

Team Psychological Capital: Comparative psychometric study of two versions of the Team Psychological Capital Questionnaire (24 and 12 items)

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Abstract

The globalized and competitive world underscores the relevance of positive organizational behavior, specifically team psychological capital (PsyCap). Indeed, teams are crucial to organizational success, and the study of PsyCap at the team level makes a significant contribution to both research and practice. Assessing the levels of PsyCap and/or its dimensions (self-efficacy, resilience, hope, and optimism) to understand the need for their promotion provides organizations with a significant advantage. This study assesses the psychometric properties of the Psychological Capital Questionnaire (PCQ) at the team level, utilizing both the 24-item and 12-item versions. A sample of 907 participants from 206 teams across 140 organizations from various sectors was analyzed. Confirmatory factor analysis was used to test the four-factor structure and a higher-order PsyCap model for both versions. Results support both models, indicating a high level of overlap between the scale versions. Both versions measure the same construct effectively, with practical advantages for the scales' shorter version. Thus, this study contributes to the understanding and application of the Team PsyCap questionnaire in organizational contexts.

Keywords: team psychological capital; team psychological capital questionnaire; teams; psychometric study.

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Capital psicológico de equipas: Estudo psicométrico comparativo de duas versões do Questionário de Capital Psicológico (24 e 12 itens)

Resumo

O mundo globalizado e competitivo destaca a relevância do comportamento organizacional positivo e, especificamente, do capital psicológico (PsyCap) das equipas. De facto, as equipas são fundamentais para o sucesso organizacional, e o estudo do PsyCap ao nível das equipas proporciona um contributo significativo, tanto para a investigação, como para a prática. Avaliar os níveis de PsyCap e/ou as suas dimensões (autoeficácia, resiliência, esperança e otimismo) para compreender a necessidade da sua promoção constitui uma importante vantagem para as organizações. Este estudo avalia as propriedades psicométricas do Questionário de Capital Psicológico (PCQ) ao nível de equipas, com recurso às versões de 24 e 12 itens. Uma amostra de 907 participantes de 206 equipas de 140 organizações de diversos setores foi analisada. A análise fatorial confirmatória testou a estrutura de quatro fatores e um modelo de PsyCap de ordem superior para ambas as versões da escala. Os resultados apoiam ambos os modelos, revelando uma elevada sobreposição entre as versões da escala. Ambas as versões medem o mesmo construto de forma eficaz, com vantagens práticas para a versão mais curta da escala. Assim, este estudo contribui para a compreensão e aplicação do questionário de PsyCap em equipas no contexto organizacional.

Palavras-chave: capital psicológico de equipas; questionário de capital psicológico de equipas; equipas; estudo psicométrico

INTRODUCTION

In recent years, there has been a growing emphasis on Positive Organizational Behavior (POB). Luthans (2002a) introduced POB to emphasize the importance of human strengths and psychological capacities in the workplace. This shift underscores the importance of managing employees' knowledge, experiences, and skills, which are crucial for organizational success (Luthans et al., 2004). It was the movement of positive psychology and, more specifically, POB, that provided the groundwork for the development of psychological capital (PsyCap) as a construct, defined as an individual's positive psychological state of development characterized by hope, optimism, self-efficacy, and resilience (Luthans et al., 2007).

The need to assess individuals' levels of PsyCap has led to the development of its measurement, the Psychological Capital Questionnaire (PCQ), developed by Luthans et al. (2007), the most used scale.

Despite the vast array of literature on the subject, one of the main areas emerging within the scope of PsyCap focuses on perceiving and measuring it as a collective construct. Evidence suggests that the attitudes and behaviors of individuals can be viewed as phenomena that collectively characterize the makeup of those individuals (Heled et al., 2015). The emergence of studies on collective PsyCap, specifically team PsyCap, follows the existing literature on teams, which is gaining increasing relevance, as explained by the fact that teamwork is indispensable for the pursuit and fulfillment of common goals (O'Neill & Salas, 2018). Whereas studies on the construct of psychological capital have been mostly focused on the individual level, knowledge of team PsyCap has the advantage of allowing organizations to apply planned team interventions and events, triggering positivity, efficacy, and resilience.

