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Paschoiotto, Waldemir Paulino
Sehnem, Simone
Cohen, Eric David

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E-Leadership in the Brazilian Public Sector: The Influence of Communication Quality on Team Commitment and Performance

E-Liderança no Setor Público Brasileiro: A Influência da Qualidade da Comunicação no Comprometimento e Desempenho das Equipes

E-Leadership en el Sector Público Brasileño: La Influencia de la Calidad de la Comunicación en el Compromiso y Desempeño del Equipo

Waldemir Paulino Paschoiotto
Universidade Federal de Santa Catarina, Brasil
paschoiotto@msn.com
Simone Sehnem
Universidade do Oeste de Santa Catarina e Universidade do Sul de Santa Catarina, Brasil
simonesehnem_adm@yahoo.com
Eric David Cohen
Universidade Estadual de Campinas, Brasil
ericdcohen@gmail.com

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Abstract

Research objective: To analyze e-leadership in the public sector, verifying the relationship of transformational and transactional styles with important variables such as the quality of communication, commitment and performance of public servants.
Theoretical framework: The research uses as a theoretical basis studies on e-leadership and transformational and transactional styles, highlighting the determining elements of this phenomenon of virtual teams, especially the quality of communication and its possible relationship with commitment and performance.
Methodology: This is a quantitative research, developed through a survey with 158 public servants from 3 different institutions, at the federal and state levels: Federal Audit Court (TCU), National Waterway Transport Agency (Antaq) and Court of Accounts for the State of Santa Catarina (TCE/SC). The analysis used descriptive statistics and structural equation modeling techniques. To measure the research constructs, scales used in other studies were adopted, whose results demonstrated their psychometric quality.
Results: It was found that the quality of communication is positively related to commitment and exerts a positive influence on the way teams see e-leadership, which favors the transformational e-leadership style. Both leadership styles have a positive influence on commitment. The relationship between commitment and performance was not significant. Only the transformational style positively influenced the performance of employees working in virtual teams.
Originality: This study stands out for exploring an innovative theme related to the leadership of virtual teams in the public sector and expands the discussion on the factors that can collaborate with the mission of e-leaders of public institutions.
Theoretical and practical contributions: The present research offers contributions for the field of public management as it provides empirical evidence that can help public managers to delineate managerial and corporate education strategies, focusing on the selection and development of leaders more able to present relevant results for the society.

Keywords: E-leadership, Public sector, Communication Quality, Commitment, Performance.

Resumo

Objetivo da pesquisa: Analisar a e-liderança no setor público, verificando a relação dos estilos transformacional e transacional com variáveis importantes como a qualidade da comunicação, o comprometimento e o desempenho dos servidores públicos.

Enquadramento teórico: A pesquisa utiliza como base teórica estudos sobre a e-liderança e os estilos transformacional e transacional, destacando os elementos determinantes desse fenômeno das equipes virtuais, especialmente a qualidade da comunicação e sua possível relação com comprometimento e desempenho.
Metodologia: Trata-se de uma pesquisa quantitativa, desenvolvida por meio de levantamento com 158 servidores públicos de 3 instituições diferentes, das esferas federal e estadual: Tribunal de Contas da União (TCU), Agência Nacional de Transporte Aquaviário (Antaq) e Tribunal de Contas do Estado de Santa Catarina (TCE/SC). A análise empregou técnicas de estatística descritiva e modelagem de equações estruturais. Para medir os construtos da pesquisa, foram adotadas escalas utilizadas em outros estudos, cujos resultados demonstraram sua qualidade psicométrica.
Resultados: Verificou-se que a qualidade da comunicação se relaciona positivamente com o comprometimento, além de exercer influência positiva na forma como as equipes enxergam a e-liderança, o que favorece o estilo de e-liderança transformacional. Os dois estilos de e-liderança exercem influência positiva no comprometimento. A relação entre comprometimento e desempenho não se mostrou significativa. Somente o estilo transformacional influenciou positivamente o desempenho dos servidores que trabalham em equipes virtuais.
Originalidade: Este estudo se destaca por explorar uma temática inovadora relacionada à liderança de equipes virtuais no setor público e amplia a discussão sobre os fatores que podem colaborar com a missão dos e-líderes das instituições públicas.
Contribuições teóricas e práticas: A presente pesquisa oferece contribuições para o campo da gestão pública pois fornece evidências empíricas que podem auxiliar os gestores públicos a delinear estratégias gerenciais e de educação corporativa, com enfoque na seleção e desenvolvimento de líderes mais aptos a apresentar resultados relevantes para a sociedade.
Palavras-chave: E-liderança, Setor público, Qualidade da comunicação, Comprometimento. Desempenho.

