of the mediating mechanisms, namely trust, potency, and commitment, in the relationship between leadership and the performance of virtual teams (Hoch & Kozlowski, 2014).

The paper is structured as follows. Section 2 presents the theory and hypotheses. Section 3 provides the empirical analysis. Section 4 discusses the findings and exposes research implications and limitations. Section 5 concludes the paper.

2. Background theory and hypotheses

2.1. Leadership approaches and performance of virtual R&D teams

Virtual teams are defined as "*a group of geographically and organizationally dispersed coworkers that were assembled using a combination of telecommunications and information technologies to accomplish an organizational task*." (Townsend, DeMarie, & Hendrickson, 1998). They have "*a shared sense of purpose, with joint responsibility for outcomes.*" (Berry, 2011).

Virtual settings have removed geographic barriers and introduced continuity of time, space, and organizational boundaries (Behrend & Erwee, 2009). Global virtual teams comprise qualified experts from various locations worldwide and collaboration through virtual communication technologies to accomplish complex tasks (Pangil & Chan, 2014). They eliminate geographic and temporal separations, while achieving competitive advantage (Ahuja, 2010).

Several studies highlighted the key components of virtual teams, such as geographic dispersion, use of technology, and common purpose to accomplish particular tasks (Gibson, Huang, Kirkman, & Shapiro, 2014). However, the apparent virtues of building virtual teams in organizations exceed the understanding of the dynamics and unique characteristics of virtual teams (Behrend & Erwee, 2009). Nonetheless, implementing virtual teams does not always yield high-performance outcomes (Berry, 2011).

Unlike traditional collocated teams, virtual R&D teams face geographical and temporal differences that hinder effective interaction, information sharing, work quality, efficient time management, and synchronous decision making (Gazor, 2012). They also face cultural differences due to members' backgrounds and organizational diversity (Muethel & Hoegl, 2010). Finally, technologies can create misunderstandings and miscommunications among members (Ebrahim, 2015).

Besides geographical and temporal differences, team leadership is another factor that affect virtual teams and explain why they should be managed differently compared to traditional teams (Misiolek & Heckman, 2005). Hoegl and Muethel (2016) acknowledged the limitations of the effectiveness of virtual team leadership. Virtual R&D teams require alternative leadership approaches, rather than traditional face-to-face leadership (Hoch & Kozlowski, 2014). Leaders in virtual environments need to integrate and maximize available resources to reach virtual team goals (Fernandez & Jawadi, 2015). Empowerment and delegation are key for effective virtual team management (Hertel, Geister, & Konradt, 2005), changing the team leader's role from traditional controlling to coaching of members, influencing teams, and moderating functions (Kayworth & Leidner, 2002).

The contemporary approach views leadership as a process where one single leader plays only one part in the process (Day & Harrison, 2007). In contrast to the traditional perspective on leadership, which focused on processes to influence others, self-leadership and shared leadership are two leadership perspectives that focus on influencing of the followers (Carte, Chidambaram, & Becker, 2006). Self-leadership is a process through which people achieve self-direction and self-motivation necessary to perform a task/mission (Houghton & Neck, 2002). Shared leadership is a dynamic, interactive influencing process among peers, with the objective of achieving personal, team, and/or organizational goals (Singh et al., 2019). It is especially effective in complex environments (Wang, Waldman, & Zhang, 2014), such as virtual teams.

Self-leadership allows individuals to control their own behavior, influencing and leading themselves through the use of specific sets of behavioral and cognitive strategies (Manz et al., 2013). This, in turn, affects self-efficacy, leading individuals to believe that they can achieve their goals. Past studies have investigated virtual team performance in terms of effectiveness (i.e., through effective collaboration, timely response, and team satisfaction) and business and individual outcomes (Gibson et al., 2014). The self-leadership approach can be beneficial for a team where individuals rarely meet or they work from distant locations (Houghton & Neck, 2002). As the leader and team members work remotely, the leaders' influence can decrease (Gazor, 2012). Moreover, virtual R&D team leaders are unable to physically observe their team members' activities and performance. Hence, self-leading team members are a good fit for work in a virtual environment (Siebdrat, Hoegl, & Ernst, 2009). Additionally, virtual work environments increase the ability of individuals to be self-leaders (Carte et al., 2006). Overall, self-

leadership should be encouraged among virtual team members who can lead themselves, increasing leadership, knowledge sharing, and individual performance (Xue, Bradley, & Liang, 2011), thus leading to collective team performance. Therefore, we propose that:

H1a: Greater level of self-leadership positively influences the performance of virtual R&D teams.

Shared leadership encourages individuals to step forward to lead others or to step back for others to lead, depending on the situation (Stewart et al., 2011). This includes the formal team leader, who shares leadership with team members (Hoegl & Muethel, 2016). It involves the distribution of the influence of leadership across different individuals (Carson, Tesluk, & Marrone, 2007), who can assume the role of influencer (leader) or influenced (follower) in the team due to different tasks and responsibilities. In the context of virtual teams, such leadership starts with a leader who accepts the environment of shared leadership and adjusts to become a team member (Hoegl & Muethel, 2016). Previous research has investigated the impact of shared leadership on productivity (Erkutlu, 2012), problem-solving capabilities, and team performance (Manz et al., 2013). Shared leadership enhances the effectiveness (Hmieleski, Cole, & Baron, 2012) of R&D teams by increasing their social and intellectual capital, including shared and collective intelligence (Kudyba, Fjermestad, & Davenport, 2020), knowledge management and skills (Singh, 2008), and team information processing and learning (Day & Harrison, 2007). As a form of participative leadership, shared leadership is a valuable predictor of team performance (Singh et al., 2019) through diverse, highly skilled, and knowledgeable individuals (Hoch, 2013) completing complex tasks (Wang et al., 2014). Shared leadership is more effective in contexts of change and competitive environments (Manz et al., 2013), such as virtual R&D teams. Better performance of virtual teams may result from team members focusing on outcomes and having a shared vision and common goal (Wang et al., 2014). Therefore, we propose that:

H1b: Greater level of shared leadership positively influences performance of virtual R&D teams.