The development of research on team PsyCap requires the adaptation of the PCQ to this level of analysis. Considering that studies on the PCQ scale primarily focus on individual-level analysis (Luthans & Youssef-Morgan, 2017), this study aims to assess the construct validity and reliability of the Portuguese adaptation of the PCQ at the team level, comparing a longer and a shorter version. By evaluating the dimensionality and reliability of these versions, as well as comparing their effectiveness, this research aims to provide organizations and researchers with robust tools for measuring and fostering team Psychological Capital (PsyCap).

Psychological Capital

PsyCap, as defined by Luthans et al. (2007) is

an individual's positive psychological state of development and is characterized by (1) having confidence (self-efficacy) to take on and put in the necessary effort to succeed at challenging tasks; (2) making a positive attribution (optimism) about succeeding now and in the future; (3) persevering toward goals and, when necessary, redirecting paths to goals (hope) to succeed; and (4) when beset by problems and adversity, sustaining and bouncing back and even beyond (resiliency) to attain success. (p. 3)

As such, PsyCap is defined as a multidimensional construct that refers to an individual's positive psychological state, characterized by four dimensions: self-efficacy, optimism, hope, and resilience. These dimensions empower employees to meet challenges and to resist and succeed in the dynamic and global environment that organizations are faced with. The four dimensions of PsyCap are rooted in well-established psychological theories. The concept of self-efficacy, based on Bandura's theory of social learning, is defined by Stajkovic and Luthans (1998) as "an individual's convictions (or confidence) about his or her abilities to mobilize the motivation, cognitive resources, and courses of action needed to execute a specific task within a given context successfully" (p. 4). Self-efficacy is seen as a state that can be developed and managed, revealing a substantial impact on human performance. The "hope" dimension consists of three main concepts: action, path, and goals, where the action is the determination for the goals and the paths correspond to the way the goals are achieved (Snyder et al., 1996). Hope is a positive concept that can be developed and measured, but it can also influence performance in the workplace. Regarding optimism, Seligman (1998) is one of the primary authors who have approached the concept, defining it as the attributions made and the explanatory style used in response to events. It presents guidance for evaluating past or recent events. Optimism can also be measured, managed, and developed. However, it needs to be carefully developed, as disadvantages such as the establishment of unrealistic goals can also arise. It is essential to cultivate a realistic and adaptable optimism, which enables adaptation to changing circumstances (Luthans, 2002a). As such, optimism is perceived as a desirable characteristic in employees, as it is associated with higher levels of motivation, satisfaction, retention, perseverance, and a greater likelihood of development. The fourth dimension of PsyCap is resilience, defined as the ability to recover from failure and is associated with the concept of adaptability (Block & Kremen, 1996). Luthans (2002b) states that resilience also concerns the ability to recover from positive changes, progress, and

increased responsibility. This ability is a part of daily life for all individuals and can be developed (Tugade et al., 2004).

When combined, these dimensions form a higher-order construct that is more powerful in predicting positive outcomes, such as performance and job satisfaction, than any of the individual components alone (Luthans & Youssef, 2007). The studies carried out, particularly the work of Luthans et al. (2007), indicate that individuals with high levels of general psychological capital perform better than those who have only one dimension of PsyCap, as it encompasses a greater number and level of positive psychological resources.

Psychological capital as a collective construct

While the individual-level construct of PsyCap has been extensively studied, recent research has begun to explore PsyCap as a collective phenomenon, particularly in team-based environments (Chen et al., 2023). It is essential to note that the emergence of studies on collective PsyCap, specifically team PsyCap, follows the existing literature on teams, which is gaining increasing relevance. The globalization and interdependence of markets are among the factors that have contributed most significantly to the growth of teamwork in organizations, which has increased by 50% or more over the past two decades (Cross et al., 2016).

PsyCap as a team phenomenon enables a focus on shared mental models that emerge through team members' communication and interactions (Dawkins et al., 2021). Indeed, studies in the field of social psychology reveal that team members develop shared mental models that allow them to communicate, and they can set up a collective PsyCap (Lim & Klein, 2006). Dawkins et al. (2015) recall the principles of social contagion, which refers to the process of communication and exchange of information between members of a group, resulting in the adoption of attitudes and beliefs shared by others. As such, social contagion can contribute to the emergence of the collective PsyCap. In this vein, Peterson and Zhang (2011) view team psychological capital as the product of the interactive dynamics among team members, while Walumbwa et al. (2011) define it as the result of interactive exchanges between members that foster a sense of group capacity to achieve the desired collective goals. Furthermore, team PsyCap is also supported by the existing references to the collective level in each of its four resources. Bandura (1997) addressed the concept of collective self-efficacy. West et al. (2009) stated that teams can share an optimistic posture toward achieving positive results, as well as developing a shared capacity to trace alternative paths to achieve the goals (hope). Finally, it has also been supported that resilience can be a collective phenomenon

concerning the team's ability to adapt to the demands of the environment (Zhang & Liu, 2012).