Resumen

Objetivo de la investigación: Analizar el e-Leadership en el sector público, verificando la relación de los estilos transformacional y transaccional con variables importantes como la calidad de la comunicación, compromiso y desempeño de los servidores públicos.
Marco teórico: La investigación utiliza como base teórica estudios sobre e-leadership y estilos transformacionales y transaccionales, destacando los elementos determinantes de este fenómeno de los equipos virtuales, en especial la calidad de la comunicación y su posible relación con el compromiso y el desempeño.
Metodología: Se trata de una investigación cuantitativa, desarrollada a través de una encuesta con 158 servidores públicos de 3 instituciones diferentes, a nivel federal y estatal: Tribunal de Cuentas Federal (TCU), Agencia Nacional de Transporte Fluvial (Antaq) y Tribunal de Cuentas del Estado de Santa Catarina (TCE/SC). El análisis utilizó estadística descriptiva y técnicas de modelado de ecuaciones estructurales. Para medir los constructos de investigación, se adoptaron escalas utilizadas en otros estudios, cuyos resultados demostraron su calidad psicométrica.
Resultados: Se encontró que la calidad de la comunicación se relaciona positivamente con el compromiso y ejerce una influencia positiva en la forma en que los equipos ven el e-leadership, lo que favorece el estilo de e-leadership transformacional. Ambos estilos de liderazgo tienen una influencia positiva en el compromiso. La relación entre compromiso y desempeño no fue significativa. Solo el estilo transformacional influyó positivamente en el desempeño de los servidores que trabajan en equipos virtuales.
Originalidad: este estudio se destaca por explorar un tema innovador relacionado con el liderazgo de equipos virtuales en el sector público y amplía la discusión sobre los factores que pueden colaborar con la misión de los e-líderes de las instituciones públicas.
Aportes teóricos y prácticos: La presente investigación ofrece aportes al campo de la gestión pública ya que aporta evidencia empírica que puede ayudar a los gestores públicos a delinear estrategias gerenciales y de educación empresarial, enfocándose en la selección y desarrollo de líderes más capaces de presentar resultados relevantes para la sociedad.
Palabras clave: E-liderazgo, Sector público, Calidad de la comunicación, Compromiso, Actuación.

1 INTRODUCTION

The advancement of information and communication technologies (ICTs) has driven the adoption of innovative work arrangements such as telecommuting for some team members or the creation of entirely virtual teams (Purvanova & Kenda, 2018; Contreras, Baykal & Abid, 2020). The Covid-19 pandemic accelerated this growing process in scope and importance, as even organizations that were not prone were forced to implement the remote working model (Pereira & Cunha, 2020; Kulshreshtha & Sharma, 2021). This movement also reached public organizations and made e-leadership suddenly become the new typical leadership (Toleikienė, Rybnikova & Juknevičienė, 2020).

Although available technology allows dispersed teams to function anywhere and at any time, several collaboration challenges stem from the virtual nature of work, especially purely electronic communication (Kahai, Huang, & Jestice, 2012). Computer-mediated communication is an inherent feature of virtual teams and can occur via media richer in signals, such as videoconferencing, or merely textual, such as emails and instant messages (Charlier, Stewart, Greco & Reeves, 2016).

Several benefits have been attributed to virtual teams, such as bringing experts together without space or time limits, increased team flexibility, and travel and per diem savings. On the other hand, virtual teams and their leaders face particular challenges. Disadvantages include low cohesion, trust, and commitment to team goals, which can negatively impact organizational performance (Hoch & Kozlowski, 2014).

In this innovative context, leadership is crucial in helping teams adapt to virtual work and face the organization's daily challenges (Purvanova & Kenda, 2018). A specific denomination emerges for the leadership of virtual teams: e-leadership or electronic leadership, an approach born as a natural response to the emergence of virtual teams whose members can work in different places and hours (Fonseca, Porto & Borges-Andrade, 2015).

This new paradigm requires further studies that contribute to understanding the phenomenon in the light of specific contexts, such as the public sector (Paschoiotto, Martins & Casagrande, 2020). A crucial point for e-leadership is that trust and team commitment are essential mechanisms by which individuals can overcome physical distance, work towards shared goals, and increase team effectiveness (Joshi, Lazarova & Liao, 2009; Cordery, Soo, Kirkman, Rosen & Mathieu, 2009).

Therefore, the study aims to analyze e-leadership in the public sector, verifying the relationship between transformational and transactional styles with essential variables such as the quality of communication, commitment, and performance of public servants. The research was carried out with employees of three different public institutions at the federal and state levels: Federal Court of Accounts - Brazil (TCU), Brazilian National Aquatic Transport Agency (ANTAQ), and the Court of Accounts of the State of Santa Catarina (TCE/SC). These organizations were chosen because they had already instituted remote work policies before the pandemic.

The study is divided into six fundamental parts, the first being this introduction, followed by conceptualizing the main constructs. Next, the research hypotheses are presented. The fourth section deals with the methodological procedures adopted in the research. Then the results. The final section discusses the results and their contributions to the field of study and suggestions for future research.

2 THEORETICAL REFERENCE

Dispersed work teams, whose members depend on information and communication technologies (ICTs) to interact with each other across temporal and geographic boundaries, are not exactly a novelty (Han, Kim, Beyerlein & DeRosa, 2020). However, face-to-face teams are becoming increasingly rare, as hybrid teams, with some individuals in the exact location and others dispersed, are already relatively common (Dixon & Pantelli, 2010). The main characteristics distinguishing virtual teams from conventional ones are geographic dispersion and technology-mediated communication (Bell & Kozlowski, 2002; Kashive, Khanna & Powale, 2022).

Due to these inherent characteristics, Hoch and Kozlowski (2014) suggest that virtual team leaders have more difficulty executing traditional hierarchical leadership behaviors, such as motivating members and managing team dynamics. In this sense, virtual leaders need to invest much more time and effort for virtual teams to function like face-to-face teams.

2.1 E-Leadership

Avolio, Kahai and Dodge (2001) produced the seminal study for coining e-leadership. They employed Adaptive Structuring Theory (DeSanctis & Poole, 1994), derived from Structuring Theory, to explain how ICTs interact with virtual leaders and teams to produce new team structures and cultures. Years later, the definition was revised with an emphasis on the role of ICTs. Thus, e-leadership came to be defined as a process of social influence incorporated in proximal and distal contexts, mediated by information and communication technologies, which can produce changes in attitudes, feelings, thoughts, behavior, and performance of the team (Avolio, Sosik, Kahai & Baker, 2014).