2.2. Role of trust, potency, and commitment

Academics stressed the influence of trust, potency, and commitment on team performance (Houghton & Neck, 2002; Muethel & Hoegl, 2010).

Trust is the willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action necessary to the trustee (Mayer, Davis, & Schoorman, 1995). Past studies have examined trust in the context of virtual team leadership and performance (Bennett & Bierema, 2010). Trust is paramount in leading effective virtual teams. It fosters virtual team relations, resulting in effective communication, knowledge sharing, and better team effectiveness (Pangil & Chan, 2014), while lowering distrust and knowledge hiding effects among R&D teams (Xiong et al., 2019).

Virtual team members adopting a self-leadership strategy tend to have greater individual trust (Chowdhury, 2005). Developing trust during the formation of virtual teams enhances performance, individual members committed to work build trust faster, especially in virtual team environments (Gazor, 2012). Some studies view trust as an antecedent to shared leadership (Carson et al., 2007), while others consider it as an outcome (Drescher, Korsgaard, Welpe, Picot, & Wigand, 2014), both resulting in improved performance. Trust encourages individuals to offer leadership, leading to higher team performance (Carson et al., 2007). Bligh et al. (2006, p.307) state that, "*higher levels of cognitive-based trust, influenced in part by team members' self-leadership strategies, will be more predictive of shared leadership.*" Therefore, we propose that:

H2: Greater level of trust mediates the relationship between self-leadership and shared leadership.

Potency refers to fundamental beliefs about the capabilities of the team across tasks and contexts (Guzzo, Yost, Campbell, & Shea, 1993). Understanding the team's background, skills, and experience generates individual potency among team members. Individual potency leads to overall performance (Avolio, Sivasubramaniam, Murry, Jung, & Garger, 2003). From the perspective of leadership, as team members get to know each other's expertise, shared leadership is developed (Mathieu, Heffner, Goodwin, Salas, & Cannon-Bowers, 2000). Further, team members' belief in each other's ability to complete tasks increases the effectiveness of shared leadership. With self-leadership, individual potency evolves into team potency (Bligh et al., 2006), which facilitates information and knowledge flow (Behrend & Erwee, 2009) and prevents misinterpretation (Bergiel, Bergiel, & Balsmeier, 2008), thereby enhancing the level of leadership in virtual R&D teams (Bligh et al., 2006).

Therefore, we propose that:

H3a: Greater level of potency positively influences performance of virtual R&D teams.
H4a: Greater level of potency mediates the relationship between self-leadership and performance of virtual R&D teams.
H4b: Greater level of potency mediates the relationship between shared-leadership and performance of virtual R&D teams.

Prior research identified several forms of commitment within the work environment. For instance, effective leaders can capitalize on personal development, collective effort, and employee commitment (Yahaya & Ebrahim, 2016). The drive and energy of knowledge leaders is paramount to building team members' commitment (Singh, 2008). Hence, influencing all team members for collective commitment and better performance (Yahaya & Ebrahim, 2016) can benefit virtual teams. Additionally, individual commitment from a team sharing a purpose increases the willingness of team members to share leadership responsibilities (George, 2000). Finally, in a virtual environment and given the complexity of virtual team, commitment and shared leadership prove to be crucial (Manz et al., 2013). Therefore, we propose that:

H3b: Greater level of commitment positively influences performance of virtual R&D teams.
H4c: Greater level of commitment mediates the relationship between self-leadership and performance of virtual R&D teams.
H4d: Greater level of commitment mediates the relationship between shared-leadership and performance of virtual R&D teams.

Fig. 1 presents the conceptual models that were tested.

3. Empirical analysis

3.1. Data collection and sample

To test the hypothesized relationships, a self-report survey was used to collect data. We approached organizations that use virtual teams. The target sample includes individuals working in virtual R&D team projects. To determine the eligibility of participants, the following criteria were set: individuals who worked in a virtual team in the past 24 months with any degree of virtuality, size, role, and industry. A questionnaire was distributed on an online platform (SurveyGizmo) to 485 participants working in a corporate setting. Overall, 207 respondents completed the survey (Response rate = 42.7%) and 154 responses were considered valid. The remaining participants had no virtual team experience. We used the snowball sampling technique, a method that increases the response quality as honest opinions are collected using trusted referral chains (Atkinson & Flint, 2001). It facilitated the access to virtual team members who could not be reached otherwise.