In addition, team PsyCap can be seen as a resource for promoting positive attitudes and behaviors in employees (Heled et al., 2015). It is explained by the cross-level relationship between team PsyCap and individual-level outcomes (such as job satisfaction, performance, and turnover intentions) since individuals develop social relations at work and are influenced by the capacities of the team (West et al., 2009).

Measuring PsyCap: The PCQ (24- and 12-item versions)

Given the relevance of psychological capital, the development and measurement of PsyCap have become a strategic priority for organizations (Ouweneel et al., 2012). As mentioned, to assess PsyCap, Luthans et al. (2007) developed the widely used Psychological Capital Questionnaire (PCQ), originally designed as a 24-item instrument to capture the multidimensional nature of individual PsyCap.

This instrument consists of a total of 24 items, six items for each of the four dimensions that make up PsyCap, adapted from existing measures previously developed for each of the constituent constructs (Avey, 2014): hope (Snyder et al., 1996), resilience (Wagnild & Young, 1993), optimism (Scheier & Carver, 1985) and self-efficacy (Parker, 1998). The adaptation essentially went through the inclusion of the context ("at work"), as well as "here and now" and the items were chosen to explore the psychological resources similar to a state (Luthans & Youssef-Morgan, 2017). These measures formed the basis from which the PsyCap questionnaire was developed, following two main criteria: each of the four constructs should have equal weight, so the six best items for each of the four measures would be those selected, and the selected items should present content validity as they are relevant to the workplace and adaptable to changes (Luthans et al., 2007). These criteria made it possible to select the 24 items that make up the PCQ-24, with response options on a 6-point Likert scale (from 1 = strongly disagree to 6 = strongly agree), in which the participant must describe how he/she thinks about him/herself when he/she answers the questionnaire (Luthans et al., 2007).

Studies on the PCQ-24 scale have demonstrated that it is a reliable instrument and a predictive measure of performance, satisfaction, and affective organizational commitment at the individual level (Luthans et al., 2006; Luthans et al., 2007). Luthans, Norman, et al. (2008) analyzed the dimensionality of the scale, using confirmatory factor analysis (CFA), to support the four-factor structure and PsyCap as a higher-order construct. The results reveal adequate indexes for the tetra structure of psychological capital, with six items for each dimension. Both

the four-factor and second-order structures obtained have adequate fit adjustment. The analyses carried out by Luthans et al. (2007) concluded that PsyCap has discriminant validity compared to other constructs, such as personality traits and criterion validity with job satisfaction. Additionally, the usefulness of PsyCap has also been compared to each of its four dimensions to understand whether the higher-order construct is more “useful” than the measures of each dimension. The findings indicate that PsyCap is more consistent in predicting performance and satisfaction than its individual components, which strengthens PsyCap as a higher-order core factor (Luthans & Youssef-Morgan, 2017).

Subsequent studies assessed the validity of the PCQ-24 in different cultural contexts and have generally supported the scale’s four-factor structure. However, in South Africa, Görgens-Ekermans and Herbet (2013) identified problematic items, such as the reverse-scored items 13 and 20. In contrast, in Brazil, Cid et al. (2020) removed the reverse-scored items due to low factor loadings, resulting in a 21-item solution. Mónico et al. (2014) conducted a study with Portuguese employees and also supported the four-factor model (but removed items 13 and 20). These findings support the four dimensions originally proposed by Luthans et al. (2007).

Despite the reported findings, the PCQ-24 scale presents some drawbacks, particularly due to its size, which is a concern for its application in the work context. Additionally, the scale presents reverse items, which are also seen as a less positive point because they usually reduce scale reliability due to reasons such as language proficiency (Peterson & Chang, 2002, cited in Luthans & Youssef-Morgan, 2017).