According to Bell and Kozlowski (2002), it is difficult to determine how the unique characteristics of virtual teams affect critical leadership functions, including performance management, motivation, and team commitment. However, previous research reveals that leaders who master communication technology are more likely to achieve higher levels of success in virtual teams (Cascio & Shurygailo, 2003; Malhotra, Majchrzak & Rosen, 2007).

DasGupta (2011) noted that this new relationship between leaders and members did not change leadership goals. In his view, the fundamental objectives of leadership remain the same but require the leader to adapt to the new format of computer-mediated communication. In the same sense, Avolio, Sosik, Kahai, and Baker (2014) assert that e-leadership can display the same style as traditional leadership, as the difference is how it manifests itself. The analyzes also support this opinion by Purvanova and Kenda (2018) and the recent review conducted by Dhamija, Chiarini and Shapla (2023).

Several approaches to conceptualizing leadership styles exist, but Burns (1978) offered the main definition. The author classified leadership into transactional and transformational: while transactional leaders promote a kind of exchange system with team members, such as financial rewards, transformational leaders use charisma and inspiration, that is, psychological stimuli.

Transformational leaders provide socio-emotional support to followers and increase the emotional appeal of organizational activities, thus developing their employees' affective commitment and attachment to the organization (Berkovich & Hassan, 2023). Bass (1990) presents the main characteristics of transactional and transformational leaders, as shown in Chart 1.

Table 1: Characteristics of transactional and transformational leaders

Table 1

Characteristics of transactional and transformational leaders

Transactional Leader	Transformational Leader
Contingent reward - negotiates the exchange of rewards for effort, promises rewards for good performance, and recognizes achievement.	Charisma - offers vision and meaning in the mission, encouraging pride, respect, and trust.
Administration by exception (active) - Observe deviations from rules and standards, and take corrective actions.	Inspiration - Communicates high expectations and uses symbols to focus efforts.
Administration by exception (passive) - only intervenes if the defaults are unmet.	Intellectual stimulation - Promotes intelligence, rationality, and careful problem-solving.
Laissez-faire - Abdicates responsibility and avoids decision-making.	Individualized Consideration - Gives personalized attention, advice, and guidance to each member individually.

Source: Adapted from Bass (1990, p. 22).

Leadership is considered universally important in team structures (Newman, Ford & Marshall, 2019). Although advances can be made in the literature on the subject (Purvanova & Bono, 2009), it is not clear which leadership style is more appropriate to the virtual context, especially in public organizations, where the presence of formally designated leaders is predominant. Based on the above, this study adopts e-leadership as representative of the virtual context, which can manifest itself in the various styles described in the literature, such as transactional and transformational. Therefore, e-leadership represents a contextual factor, with e-leadership styles being implemented as distinct variables in the tested structural model. The transactional and transformational styles were adopted in this study because they are the most referenced by the literature in the field.

2.2 Communication quality

Virtual teams work on a common task but do not share the same space and rely on computer-mediated communication resources. In the view of Driskell, Radtke and Salas (2003), it is necessary to bear in mind that the type of communication environment implemented will significantly impact team interaction. Furthermore, according to the authors, the distribution of team members in computer-mediated systems can interrupt interaction under some conditions and facilitate interaction under others. As a result, coordinating activities is an activity that inevitably becomes more difficult (Driskell, Radtke & Salas, 2003), mainly due to the lack of richness of face-to-face interactions (Kniffin et al., 2021).

Lin, Standing and Liu (2008) emphasize that the Theory of Media Wealth postulates that the success of the organization will depend on its ability to process information of adequate richness in order to reduce uncertainty (absence of information) and clarify ambiguity (possibility of misconceptions). In this sense, media limitations in the work context of virtual teams can reduce the quantity and quality of information.

In this way, the most effective communication will depend on the choice of ICTs that offer greater media richness. Furthermore, by using richer means of communication, the e-leader can minimize the loss of non-verbal cues, a deficiency inherent in the model of virtual teams that exchange information essentially asynchronously. Thus, it will be necessary to interact with the team using digital tools, and the richness of the media and the frequency of interactions are identified as critically indispensable (Driskell, Radtke & Salas, 2003; Dixon & Pantelli, 2010; Gajendran & Joshi, 2012; Newman, Ford & Marshall, 2019).

2.3 Organizational commitment and its relationship with performance

Organizational commitment is often described as the individual's bond with the organization they are a part of (Tomazzoni, Costa, Antonello & Rodrigues, 2020). Studies emphasize leaders' role in developing team organizational commitment (Berkovich & Hassam, 2023). Mowday, Porter and Steers (1982) were the forerunners of the reflection of organizational commitment. For them, commitment requires an active posture to pursue the organization's well-being, which goes far beyond organizational loyalty.

Meyer and Allen (1991) defined commitment as identification and involvement with the team and proposed a three-component model to explain the concept. First, affective commitment represents the individual's desire to remain in the organization due to a feeling of attachment to the bond's emotional nature. Instrumental commitment portrays the assessment of the costs of staying or leaving the organization, in which the individual perceives his specific investments in the organization and has no alternatives to change. Finally, normative commitment characterizes as binding by obligation, in which the individual feels morally obligated to remain (Meyer & Allen, 1991).

The leader plays a crucial role in helping teams form a common identity among individual members and increasing individuals' commitment to team goals, which helps retain employees and keep them satisfied (Morgeson, DeRue & Karam, 2009). In addition, a significant body of previous research has suggested that team commitment will positively influence the team's functioning and, more specifically, its performance (Joshi, Lazarova & Liao, 2009).