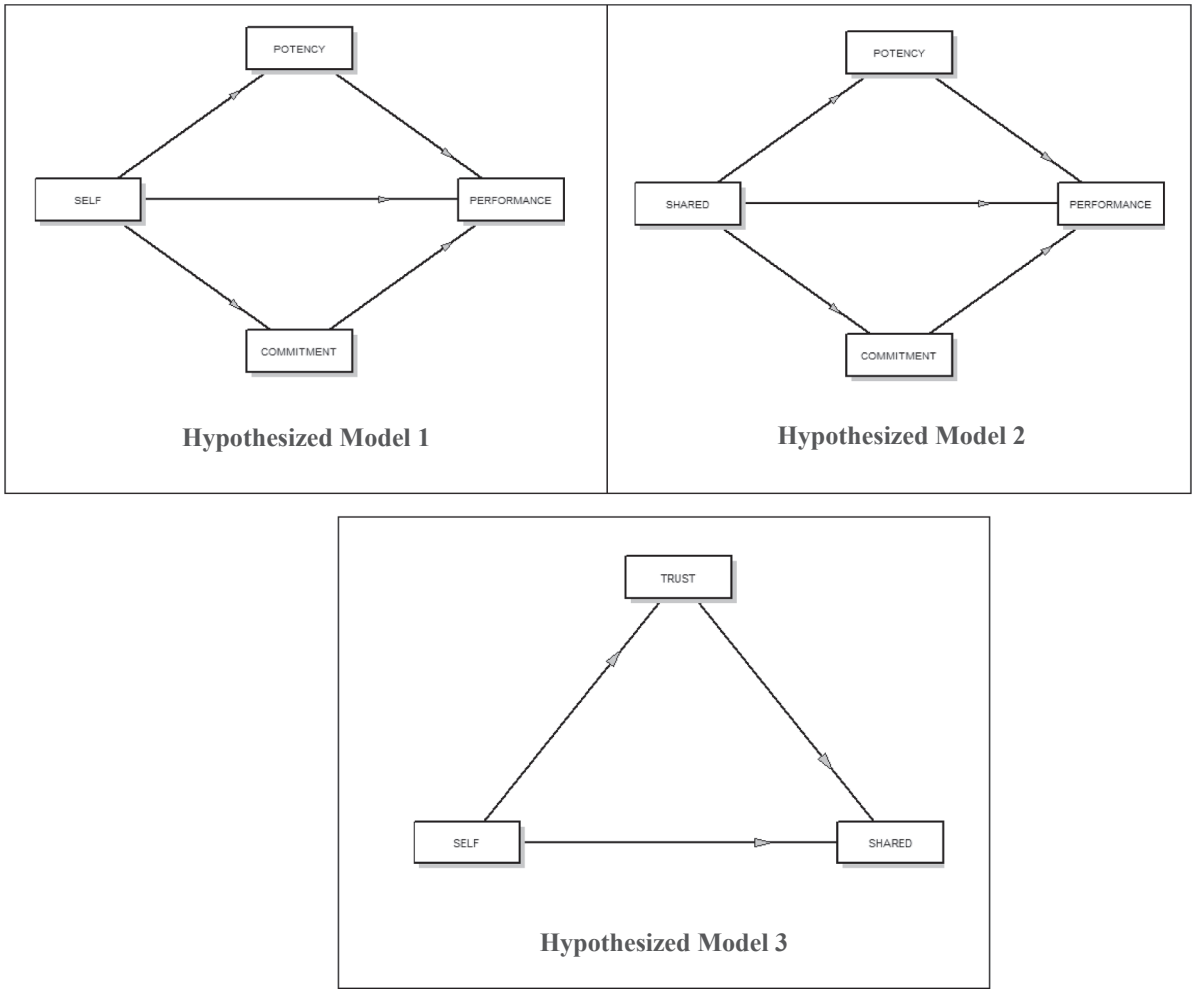

Fig. 1. Conceptual model.

3.2. Measures and data analysis

We asked respondents to evaluate their self-leadership and shared leadership skills, trust in team members, team potency, commitment to the team, and the perceived performance of the virtual R&D teams they work in. Each item is assessed on a 5-point Likert scale as they were measured in the original studies. We used the structural equation modeling (SEM) technique to assess the direct, indirect, and total effects of the constructs that were investigated. SEM is a powerful multivariate statistical technique as it allows researchers to build complex linear models with causal relations (Ho, Stark, & Chernyshenko, 2012). We empirically tested the relationship between leadership styles, commitment, team potency, trust, and team performance as hypothesized above. The details of the measurement variables and the questionnaire are provided in Appendix 1. The internal consistency (Cronbach's alpha) is high for all variables (Appendix 1) except for trust, which remained low (0.62) but still acceptable (Hair, Black, Babin, & Anderson, 2010). To further ensure reliability (Lance, Butts, & Michels, 2006), we conducted a principle component analysis (PCA), whose results indicated that all factor loadings were between 0.71 and 0.82 using Varimax rotation.

3.3. Findings

Most respondents are male (62.99%) with a master's degree (56.49%) or a bachelor's degree (30.52%). They mainly work in business consulting (35.06%), computer science and engineering (28.57%), and non-profit organizations including those in education, government, and healthcare sectors (18.18%). Most respondents (82.47%) already had previous virtual team experience. In their current virtual teams, 52.60% worked as a team member, while 43.51% worked as virtual team leader. Additionally, 9.74% had a full (100%) virtual team structure, 68.18% functioned as a hybrid virtual team, and 7.79% claimed that their teams were virtual only at the beginning. These virtual teams were mostly based in Thailand (59.09%) and the US (37.01%), with some in other places (3.90%).

We used an open source and free statistical software jamovi v.1.0.6. Table 1 presents the descriptive statistics and the correlation matrix. All variables are significantly correlated at the 0.01 significance level, thus confirming the directional relationships between the variables in our models as hypothesized.

We ran additional confirmatory and explanatory factor analyses to obtain further evidence of reliability and validity (Table 2). Convergent validity is satisfied as confirmatory factor analysis results were found to be significant ($\chi^2 = 1645$, df = 930, $\chi^2/df = 1.77 < 3$, $p < 0.001$). The fit measures of the confirmatory factor analyses also yielded satisfactory results (comparative fit index [CFI] = 0.85, Tucker-Lewis index [TLI] = 0.84, root mean square of error approximation, [RMSEA] = 0.07). To address the common method bias, we applied Harman's single factor test using the principle axis extraction method. The total variance explained score remained at 0.437, which is below the 0.5 threshold, confirming that the threat of common method bias is controlled for. With measurement equivalence supported, we ran multiple-group path analyses to test the hypothesized mediation models using self-leadership

Table 1
Correlation matrix.

Measurement	Mean	SD	SF	SH	TST	COM	POT	PERF
Self-leadership (SF)	3.67	0.798	[0.88]					
Shared leadership (SH)	3.92	0.775	0.723*	[0.95]				
Trust (TST)	3.15	0.914	0.401*	0.421*	[0.62]			
Commitment (COM)	3.82	0.950	0.600*	0.793*	0.511*	[0.87]		
Team potency (POT)	3.80	0.867	0.645*	0.847*	0.391*	0.738*	[0.88]	
Team performance (PERF)	3.77	1.069	0.457*	0.691*	0.374*	0.664*	0.649*	[0.87]

*Correlation is significant at the 0.01 level (2-tailed), N = 154.
Diagonals in brackets indicate the Cronbach's alpha reliability scores.