Recognizing the need for a more concise tool, a 12-item version of the PCQ was later developed, offering a shorter yet robust measure of PsyCap. This scale is composed of 12 items derived directly from the PCQ-24 and rated on the same 6-point Likert scale: four items representing hope (two for each of the hope mechanisms: agency and pathways), three items representing efficacy, two items representing optimism, and three items representing resilience (Avey et al., 2011; Luthans, Avey, et al., 2008). To identify these items, Avey et al. (2011) employed the criteria established by Stanton et al. (2002). They first selected the items from the confirmatory factor analysis loadings available in previous literature. After that, the criteria for the contribution of the items to the scale’s internal reliability were considered. In third place, they selected the items that allowed the breadth of the construct to be maximized. Lastly, the numbers of items per component were considered. While the PCQ-24 has been extensively validated across various cultures, the 12-item version (PCQ-12) has also undergone significant cultural adaptations. Wernsing (2014) conducted a measurement invariance analysis of the PCQ-12 across 12 different cultures, providing evidence of the scale’s consistency and supporting the second-order structure of psychological capital across cultures.

Additionally, Luthans, Avey, et al. (2008) explored the validity of the PCQ-12 in Mandarin Chinese and found that the scale retains its four-factor structure and demonstrates standard acceptable values, supporting its applicability and effectiveness in measuring psychological capital among Chinese workers. The PCQ-12 scale has important advantages. In fact, besides the short length that lowers fatigue and enables cooperation, the shorter version has no reverse-scored items, which seem to tend to compromise the measure.

These two versions have been widely used, with the shorter version being particularly useful in contexts where time constraints or respondent fatigue are concerns.

PCQ (Psychological Capital Questionnaire) adapted to the team level

The conceptualization and the assessment of PsyCap at the collective level underscore the need for an adapted PCQ that measures PsyCap at the team level. Rebelo et al. (2018) emphasized the importance of translating the PsyCap measure to the team level and its independent relevance from the individual level. Thus, the authors adapted PCQ-24 in Portuguese for the team level, with results indicating that it is a reliable, stable, and promising adaptation. The adaptation included not only translation and linguistic adjustments but also modification of items to reflect the team level. That was made using the “referent shift consensus model” (Chan, 1998), which focuses on the perception that an individual has about their team. Thus, the referent of the scale was changed to represent the collective-level construct. In other words, instead of asking participants to assess their confidence in their abilities, they are asked to assess their confidence in the collective skills of the team to perform a given task (Luthans & Youssef-Morgan, 2017). When measuring collective PsyCap with this approach, a team member can have a high level of individual PsyCap and the perception of a low level of team psychological capital, as they are constructs operating differently and, for this reason, the referent shift consensus model is recommended to measure the collective psychological capital. The influence of the collective PsyCap is better assessed when team members are asked to reflect on the skills shared by the team and not when the referent is at the individual level (Dawkins et al., 2015).

To evaluate the adequacy of the questionnaire adaptation to Portuguese and at the team level, a pilot study was conducted with a team from the services sector. It aimed to identify and correct words and items perceived as dubious or subject to different interpretations. After completing the questionnaire, a debate arose regarding existing doubts and suggestions, which led to slight reformulations of a few items. Additionally, the revised version of the questionnaire was submitted for evaluation by two experts and to a translator to verify their agreement with the

translation of the items (DeVellis, 2012). Thus, the questionnaire was applied to the final sample, comprising 82 teams and 353 members. The psychometric evaluation of the scale was conducted through Principal Components Analysis (PCA), which aimed to explore the underlying structure of the instrument (Rebelo et al., 2018). The PCA revealed a tetra-factorial structure, accounting for 65.83% of the total variance. This outcome was achieved after the removal of six items, including all three reverse items, which were necessary due to their poor loadings. The reliability was assessed using Cronbach's alpha, which indicated an adequate internal consistency of the four factors since these values are above .70, which is the commonly accepted cut-off proposed by Nunnally & Bernstein (1994): .90 for self-efficacy, .85 for hope, .80 for optimism, and .75 for resilience. Subsequently, a Confirmatory Factor Analysis (CFA) was conducted to test the model, with psychological capital (PsyCap) as a second-order factor, implying that PsyCap is conceptualized as a construct composed of four first-order dimensions. The CFA results supported the theoretical framework of PsyCap as a higher-order construct, aligning with previous research (Rebelo et al., 2018). This finding reinforces the validity of the scale in capturing the integrated nature of psychological capital. Overall, the results provide evidence for the construct validity and reliability of the scale, affirming its adequacy in measuring the four dimensions of team psychological capital and supporting its conceptualization as a higher-order construct.