Ellemers, Gilder and Haslam (2004), for example, would argue that identification with collective entities, such as the team, can give individuals greater energy to work for the benefit of the group instead of spending efforts to achieve individual goals and rewards. In addition, it was highlighted that social vandalism is less prevalent in tightly-knit groups than in groups composed of strangers or mere acquaintances. Sivunen (2006), in turn, observed that leaders who instilled a common team identity made members work together more effectively and achieved superior performance.

According to Taifel (1982), the social identity theory is the main theoretical argument supporting the hypothesis about the impact of members' commitment on team performance. For the author, the acquisition of social identity is defined by the perception of the individual's position in society and results from affiliation with different social groups. In the case of virtual teams, team commitment can create a network of psychological connections between distant team members to overcome the physical distance that separates them (Fiol & O'Connor, 2005).

According to Joshi, Lazarova and Liao (2009), when a shared team identity is pronounced, members tend to be more concerned with achieving collective goals and the team's overall well-being. Thus, when team members shift their thinking from individual to collective, they are more likely to pursue shared goals, behave according to shared group identity, and thus contribute to team performance (Hinds & Mortensen, 2005). Based on the above arguments, it is possible to perceive that commitment and performance are closely related, these two factors being of crucial importance for the success of the organization.

3 CONCEPTUAL MODEL AND HYPOTHESES

A significant amount of previous studies suggest that commitment positively affects the performance of virtual teams (e.g., Jarvenpaa & Leidner, 1999; Ellemers, Gilder & Haslam, 2004; Hinds & Mortensen, 2005; Sivunem, 2006; Joshi, Lazarova & Liao, 2009; Morgeson, DeRue & Karam, 2009; Gilson, Maynard, Young, Vartiainen & Hakonen, 2014; Eseryel, Crowston & Heckman, 2020). In addition, previous research focused on e-leadership highlighted the need to increase the commitment of the individuals who make up the team (Katzenback & Smith, 2011; Hoch & Kozlowski, 2014; Manha, 2015), especially in the public sector where historically commitment levels are low. (Zeffane, 1994; Boyne, 2002).

Organizational commitment is essential for virtual teams to overcome physical distance and work to achieve goals (Joshi, Lazarova, & Liao, 2009; Cordery, Soo, Kirkman, Rosen & Mathieu, 2009). As e-leadership can display the same styles as traditional leadership, since the difference is the way it manifests itself (Avolio et al., 2014), we will adopt the leadership styles most studied by the field literature: transactional and transformational. Therefore, based on the preceding arguments, the following hypotheses are constructed:

H1: E-leadership (transactional and transformational) is positively and significantly related to team commitment.

H2: Commitment is positively and significantly related to team performance.

H3: E-leadership (transactional and transformational) is positively and significantly related to team performance.

Furthermore, the eminently virtual nature of e-leadership emphasizes the role of communication in achieving organizational objectives. The e-leader will need to interact intensively with the team using digital tools, and the wealth of information becomes critically indispensable (Hollingshead, McGrath & O'Connor, 1993; Bell & Kozlowski, 2002). More ideas are generated and implemented when there are more communications and dynamic interactions (Eseryel, Crowston & Heckman, 2020).

The characteristics of the adopted media and the frequency of communication between the e-leader and the team will predict his ability to develop a better relationship and increase the team's commitment (Driskell, Radtke & Salas, 2003; Dixon & Pantelli, 2010; Gajendran & Joshi, 2012; Newman, Ford, & Marshall, 2019). Thus, the following hypotheses are formulated:

H4: The quality of communication is positively and significantly related to e-leadership (transactional and transformational).

H5: The quality of communication is positively and significantly related to commitment.

The theoretical model of the research is presented in Figure 1, characterizing the hypotheses.