Table 2
Goodness of fit statistics of measurement models.

Measurement model	χ^2(df)	CFI	TLI	RMSEA	SRMR
Model 1 (SF as IV)	391.96 (203)	0.905	0.892	0.078	0.061
Model 2 (SH as IV)	900.93 (489)	0.885	0.876	0.074	0.051
Model 3 (TST as mediator SF->SH)	844.17 (461)	0.865	0.855	0.073	0.061

*Trust dimension removed. IV = Independent variable, CFI = Comparative Fit Index; TLI = Tucker Lewis Index; RMSEA = Root Mean Square Error of Approximation; SRMR = Standardized Root Mean Square Residual.

and shared leadership as independent variables.

We built two mediation models using trust, commitment, and team potency as mediators (Fig. 1). To secure mediation analyses, it is crucial to confirm that the mediators are not only correlated to variables in the measurement models, but also show statistical significance in predicting outcome variables (Preacher & Hayes, 2008). Thus, we tested additional models after removing the trust dimension. With measurement equivalence supported, we ran multiple-group path analyses to test the hypothesized mediation models using self-leadership and shared leadership as independent variables separately.

Overall, the two types of leadership including potency and commitment positively influence the performance of virtual R&D teams. The total effects of leadership styles were found to be significant, thus both models can be accepted. Model 1 ($\beta = 0.457$; $p \leq 0.001$) and model 2 ($\beta = 0.691$; $p \leq 0.001$) are statistically significant (Table 3).

The direct effect of self-leadership on performance is not statistically significant and it is negative ($\beta = -0.023$) (model 1). H1a is not supported. The direct effect of shared leadership on performance is statistically significant and positive ($\beta = 0.329$; $p \leq 0.001$) (model 2). H1b is supported.

In the self-leadership model (model 1), the potency effect is statistically significant for the indirect effect ($\beta = 0.379$; $p \leq 0.001$) between self-leadership and performance. In the shared-leadership model (model 2), the potency effect is not statistically significant for the indirect effect ($\beta = 0.136$) and the component effect ($\beta = 0.161$) between shared leadership and performance. Thus, H3a is partially supported.

In the self-leadership model (model 1), the commitment effect is statistically significant and positive for the indirect effect ($\beta = 0.436$; $p \leq 0.001$) between self-leadership and performance. In the shared-leadership model (model 2), the commitment effect is also statistically significant and positive for the indirect effect ($\beta = 0.286$) between shared leadership and performance. Thus, H3b is supported.

The Baron and Kenny (1986) steps for mediation (IV → DV; mediator → DV; IV and mediator → DV) show that greater level of potency mediates the relationship between self-leadership and performance of virtual R&D teams. Thus, H4a is supported. However, greater level of potency does not mediate the relationship between shared-leadership and performance. Hence, H4b is not supported. As regards, the second set of mediation, greater level of commitment mediates the relationship between self-leadership and performance of virtual R&D teams and between shared-leadership and performance of virtual R&D teams. Therefore, H4c and H4d are supported.

To better understand the relationship between self-leadership and shared leadership, we tested another mediation model (model 3) highlighting the role of trust on virtual team (Table 4).

4. Discussion

Virtual R&D teams face numerous challenges such as team cohesion, adaptability of communication technologies, and time constraint (Ahuja, 2010). Leading such teams and tracking their performance is cumbersome because of lack of face-to-face interactions and distance between members (Fernandez & Jawadi, 2015). This study analyzed the role of self and shared leadership with respect to trust, potency, and commitment as mediating mechanisms in enhancing the performance of

Table 4
Mediation analysis of hypothesized models.

Type	Effect	Estimate	SE	β
Indirect	SELF ⇒ TRUST ⇒ SHARED	0.061	0.026	0.063*
Component	SELF ⇒ TRUST	0.459	0.085	0.401***
	TRUST ⇒ SHARED	0.133	0.050	0.156**
Direct	SELF ⇒ SHARED	0.641	0.058	0.661***
Total	SELF ⇒ SHARED	0.702	0.054	0.723***

Note: ***≤0.001; **≤0.01; *≤0.5.

Table 3
Mediation analysis of hypothesized models.

Indirect and total effects		MODEL 1 (X = SELF)			MODEL 2 (X = SHARED)		
Type	**Effect**	**Estimate**	**SE**	**β**	**Estimate**	**SE**	**B**
Indirect	**X** ⇒ POT ⇒ PERF	0.311	0.071	0.247***	0.187	0.123	0.136
	X ⇒ COM ⇒ PERF	0.332	0.068	0.262***	0.312	0.102	0.227**
Component	**X** ⇒ POT	0.701	0.067	0.645***	0.948	0.048	0.847***
	POT ⇒ PERF	0.443	0.092	0.379***	0.198	0.129	0.161
	X ⇒ COM	0.714	0.077	0.600***	0.972	0.060	0.793***
	COM ⇒ PERF	0.464	0.080	0.436***	0.321	0.103	0.286**
Direct	**X** ⇒ PERF	−0.030	0.116	−0.023	0.453	0.176	0.329**
Total	**X** ⇒ PERF	0.613	0.096	0.457***	0.953	0.081	0.691***

Note: ***≤0.001; **≤0.01; *≤0.5.

virtual R&D teams.