Other authors (Table 1) also measured team PsyCap with the referent at the team level. West et al. (2009) measured team optimism, team efficacy, and team resilience using six items per dimension from PCQ-24 that were adapted to have the team as a referent. In their research, participants were assigned to team projects. The data showed adequate reliability regarding those psychological capital resources, ranging from .75 to .96. Walumbwa et al. (2009), in turn, assessed team PsyCap through eight items retrieved from PCQ-24, resulting in a Cronbach's alpha of .79. They performed a CFA, and the results indicate that the model fits the data. Mathe et al. (2014) used an 11-item scale (an item from the hope dimension was dropped from the PCQ-12 in a prior analysis due to a low factor loading) to measure team PsyCap, with a Cronbach's alpha of .90. The authors conducted a CFA, and the results indicate that all factor loadings were above .40 and the second-order model showed an adequate fit. Lastly, Heled et al. (2015) measured team collective PsyCap with the revised PCQ with 11 items (Mathe et al., 2014). They performed a CFA that led to dropping three items due to factor loadings, and an eight-item scale emerged with better results than the 11-item scale and with a Cronbach's alpha of .78. Dawkins et al. (2021) also assessed team PsyCap by using some items adapted from the PCQ-24 with a team referent, demonstrating good reliability (.92). More

recently, Dimas et al. (2022) used the scale adapted by Rebelo et al. (2018), with the removal of five items, and confirmed the second-order model with an adequate fit.

Hence, the few studies that have emerged using the PCQ (or some of its dimensions or items) with the team as a referent obtained satisfactory results. Given the increasing importance of team PsyCap, this study aims to examine the construct validity and reliability of both the 24-item and 12-item Portuguese versions of the PCQ at the team level.

Table 1

Summary of studies measuring team PsyCap with PCQ

Study	Number of Items	Cronbach's Alpha	Key Findings
West et al. (2009)	18	Above .75	Scale's reliability supported
Walumbwa et al. (2009)	8	.79	The model fits the data
Mathe et al. (2014)	11	.90	Second-order model supported
Heled et al. (2015)	11 (revised to 8)	.78	CFA led to reduction of three items; better results with 8 items.
Rebelo et al. (2018)	24	Above .75	Tetra-factorial structure supported after the removal of six items. Second-order model is also supported
Dawkins et al. (2021)	24	.92	Scale's reliability supported
Dimas et al. (2022)	24	Above .73	Four-factor structure supported after the removal of five items. Second-order model is also supported

METHOD

Participants

The sample is composed of 907 subjects from 206 teams. The teams belong to 140 organizations from several activity sectors, namely industrial, associative, trade, and services, the latter being the most representative. Regarding the participants' sociodemographic characteristics (Table 2), 895 participants answered the question of age, with an average of 36.71 ($SD = 11.94$), ranging from 18 to 70 years old. Most respondents are female ($n = 894$; 61.9%). Concerning academic qualifications, 38.7% ($n = 882$) completed 12 schooling years or have lower qualifications, followed by 35.9% of subjects with an academic degree. The average tenure in the organization is 9.66 years ($SD = 10.14$). As for tenure in the current team, the average is approximately five years ($SD = 6.75$). The teams have an average of six elements ($SD = 3.75$), ranging from three to 22 elements.

Table 2*Sample Characteristics*

Sociodemographic Characteristics	<i>N</i>	%	<i>M</i>	<i>SD</i>
Gender	894			
Female	561	61.9	-	-
Male	333	38.1	-	-
Academic Qualifications	882			
9 School Years or Lower	120	13.2		
12 School Years or Lower	351	38.7	-	-
Graduation	326	35.9	-	-
Master's degree	85	9.4		
Age	895	-	36.71	11.94
Organization Tenure (Years)	886	-	9.66	10.14
Team Tenure (Years)	880	-	5.00	6.75

Note: Descriptive statistics are provided for continuous variables (mean and standard deviation). Frequencies and percentages are reported for categorical variables.

Procedures

The sample was collected in two large research projects focusing on team functioning and effectiveness carried out by the research group between 2016 and 2019. To be considered a team in these studies, it was necessary to be constituted by three or more elements; the members had to be recognized and recognize themselves as a team; they must have interdependent relationships and interact regularly to achieve a common goal (Lourenço et al., 2014).