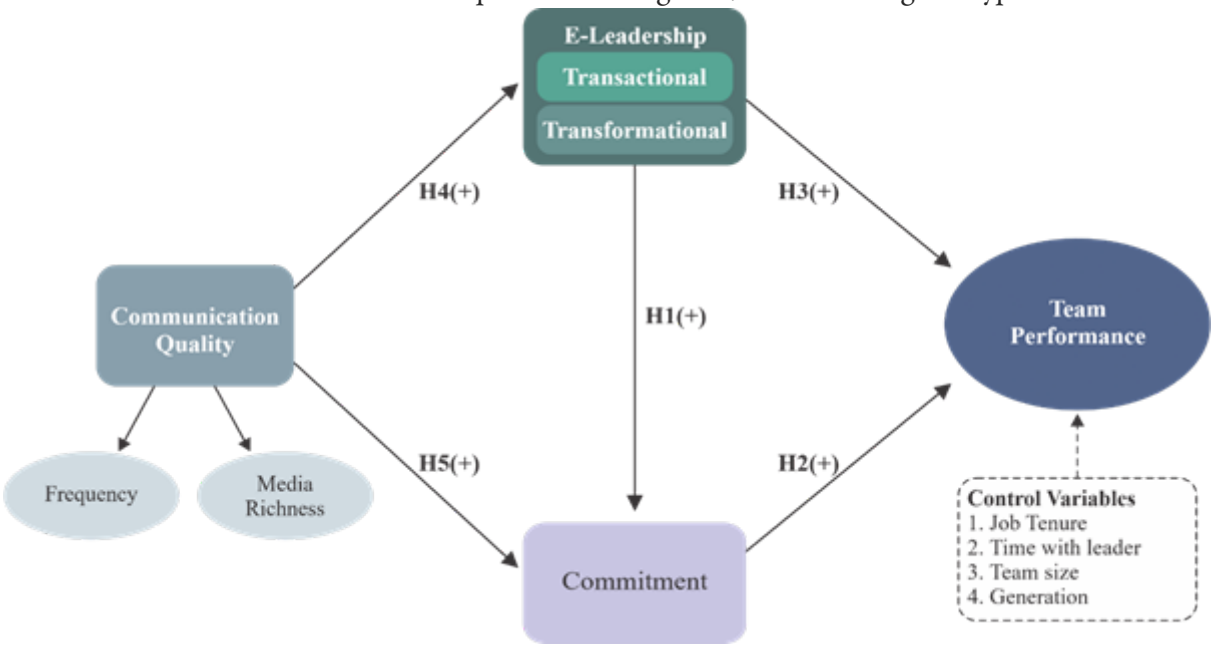

Figure 1
Theoretical research model and hypotheses

As it turns out, e-leadership can manifest itself according to transactional or transformational styles (Cordery et al., 2009; DasGupta, 2011; Avolio et al., 2014; Purvanova & Kenda, 2018). Thus, e-leadership is considered contextual and composed of two distinct variables: transactional e-leadership and transformational e-leadership. Therefore, its implementation in the structural model occurs separately, that is, a structural model for each style of e-leadership.

The quality of communication, in turn, will be represented by the dimensions of frequency of interactions with the leader (Kacmar, Witt, Zivnuska & Gully, 2003) and the richness of the media adopted in these communications (Dennis & Kinney, 1998). In this case, the modeling considers the quality of communication as a single, second-order variable composed of the first-order variables' frequency and richness of the media.

4 METHODOLOGICAL PROCEDURE

This study is quantitative-descriptive. A nationwide survey was developed and operated via the internet (survey). The target population comprises employees of public organizations carrying out their activities in a remote work system at the time of the research. Some federal and state public organizations were selected for the application of the questionnaire and data analysis, namely: the Federal Court of Accounts (TCU), the Brazilian National Aquatic Transport Agency (ANTAQ), and the Court of Accounts of the State of Santa Catarina (TCE-SC).

The sample was characterized as non-probabilistic since the target audience should confirm that they carry out their activities in telework. Erdfelder's G*Power software (Faul, Erdfelder, Lang & Buchner, 2007) in its third version (3.1.9.2) was used to analyze the test's power and calculate the sample resulted in 98 minimum samples. Following the recommendations of Bentler & Chou (1987) and Hair, Black, Babin, Anderson & Tatham (2009), this research sought a minimum sample of 150 respondents, reaching 158 participants. As shown in Table 1, the final sample increased the statistical power (from 80% to 94%) and the sensitivity (f^2 from 0.15 to 0.10) of subsequent statistical analyzes.

Table 1
Sample calculation

Adopted Assumptions	A priori	Post hoc	Sensitivity
Effect Size (f^2)	0.15	0.15	0.10
Significance Level (α)	0.05	0.05	0.05
Statistical Power ($1 - \beta$)	0.8	0.94	0.8
Number of Predictors	8	8	6
Sample size	109	158	158

Source: Software G*Power version 3.1.9.2.

According to Hoch and Kozlowski (2014), the theoretical focus of e-leadership is specified at the team level. Therefore, all measures adopted in this study were specified at this level. In addition, the measurement items of the questionnaire were taken from previous studies that proved their good psychometric quality to assess the variables.

The Multifactor Leadership Questionnaire (MLQ) was adopted to measure e-leadership styles (transformational or transactional), inspired by the general concept of Burns (1978), incorporating the work of Bass (1990) and revised by Bass and Avolio (1994). Although transformational leadership includes four dimensions, it was decided to limit the analysis to idealized influence since, according to Bass and Avolio (1994), this dimension highlights the collective meaning among members and encourages them to act following the group values. Transactional leadership also includes four dimensions. Given the need to limit the number of items in the questionnaire, we chose to focus on the dimension related to contingent reward, as this dimension associates the satisfaction of team members with their motivation. Cronbach's alpha was 0.889 for transformational leadership and 0.771 for transactional leadership.

Organizational commitment was measured based on the six-item version proposed by Mowday, Seteers and Porter (1979) of the Organizational Commitment Questionaire (OCQ), with a Cronbach's alpha of 0.800. This scale was selected because, according to Benkhoff (1997), it is the most used model to measure commitment. Performance was measured with a five-item scale, three of which came from the study by Lin, Standing and Liu (2008) and two from the research by Costa (2014). The first scale was also adopted by Sedrine, Bouderbala and Nasraoui (2020), with a Cronbach's alpha of 0.839; the second had a reliability of 0.957.

The quality of communication is considered an independent variable, represented by indicators of frequency of communication with the leader (Kacmar et al., 2003) and richness of media used (Dennis & Kinney, 1998), with Cronbach's alpha of 0.800 and 0.740, respectively. Furthermore, different Likert scales (1 to 5 or 1 to 7 items) were used, which increased the instrument's internal consistency (Masters, 1974). In addition, the sample is composed of highly qualified people, therefore able to analyze more alternatives (Weathers, Sharma & Niedrich, 2005). Table 2 presents a summary of the measures used.

Table 2
Measures used in the research

Variables	Constructs	Subconstructs	No. of Items	Type	Scale
Independent	E-Leadership	Transformational	4	Likert	1 to 5
		Transactional	5	Likert	1 to 5
	Communication Quality	Frequency	4	Likert	1 to 7
		Media wealth	4	Likert	1 to 5
	Commitment		6	Likert	1 to 5
Dependent	Performance		5	Likert	1 to 5
Control	Generation of members		1	Quantitative	
	Home time		1	Quantitative	
	Time with the leader		1	Quantitative	
	Team size		1	Quantitative	
Demographics	Gender		1	Dummy	
	Education		1	Dummy	
	Organization		1	Dummy	

Source: Prepared by the authors (2022).