Although several studies recommended studying both leadership approaches (Bligh et al., 2006), research focusing on self and shared leadership for enhancing the performance of virtual R&D teams are still scare. Empirical evidence showed that self-leadership, including self-goal setting, visualizing successful performance, and self-observation, has no impact on the performance of virtual R&D teams, contradicting previous research (Stewart et al., 2011; Manz et al., 2013). However, shared leadership, including shared vision, culture of shared leadership, delegation, and collaboration, positively contributes to enhancing the performance of virtual R&D teams, concurring with the conclusions of Kudyba et al. (2020) that leaders contribute to the positive work outcomes. Past research suggested that self-leadership is a prerequisite for team leadership and shared leadership for self-leadership (Neck & Houghton, 2006). In global virtual R&D teams, shared leadership may suffice for achieving better performance of virtual R&D teams. Self-leadership, which is focused on the self, requires additional mediating mechanisms. In line with past research (Bligh et al., 2006), a combination of both leadership approaches ensures better team performance. Functions and tasks of virtual R&D teams can be accomplished by distributing leadership to the right team members based on the self and shared approaches.

Our results emphasize the mediating role of trust between self and shared leadership, corroborating the findings of previous research (Bligh et al., 2006). As virtual teams lack social interactions, trust develops faster (Gazor, 2012), enabling the evolution from self to shared leadership, through increasing knowledge sharing and communication among team members (Pangil & Chan, 2014). However, distance, cultural, and communication diversity might impede trust among virtual teams. As such, trust is more effective on leadership styles rather than performance of virtual R&D teams.

In addition, our results show that potency and commitment do not mediate the relationship between leadership style and performance of virtual R&D teams in similar ways. Potency mediates the relationship between self-leadership and performance, but it does not mediate the relationship between shared-leadership and performance. Hence, in a virtual team setting, self-leadership nurtures team potency, which in turn makes such a leadership style more effective on team performance. As regards shared leadership, potency may have a role at the early stage of team formation (Mathieu et al., 2000), where self-leadership is paramount. Such potency may then vanish when the team evolves towards a more shared-leadership style. Hence, such mediating mechanism may not be effective on the performance of virtual teams. Finally, empirical evidence detected the direct and indirect role of commitment on the performance of virtual R&D teams, thus supporting previous research (Yahaya & Ebrahim, 2016). Our findings also indicate a greater mediating effect of commitment on the relationship between self-leadership and team performance and a lower mediating effect between shared leadership and team performance. Commitment proved to be more effective for self-leadership style as it is essentially focused on the self. However, such mechanism may already be embedded in shared leadership values, making it less effective on virtual team performance.

4.1. Theoretical contributions

This study investigated the roles of self and shared leadership on the performance of virtual R&D teams, shedding some light on the impact of leadership on the effectiveness of global virtual teams (Mockaitis et al., 2018).

From a theoretical standpoint, this article contributes to the literature on leadership and enriches previous works on the virtual teams, especially virtual R&D teams. First, in line with previous research, we found that leadership positively influences performance of virtual teams. However, as specified in the literature, virtual teams should be managed differently in comparison to traditional ones (Misiolek & Heckman, 2005). As such, this study is the first to bring together the two approaches in a single empirical study, highlighting the relevance of applying different leadership approaches (i.e., self and shared leaderships), in virtual team setting (Hoch & Kozlowski, 2014). As R&D teams are characterized by high level of virtuality and computer-mediated technologies (Orhan, 2017), empirical evidence shows that shared leadership has a strong impact on the performance of virtual R&D teams, enriching the findings of Hoch and Kozlowski (2014). Efficient virtual team leaders need to act more as coaches (Kayworth & Leidner, 2002) by promoting empowerment and delegation among virtual team members (Hertel et al., 2005). In addition, while most of the prior studies have emphasized the benefits of leadership on team outcomes, this study performed a more granular analysis. Even if already identified as a key feature of virtual team success (Pangil & Chan, 2014), the results show that trust is the underlying mechanism that transforms self-leadership into shared leadership.

Second, as indicated by the literature review, overcoming the challenges of virtual R&D teams is crucial. This study enriches the past literature that conducted limited investigations into the mediating role of potency and commitment on the effects of leadership on team performance. The findings shed some light on specific mediating mechanisms between distinctive leadership approaches and performance of virtual R&D teams (Hoch & Kozlowski, 2014). The results validate the mediating role of potency on the relationship between self-leadership and performance. In a virtual setting, self-leadership helps form team potency (Bligh et al., 2006), in turn improving team performance. Additionally, commitment mediates the relationship between both shared and self-leadership, and team performance, indicating the need for either individual (George, 2000) and collective (Yahaya & Ebrahim, 2016) commitment for performant virtual team leadership. Overall, leaders in virtual environments need to integrate and maximize fundamental beliefs, like potency, and psychological factors, like commitment, with respect to teams' capabilities across tasks and contexts (Guzzo et al., 1993).

4.2. Managerial implications

This research has several implications for managers and organizations who aim to implement intra and/or interorganizational arrangements among R&D team members that are geographically dispersed and working on complex projects. First, when developing virtual R&D teams, managers need to consider the leadership style they wish to deploy to achieve better team performance. Our findings show that shared leadership yields higher outcomes. From an HR perspective, firms need to create the necessary conditions to implement and foster shared leadership skills among managers involved in virtual teams. Consequently, participation, collaboration, and delegation of skills can be mandatory criteria for firms' recruitment, training, and incentive policies.

Second, the empirical results indicate that not all leadership approaches bring similar outcomes. For instance, firms need to consider self-leadership as a prerequisite for shared leadership when the trust dimension is taken into consideration. Leadership development commonly starts at the individual level and self-leadership lies in understanding individual role in leadership development and mastering oneself. In technology mediated situations, team members need to concede some control while accepting some vulnerability. Trust helps build a collective identity between geographically dispersed team members meeting virtually by boosting both individual and collective team performance. As such, trust allows evolution from self to shared leadership by aligning individual goals with a team's shared vision, thereby promoting the right mindset and bringing greater results for a virtual environment.