The data collection was based on a non-probabilistic sample procedure, specifically the convenience (or accessibility) sampling method, which relies on the use of interpersonal and contact networks (Hill & Hill, 2005). The initial contact with the organization was established in person or by email, along with the document of the collaboration project. This document provides a detailed explanation of the scope and goals of the research project, including the variables to be analyzed, the type of collaboration proposed, the steps and methods of data collection, as well as the rights and responsibilities of the researchers and organizations.

The application of the questionnaires was carried out after obtaining the organizations' approval, and it was performed in person or through an online version. This multi-modal procedure has the advantage of responding to the preferences and skills of respondents, thereby increasing the overall response rates across different groups' profiles (Lavrakas, 2008). The entire procedure adhered to the ethical principles of research in psychology, specifically the informed consent of participants, confidentiality and anonymity of the data, and the voluntary nature of participation in the study. None of the participants received any form of com-

pensation for their participation in the study, and all the companies were contacted and granted permission for their participation in this research.

Measure

The team PCQ with 24 items adapted by Rebelo et al. (2018) was applied to the sample. This scale uses the team as a referent and consists of 24 items adapted from the PCQ developed by Luthans et al. (2007), with six items for each of the PsyCap resources. Two sample items are “In our team, we feel confident sharing information...” and “In our team, we can overcome the difficult moments...”. The instrument has a 6-point Likert scale (1 = *strongly disagree* to 6 = *strongly agree*), in which the participant must describe how he/she thinks about him/her team when he/she answers the questionnaire.

The PCQ-12 was also applied to the sample. It is derived from the PCQ-24 and is composed of 12 items selected from the original scale and rated on the same 6-point Likert scale: four items representing hope (two for each of the hope mechanisms: agency and pathways), three items representing efficacy, two items representing optimism, and three items representing resilience (Avey et al., 2011; Luthans, Avey, et al., 2008).

In both measures, higher scores indicate a strong level of psychological capital, suggesting greater resilience, optimism, hope, and self-efficacy. Lower scores, on the other hand, may indicate areas where psychological capital could be developed or strengthened, potentially pointing to challenges in resilience, optimism, hope, and self-efficacy.

Data Analysis

To assess the scale's construct validity and test the four-factor and second-order structure of both versions of the PCQ (24 and 12 items), a CFA (CFA) was performed with IBM SPSS AMOS 25 software using the maximum likelihood (ML) estimation method. The decision regarding the goodness-of-fit of the models was supported by a formal hypothesis test, the chi-square test, and, as this test is highly sensitive to sample size and model complexity, by a chosen set of fit indexes. For the analysis undertaken, the following indexes were considered the most common recommendation with CFA: comparative fit index (CFI), which evaluates the model fit by comparing the discrepancy between the data and the hypothesized model (values ranging between 0 and 1, with 1 being the best model fit); Tucker-Lewis index (TLI), which makes up for the negative bias issues (values approaching one are considered a good model fit); standardized root mean square residual (SRMR), that “can be viewed as the average discrepancy between the correlations observed

in the input matrix and the correlations predicted by the model” (Brown, 2015, p. 70) and root mean square error of approximation (RMSEA), which assesses how the model fits the population, with values of 0 indicating perfect fit. The cut-off points considered for the assessment of the models were .90 for CFI and TLI and .07 for RMSEA and SRMR (Brown, 2015; Hair et al., 2006). As for the loadings, a cut-off of .45 was considered a fair association (Tabachnick & Fidell, 2007). Cronbach's alpha and McDonald's omega were computed to evaluate the internal consistency of the team PCQ scale (24 and 12 items), both in the global latent variable and in each of its four dimensions, with a cut-off of .70 being adopted (Nunnally & Bernstein, 1994).