To verify possible relationships not explained by the proposed model, the variables length of service, time with the leader, team size, and generation of members were controlled.

5 DATA PRESENTATION AND ANALYSIS

Table 3 presents the demographic data of the respondents who voluntarily participated in the survey.

Table 3
Demographic data of the researched subjects

Identification data	Aspects evaluated	Absolute Frequency	Relative Frequency
Gender	Feminine	52	33%
	Masculine	106	67%
Education	College Education	30	19%
	Postgraduate	82	52%
	Master's degree	37	23%
	Doctorate	9	6%
Generation	BabyBoomers (born from 1940 to 1959)	39	25%
	Generation X (from 1960 to 1979)	33	21%
	Y or Millennials (from 1980 to 1994)	46	29%
	Generation Z (from 1995 to 2010)	40	25%
Organization	TCU	108	68%
	ANTAQ	15	9%
	TCE-SC	35	22%
Home time	1 to 5 years	16	10%
	6 to 10 years	19	12%
	11 to 15 years	61	39%
	16 to 20 years	23	15%
	Over 20 years	39	25%
Team size	1 to 5 people	32	20%
	6 to 10 people	76	48%
	11 to 15 people	16	10%
	16 to 20 people	8	5%
	Over 20 people	25	16%

Source: Prepared by the authors (2022).

Data from the applied questionnaires were exported from the collection tool and tabulated in a spreadsheet to form the database. The analysis was performed using Structural Equation Modeling (SEM), with the partial least squares method estimation using the SmartPLS software (version 3.3.3). In addition, Partial Least Squares regression (PLS) for SEM was used because the data did not adhere to the normal distribution, as identified in the Kolmogorov-Smirnov test.

The PLS was considered the most appropriate because it is the model based on the recommendations of Fornell and Bookstein (1982) since it considers all path coefficients at the same time, allowing the analysis of all spurious variants, direct and indirect, to be evaluated together (Chin, 1998; Fornell & Bookstein, 1982). Furthermore, because it is based on components, it avoids problems with inadmissible solutions and the indeterminacy of factors (Fornell & Bookstein, 1982; Whittaker, Ledden & Kalafatis, 2007). Table 4 presents the convergent and discriminant validity tests at the item level.

Table 4
Convergent and discriminant validity at the item level

	E-Leadership Transformational	E-Leadership Transactional	Commitment	Media wealth	Frequency of communication	Performance
LDTF_1	**0.827**	0.508	0.318	0.155	0.110	0.252
LDTF_2	**0.834**	0.536	0.233	0.208	-0.002	0.373
LDTF_3	**0.893**	0.501	0.198	0.228	0.058	0.247
LDTF_4	**0.868**	0.602	0.234	0.170	0.192	0.143
LDTS_1	0.697	**0.861**	0.259	0.191	0.174	0.217
LDTS_2	0.478	**0.842**	0.162	0.136	0.019	0.149
LDTS_3	0.531	**0.877**	0.228	0.215	0.039	0.122
LDTS_4	0.443	**0.772**	0.199	0.202	0.023	0.116
LDTS_5	0.435	**0.872**	0.229	0.199	-0.018	0.145
COMP_1	0.159	0.218	**0.710**	0.187	0.141	0.199
COMP_2	0.224	0.206	**0.863**	0.141	0.069	0.222
COMP_3	0.275	0.232	**0.856**	0.206	0.154	0.209
COMP_6	0.197	0.095	**0.512**	0.130	0.095	0.101
RIQM_1	0.257	0.233	0.229	**0.899**	-0.033	0.207
RIQM_3	0.093	0.130	0.138	**0.785**	0.087	0.262
FREQ_1	0.065	0.019	0.079	0.073	**0.905**	0.037
FREQ_2	0.039	-0.059	0.085	0.012	**0.877**	0.030
FREQ_3	-0.024	-0.026	0.050	0.018	**0.861**	-0.054
FREQ_4	0.178	0.177	0.226	-0.013	**0.863**	0.051
DES_1	0.281	0.148	0.289	0.243	0.089	**0.903**
DES_2	0.242	0.188	0.206	0.215	0.090	**0.901**
DES_3	0.167	0.107	0.030	0.175	0.011	**0.707**
DES_4	0.284	0.176	0.245	0.205	-0.003	**0.907**
DES_5	0.279	0.158	0.229	0.305	-0.047	**0.878**

Source: Prepared by the authors (2022).

Based on the data in Table 4, it is possible to verify convergent and discriminant validity at the level of the items that comprise the latent variables. Again, all factor loadings were significant at 1%. Table 5 below presents the analysis of convergent and discriminant validity at the level of latent variables. From this point on, the first-order variables (communication frequency and media richness) compose the second-order variable (communication quality); due to the difference between the number of items for each first-order variable, a two-step approach was adopted to create the second-order latent variable.

Table 5
Convergent and discriminant validity at the level of latent variables

	1	2	3	4	5
1 - Transformational e-Leadership	**0.856**				
2 - Transactional e-leadership	0.630	**0.846**			
3 - Commitment	0.287	0.260	**0.749**		
4 - Communication Quality	0.249	0.237	0.271	**0.711**	
5 - Performance	0.298	0.183	0.251	0.260	**0.863**
Composite reliability	0.916	0.926	0.831	0.641	0.935
Average Variance Extracted (AVE)	0.732	0.715	0.561	0.506	0.745
Cronbach's alpha	0.878	0.901	0.722	0.031	0.914

Source: Prepared by the authors (2022).
Reference: αC and CC > 0.7; AVE > 0.5, Matrix Diagonal (Square Root of AVE) greater than the other values of the latent variables.