Third, firms benefiting from virtual teams need to reduce the risks inherent to the complexity of online environments. As virtual teams have different lifespans, objectives, goals, and roles of members, potency and commitment become even more crucial. Potency initially originates from individual beliefs, which are then shared collectively, ultimately

leading to team bonding. Consequently, firms need to encourage potency mechanisms to foster success. Additionally, the type of virtual teams (i.e., short-term versus long-term orientation; cross-functional versus linear; corporate versus product/service), generates additional difficulty. The findings show that commitment is a necessary condition and an efficient mean to overcome such challenge in the context of virtual R&D teams. Commitment reinforces identification, involvement, and loyalty towards the team. Finally, from an empirical standpoint, this research used a field sample of real-world virtual R&D teams, greatly enriching the literature on virtual teams and their complexity, as there is sparse empirical evidence in earlier works (Gilson et al., 2015).

4.3. Limitations and future perspectives

This research has several limitations that also represent opportunities for future research. First, it investigated the impact of leadership styles on perceived performance of virtual R&D teams. A possible limitation is that leadership style and team performance are measured using self-reported statements. This approach might lead to bias in the results as participants might over-estimate or minimize the actual performance of virtual R&D teams. Future studies may consider actual team performance to get a more accurate evaluation of the construct and make the study more robust. Another alternative may involve getting peer evaluation and gathering data from members to capture the consistency of performance construct across all team members. Second, this research focused on questioning virtual team members on one single team experience. To bring more granularity to future studies, additional research may conduct a comparative analysis of multiple team experiences and investigate the impact of team size and background on leadership styles and performance of virtual R&D teams. Along the same lines, we mentioned the diversity of virtual teams based on their scope, length of duration, objectives, and aim. New research can identify and examine fresh dynamics inherent to such diversity following the work of Batarseh et al. (2017). Finally, this study was conducted in an IT/data analytics industrial context, limiting its generalizability. Future research can investigate whether the antecedents and mediating factors of virtual R&D team success hold in other settings, due to their distinctive characteristics. A cross-industry analysis of leadership and team performance in a virtual setting and comparison across geographical regions and countries are some future research directions that may bring additional insights.

5. Conclusion

The article proposes a self and shared leadership – virtual team performance model using primary data from real-world virtual R&D teams to empirically investigate the roles of these two contemporary leadership styles on team performance. Results reveal the leadership styles' interplay and their impact on team performance, as well as the roles of trust, potency and commitment as key mediating mechanisms of the suggested model. Such findings are noteworthy for managers and organizations developing intra and inter-firm networks among R&D teams and knowledge-intensive projects.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix 1

Variables	Source	Cronbach alpha
Self-leadership		
I establish specific goals for my own performance	Houghton and Neck (2002)	0.88
I make a point to keep track of how well I'm doing at work		
I work toward specific goals I have set for myself		
I visualize myself successfully performing a task before I do it		
Sometimes I picture in my mind a successful performance before I actually do a task		
When I have successfully completed a task, I often reward myself with something I like		
Sometimes I talk to myself (out loud or in my head) to work through difficult situations		
I try to mentally evaluate the accuracy of my own beliefs about situations I am having problems with		
I think about my own beliefs and assumptions whenever I encounter a difficult situation		
Shared leadership		
In my team, I collaborate regularly with my team members to achieve goals	Avolio et al. (2003)	0,95
My team has a shared vision with agreed-upon goals		
The formal leaders in my team are willing to delegate some control to informal leaders		
My team members trust each other to work effectively and get the job done		
I understand my team's purpose and goals		
When major decisions must be made, team members are involved in the decision process in a meaningful way		
Each team member's unique expertise is valued and utilized		
When I think of leadership, I think of a shared mission to learn and construct knowledge collaboratively		
I have an excellent rapport with at least two other team members		
When a new task arises, leadership responsibilities are determined by members' strengths, not by formal titles		
I feel confident taking on leadership responsibilities in this team		
If the team's chairperson left, the team would continue to make progress toward its goals		
When team members work together as leaders, they share beliefs, values, and goals		
As a leader in the team, I have responsibilities in multiple roles/positions		
All members of my team value collective efficacy		
I know what strengths and skills each of the other team members possesses		
In addition to the team's formally designated leaders, I can identify at least two other team members who act as informal leaders		
The leadership roles available in my group result from the needs arising from our goals		
I feel that every other team member has a capacity for leadership		
Multiple people are trusted with information and decision-making for every activity our group undertakes		
Team potency		
My Team believes it can become unusually good at producing high-quality work	Guzzo et al. (1993)	0,88
My Team expects to be known as a high-performing team		
My team believes it can be very productive		

(continued on next page)

(*continued*)

Variables	Source	Cronbach alpha
My team can get a lot done when it works hard		
No task is too tough for this team		
My team expects to have a lot of influence around here		
Trust		
If I had my way, I would not let the other team members have any influence over issues that are important to the project	Jarvenpaa and Leidner (1999)	0,62
I would be comfortable giving the other team members complete responsibility for the completion of this project		
I really wish I had a good way to oversee the work of the other team members on the project		
Commitment		
I feel strong sense of belonging	Meyer and Allen (1997)	0,87
I feel personally attached to my work team		
I am proud to tell other I work in my team		
Working in my team has great deal of personal meaning to me		
Team performance		
Generally, the project was completed on schedule	Cheung, Yiu, and Lam (2013)	0,87
The project was completed within budget		
The quality of the project deliverable was satisfactory		

References

Ahuja, J. (2010). A study of virtuality impact on team performance. *IUP Journal of Management Research, 9*(5).

Ambos, B., & Håkanson, L. (2014). The concept of distance in international management research. *Journal of International Management, 20*(1), 1–7.

Ambos, T. C., Ambos, B., Eich, K. J., & Puck, J. (2016). Imbalance and isolation: How team configurations affect global knowledge sharing. *Journal of International Management, 22*(4), 316–332.

Atkinson, R., & Flint, J. (2001). Accessing hidden and hard-to-reach populations: Snowball research strategies. *Social Research Update, 33*(1), 1–4.

Avolio, B.J., Sivasubramaniam, N., Murry, W.D., Jung, D. and Garger, J.W. (2003), "Assessing shared leadership: development and preliminary validation of a team multifactor leadership questionnaire". In: Pearce, C.L. and Conger, J.A. (Eds.), Shared Leadership. Reframing the Hows and Whys of Leadership, Sage Publications, Thousand Oaks, CA, 143–172.

Baron, R. M., & Kenny, D. A. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology, 51*(6), 1173.

Batarseh, F. S., Usher, J. M., & Daspit, J. J. (2017). Absorptive capacity in virtual teams: Examining the influence on diversity and innovation. *Journal of Knowledge Management, 21*(6), 1342–1361.

Behrend, F. D., & Erwee, R. (2009). Mapping knowledge flows in virtual teams with SNA. *Journal of Knowledge Management, 13*(4), 99–114.

Bennett, E. E., & Bierema, L. L. (2010). The ecology of virtual human resource development. *Advances in Developing Human Resources, 12*(6), 632–647.

Bergiel, B. J., Bergiel, E. B., & Balsmeier, P. W. (2008). Nature of virtual teams: A summary of their advantages and disadvantages. *Management Research News, 31*(2), 99–110.

Berry, G. R. (2011). Enhancing effectiveness on virtual teams: Understanding why traditional team skills are insufficient. *Journal of Business Communication, 48*(2), 186–206.

Bligh, M. C., Pearce, C. L., & Kohles, J. C. (2006). The importance of self-and shared leadership in team based knowledge work. *Journal of Managerial Psychology., 21*(4), 296–318.

Carson, J. B., Tesluk, P. E., & Marrone, J. A. (2007). Shared leadership in teams: An investigation of antecedent conditions and performance. *Academy of Management Journal, 50*(5), 1217–1234.

Carte, T. A., Chidambaram, L., & Becker, A. (2006). Emergent leadership in self-managed virtual teams. *Group Decision and Negotiation, 15*(4), 323–343.

Cheung, S. O., Yiu, T. W., & Lam, M. C. (2013). Interweaving trust and communication with project performance. *Journal of Construction Engineering and Management, 139*(8), 941–950.

Chowdhury, S. (2005). The role of affect-and cognition-based trust in complex knowledge sharing. *Journal of Managerial Issues*, 310–326.

Day, D. V., & Harrison, M. M. (2007). A multilevel, identity-based approach to leadership development. *Human Resource Management Review, 17*(4), 360–373.

Del Giudice, M., Della Peruta, M. R., & Maggioni, V. (2015). A model for the diffusion of knowledge sharing technologies inside private transport companies. *Journal of Knowledge Management, 19*(3), 611–625.

Del Giudice, M., & Maggioni, V. (2014). Managerial practices and operative directions of knowledge management within inter-firm networks: A global view. *Journal of Knowledge Management, 18*(5), 841–846.

Drescher, M. A., Korsgaard, M. A., Welpe, I. M., Picot, A., & Wigand, R. T. (2014). The dynamics of shared leadership: Building trust and enhancing performance. *Journal of Applied Psychology, 99*(5), 771.

Ebrahim, N. A. (2015). Virtual R&D teams: A new model for product development. *International Journal of Innovation, 3*(2), 1–27.

Erkutlu, H. (2012). The impact of organizational culture on the relationship between shared leadership and team proactivity. *Team Performance Management: An International Journal, 18*(1/2), 102–119.

Fernandez, D. B. B., & Jawadi, N. (2015). Virtual R&D project teams: From e-leadership to performance. *Journal of Applied Business Research, 31*(5), 1693.

Gazor, H. (2012). A literature review on challenges of virtual team's leadership. *Journal of Sociological Research, 3*(2), 134–145.

George, J. M. (2000). Emotions and leadership: The role of emotional intelligence. *Human Relations, 53*(8), 1027–1055.

Gibson, C. B., Huang, L., Kirkman, B. L., & Shapiro, D. L. (2014). Where global and virtual meet: The value of examining the intersection of these elements in twenty-first-century teams. *Annual Review of Organizational Psychology and Organizational Behavior, 1*(1), 217–244.

Gilson, L. L., Maynard, M. T., Jones Young, N. C., Vartiainen, M., & Hakonen, M. (2015). Virtual teams research: 10 years, 10 themes, and 10 opportunities. *Journal of Management, 41*(5), 1313–1337.

Guzzo, R. A., Yost, P. R., Campbell, R. J., & Shea, G. P. (1993). Potency in groups: Articulating a construct. *British Journal of Social Psychology, 32*(1), 87–106.

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2010). *Multivariate data analysis* (17th ed.). Upper Saddle River, New Jersey: Prentice Hall.

Hertel, G., Geister, S., & Konradt, U. (2005). Managing virtual teams: A review of current empirical research. *Human Resource Management Review, 15*(1), 69–95.

Hmieleski, K. M., Cole, M. S., & Baron, R. A. (2012). Shared authentic leadership and new venture performance. *Journal of Management, 38*(5), 1476–1499.

Ho, M. R., Stark, S., & Chernyshenko, O. (2012). Graphical representation of structural equation models using path diagrams. In R. H. Hoyle (Ed.), *Handbook of structural equation modeling* (pp. 43–55). The Guilford Press.

Hoch, J. E. (2013). Shared leadership and innovation: The role of vertical leadership and employee integrity. *Journal of Business and Psychology, 28*(2), 159–174.

Hoch, J. E., & Dulebohn, J. H. (2017). Team personality composition, emergent leadership and shared leadership in virtual teams: A theoretical framework. *Human Resource Management Review, 27*(4), 678–693.

Hoch, J. E., & Kozlowski, S. W. (2014). Leading virtual teams: Hierarchical leadership, structural supports, and shared team leadership. *Journal of Applied Psychology, 99*(3), 390.