Values on the diagonal, highlighted, are the square root of the AVE; as they are greater than the correlations between values outside the diagonal, there is discriminant validity at the level of latent variables. It should be noted that the second-order variable Communication Quality was operationalized using a two-step approach, consisting of the first-order variables Communication Frequency (Cronbach's alpha 0.900) and Media Richness (Cronbach's alpha 0.632). This is why Cronbach's Alpha in the second order presented a value below the expected parameters, which, however, does not affect the validity of the construct.

Two different models were generated in SmartPLS to test the hypotheses formulated in this study, one for each e-leadership style (Transactional and Transformational). Table 6 presents the results of the hypotheses considering that e-leadership manifests itself in the transformational style.

Table 6
Results for the transformational eleadership style

Hypotheses and Structural Relationships	VIF	f²	Structural coefficient	Standard error	T value	P value	Adjusted R^2	Status
H1(+) e-leadership Transf. → Commitment	1.06	0.061	0.237	0.097	2.44	**0.015**	0.119	**Not rejected**
H2(+) Commitment → Performance	1.09	0.034	0.18	0.13	1.38	0.168	0.113	Rejected
H3(+) e-leadership Transf. → Performance	1.09	0.068	0.255	0.115	2.22	**0.026**	0.113	**Not rejected**
H4(+) Quality → Transactional e-leadership	1	0.064	0.246	0.083	2.98	**0.003**	0.054	**Not rejected**
H5(+) Quality → Commitment	1.06	0.052	0.219	0.089	2.47	**0.014**	0.119	**Not rejected**

In Table 7, the results of the hypotheses are found, considering that e-leadership manifests itself in the transactional style.

Table 7
Results for the transactional eleadership style

Hypotheses and Structural Relationships	VIF	f²	Structural coefficient	Standard error	T value	P value	Adjusted R²	Status
H1(+) e-leadership Transf. → Commitment	1.06	0.061	0.237	0.097	2.44	**0.015**	0.119	**Not rejected**
H2(+) Commitment → Performance	1.09	0.034	0.18	0.13	1.38	0.168	0.113	Rejected
H3(+) e-leadership Transf. → Performance	1.09	0.068	0.255	0.115	2.22	**0.026**	0.113	**Not rejected**
H4(+) Quality → Transactional e-leadership	1	0.064	0.246	0.083	2.98	**0.003**	0.054	**Not rejected**
H5(+) Quality → Commitment	1.06	0.052	0.219	0.089	2.47	**0.014**	0.119	**Not rejected**

After presenting the results, and as shown in Tables 6 and 7, it can be seen that the theoretical model behaves differently depending on the adopted e-leadership style. Although all analyzed relationships positively influenced the variables of interest, e-leadership in the transactional style, compared with the transformational style, showed lower loads and more rejected hypotheses. Figure 2 presents the theoretical model of the research with the results of the tests, highlighting the transformational style and the hypotheses whose results allow them not to be rejected.

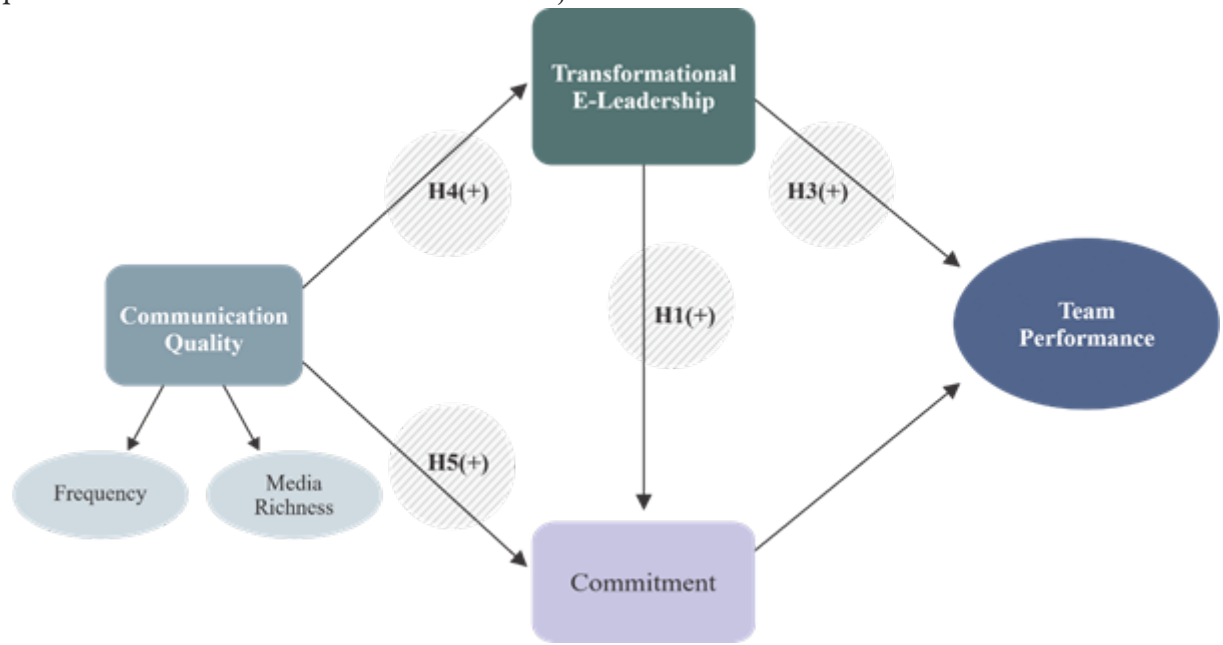

Figure 2
Summary of search results

Figure 2: Summary of search results.