Hoegl, M., & Muethel, M. (2016). Enabling shared leadership in virtual project teams: A practitioners' guide. *Project Management Journal, 47*(1), 7–12.

Houghton, J. D., & Neck, C. P. (2002). The revised self-leadership questionnaire: Testing a hierarchical factor structure for self-leadership. *Journal of Managerial Psychology, 17*(8), 672–691.

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.

Hurtado-Torres, N. E., Aragón-Correa, J. A., & Ortiz-de-Mandojana, N. (2018). How does R&D internationalization in multinational firms affect their innovative performance? The moderating role of international collaboration in the energy industry. *International Business Review, 27*(3), 514–527.

Jaruzelski, B., Schwartz, K., & Staack, V. (2015). Innovation's new world order. Strategy + business, 27, 81. Accessed Nov, 1st, 2019. Available at: https://www.strategy-business.com/feature/00370?gko=9f2c4.

Jarvenpaa, S. L., & Leidner, D. E. (1999). Communication and trust in global virtual teams. *Organization Science, 10*(6), 791–815.

Kayworth, T. R., & Leidner, D. E. (2002). Leadership effectiveness in global virtual teams. *Journal of Management Information Systems, 18*(3), 7–40.

Kudyba, S., Fjermestad, J., & Davenport, T. (2020). A research model for identifying factors that drive effective decision-making and the future of work. *Journal of Intellectual Capital, 21*(6), 835–851.

Lance, C. E., Butts, M. M., & Michels, L. C. (2006). The sources of four commonly reported cutoff criteria: What did they really say? *Organizational Research Methods, 9*(2), 202–220.

Liao, C. (2017). Leadership in virtual teams: A multilevel perspective. *Human Resource Management Review, 27*(4), 648–659.

Manz, C. C., Pearce, C. L., Mott, J. W., Henson, Z., … Sims, H. P., Jr (2013). Don't take the lead… share the lead. *Organizational Dynamics, 42*(1), 54–60.

Mathieu, J. E., Heffner, T. S., Goodwin, G. F., Salas, E., & Cannon-Bowers, J. A. (2000). The influence of shared mental models on team process and performance. *Journal of Applied Psychology, 85*(2), 273.
Mayer, R. C., Davis, J. H., & Schoorman, F. D. (1995). An integrative model of organizational trust. *Academy of Management Review, 20*(3), 709–734.
Meyer, J. P., & Allen, N. J. (1997). *Commitment in the workplace: Theory, research, and application*. Thousand Oaks: Sage.
Misiolek, N. I., & Heckman, R. (2005). *Patterns of emergent leadership in virtual teams*. IEEE, 49a–49a.
Mockaitis, A. L., Zander, L., & De Cieri, H. (2018). The benefits of global teams for international organizations: HR implications. *The International Journal of Human Resource Management, 29*(14), 2137–2158.
Muethel, M., & Hoegl, M. (2010). Cultural and societal influences on shared leadership in globally dispersed teams. *Journal of International Management, 16*(3), 234–246.
Neck, C. P., & Houghton, J. D. (2006). Two decades of self-leadership theory and research: Past developments, present trends, and future possibilities. *Journal of Managerial Psychology, 21*(4), 270–295.
Orhan, M. A. (2017). The evolution of the virtuality phenomenon in organizations: A critical literature review. *Entrepreneurial Business and Economics Review, 5*(4), 171–188.
Pangil, F., & Chan, J. M. (2014). The mediating effect of knowledge sharing on the relationship between trust and virtual team effectiveness. *Journal of Knowledge Management, 18*(1), 92–106.
Pinjani, P., & Palvia, P. (2013). Trust and knowledge sharing in diverse global virtual teams. *Information & Management, 50*(4), 144–153.
Preacher, K. J., & Hayes, A. F. (2008). Assessing mediation in communication research (pp. 13-54). London: The Sage sourcebook of advanced data analysis methods for communication research.
Siebdrat, F., Hoegl, M., & Ernst, H. (2009). How to manage virtual teams. *MIT Sloan Management Review, 50*(4), 63.
Singh, S. K. (2008). Role of leadership in knowledge management: A study. *Journal of Knowledge Management, 12*(4), 3–15.
Singh, S. K., Del Giudice, M., Tarba, S. Y., & De Bernardi, P. (2019). Top management team shared leadership, market-oriented culture, innovation capability, and firm performance. *IEEE Transactions on Engineering Management*. https://doi.org/10.1109/TEM.2019.2946608.
Stewart, G. L., Courtright, S. H., & Manz, C. C. (2011). Self-leadership: A multilevel review. *Journal of Management, 37*(1), 185–222.
Townsend, A. M., DeMarie, S. M., & Hendrickson, A. R. (1998). Virtual teams: Technology and the workplace of the future. *Academy of Management Perspectives, 12*(3), 17–29.
Wang, D., Waldman, D. A., & Zhang, Z. (2014). A meta-analysis of shared leadership and team effectiveness. *Journal of Applied Psychology, 99*(2), 181.
Xiong, C., Chang, V., Scuotto, V., Shi, Y., & Paoloni, N. (2019). The social-psychological approach in understanding knowledge hiding within international R&D teams: An inductive analysis. *Journal of Business Research*. https://doi.org/10.1016/j.jbusres.2019.04.009.
Xue, Y., Bradley, J., & Liang, H. (2011). Team climate, empowering leadership, and knowledge sharing. *Journal of Knowledge Management, 15*(2), 299–312.
Yahaya, R., & Ebrahim, F. (2016). Leadership styles and organizational commitment: Literature review. *Journal of Management Development, 35*(2), 190–216.
Zhu, J., Liao, Z., Yam, K. C., & Johnson, R. E. (2018). Shared leadership: A state-of-the-art review and future research agenda. *Journal of Organizational Behavior, 39*(7), 834–852.

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