In search of explanations outside the structural model, the variables length of service, time with the leader, team size, and generation of members were controlled. However, no evidence of significant effects of these variables on the performance variable was identified. The results are discussed below.

6 DISCUSSION

The analysis indicates that the quality of communication, a second-order construct composed of the first-order variables "media richness" and "frequency of communication," positively influences how teams view e-leadership. Although the transformational style has a higher factorial load, which suggests a more intense relationship with the quality of communication, the transactional style also suffers a positive and significant influence. This conclusion is consistent with the findings of Sedrine, Bouderbala and Nasraoui (2020), for whom the high level of media richness in virtual teams favors the potential of the transformational style compared to the transactional style. In addition, high-definition eye contact establishes intimacy between members (Avolio, Kahai & Dodge, 2001), which favors the transformational e-leadership style, whose most pronounced characteristics are charisma and inspiration (Bass, 1990).

The quality of communication was also positively and significantly related to the teams' commitment. Previous research has revealed that in virtual teams, commitment is essential for members to engage in collaborative behaviors adapted to the dispersion context (Jarvenpaa & Leidner, 1999; Hill & Bartol, 2016). This result indicates that effective communication, a more frequent and richer means of communication, can minimize the loss of non-verbal cues and help the e-leader strengthen the team's bond and project loyalty to the organization.

The two e-leadership styles were also positively and significantly related to commitment. Ensuring team commitment has been described as the biggest challenge for virtual team leaders (Cordery et al., 2009). The results indicate that Brazilian public service e-leaders are developing ways to deal with this. Again, the transformational style presented more consistent results, which aligns with the study's other conclusions. If the quality of communication has a positive influence on commitment, it was expected that transformational e-leadership would be able to extract more value from this relationship since it is based on stimulation and individualized consideration, attitudes conducive to establishing a network of psychological connections between distant team members and encourage commitment (Fiol & O'Connor, 2005).

However, the relationship between commitment and performance was insignificant, and the corresponding hypothesis was rejected. Previous research found a positive and significant relationship, for example, Joshi, Lazarova and Liao (2009) and Sivunen (2006). A possible explanation may be related to the context of these studies: the respondents were private-sector workers. In the public sector, in the case of the subjects surveyed in this study, commitment is usually lower than in the private sector, mainly because of the inflexibility of personnel procedures and the weak link between performance and rewards (Boyne, 2002). Thus, even though the two styles of e-leadership can positively influence public servants' commitment, such an increase does not necessarily result in increased performance for the public organization.

Finally, the study's most relevant finding is that e-leadership styles in the public sector behave differently regarding their relationship with team performance. The results reject the hypothesis that transactional e-leadership has an impact on performance. However, they demonstrate that transformational e-leadership positively influences performance in a significant relationship whose factorial load is the highest among the studied relationships.

Thus, in line with the research by Purvanova and Bono (2009), it can be said that the most effective virtual leaders in the public sector also tend to be those who adopt the transformational e-leadership style. Furthermore, considering that the selected organizations already had considerable experience in adopting virtual teams, it is likely that the technological resources available to the teams are adequate to allow the transformational style to stand out. All factorial loads of the communication quality variable were

significant, suggesting that communication is frequent and predominantly synchronous in the researched organizations.

7 FINAL CONSIDERATIONS

This study aimed to analyze the relationship between the quality of communication, e-leadership, commitment, and performance of virtual teams of public servants. Two styles of e-leadership were analyzed to achieve this intent: transformational and transactional. In addition, the quality of communication was measured according to the variables of communication frequency and media richness.

The results obtained with the application of the SEM highlighted the importance of adopting more effective communication in the virtual environment, seeking greater frequency and favoring synchronous communication tools that allow better interaction between team members. In this sense, the quality of communication proved to be essential for the prevalence of positive results of e-leadership in the transformational style compared to the transactional one. Thus, in line with previous research results, it seems that the public sector context is also conducive for the transformational style to stand out in the virtual environment by making better use of the communication strategies typical of this dispersed organizational format.

Virtual teams are an organizational arrangement that demands more from the leader. Nevertheless, leadership is considered the main governance mechanism in the public sector, responsible for providing essential services to society (Brasil, 2014). It is imperative, therefore, that public organizations choose leaders able to deal with the peculiar circumstances of the virtual world. This study contributes to managerial practice in the public service by confirming that what previous studies perceived in private organizations also applies in this sector: the transformational style is more suitable for dealing with virtual teams than the transactional one. In this way, public institutions can develop specific leadership programs for the virtual context or even improve the selection of leaders who demonstrate greater aptitude for the transformational e-leadership style.

Furthermore, the study's main practical contribution is mapping the relationship between the analyzed constructs. As a result, it was possible to assess the quality of communication in the e-leadership process and its impact on performance. At the same time, the theoretical contribution is associated with analyzing the e-leadership of virtual teams and its influence on performance from a perspective of public services in an emerging country with gigantic territorial, geographic, and cultural asymmetries. Furthermore, the social relevance of the study lies in understanding the workspace conducive to the development of transformational and transactional leadership, even if supported by electronic artifacts for its viability. Finally, the managerial implications are associated with understanding a recent social phenomenon, which has contributed significantly to the full functioning of public services, reducing costs, promoting synergies between work teams, and generating results and progress for Brazilian society.

As the limitations of this research, it is necessary to highlight that the collected data represent the respondents' perceptions. These perceptions were not collated with secondary data from the organization. For future studies, it is recommended to compare the perception with real data from the researched organizations, such as the performance variable.

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