RESULTS

Dimensionality of the 24 and the 12-item version of Team PCQ

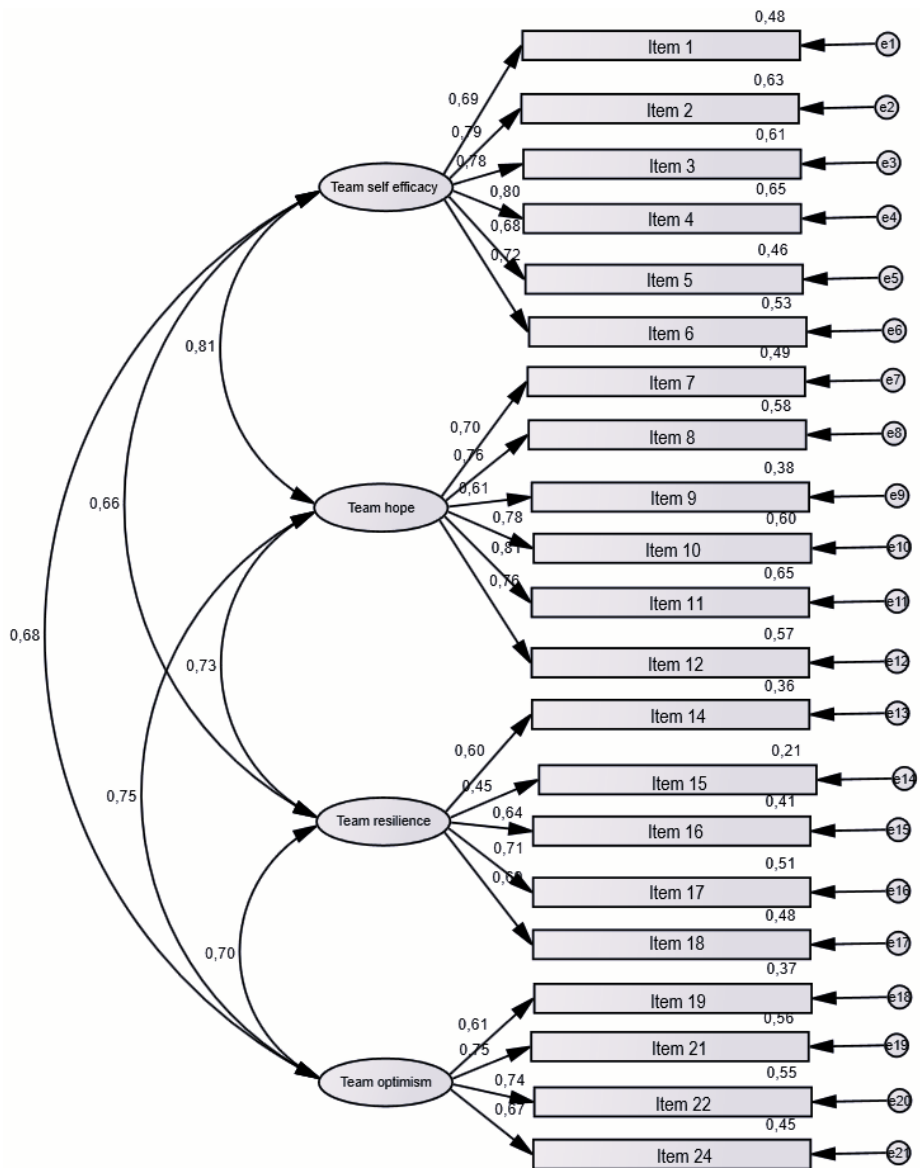
Regarding the extended scale structure (24 items), a set of concurrent models was tested using CFA. The first model tested assumed the hypothesis that all items were represented in a single factor. The results indicated that PsyCap is not represented by a single-factor solution (see Table 3), and we then proceeded to a CFA to test the four-factor original model (see Table 3). The inspection of the standardized solution revealed that items 13, 20, and 23 had low loadings (.23, .19, .18, respectively), meaning that their association with the factor was weak, and they were excluded, leaving a 21-factor solution. The items excluded are reversed, and similar levels of association were also verified in previous studies (Rebelo et al., 2018). The retained structure was tested using the same CFA procedure, initially for a single-factor model, which did not reveal results that supported this option, as expected (see Table 3). Then a new CFA was performed to test the four-factor structure of the scale, which revealed an overall fit adjustment [χ^2 (183) = 894.99, $p < .001$, CFI = .92, TLI = .91, SRMR = .05, RMSEA = .07, $p = .000$, 90% CI [.061, .070], with loadings between .45 and .81 (see Figure 1). Regarding the correlations between first-order factors, in the 21-item scale (Figure 1), the correlations are generally large, indicating strong relationships among self-efficacy, hope, optimism, and resilience, with values ranging between .66 and .81. Finally, a CFA was conducted with the 21-item structure and team psychological capital as a second-order factor. The results also showed a model with an adequate level of adjustment [χ^2 (185) = 906.61, $p < .001$, CFI = .92, TLI = .91, SRMR = .05, RMSEA = .07, $p = .000$, 90% CI [.06, .07] and loadings ranged between .46 and .80 (see Figure 2). Although the difference in the chi-square of the two models was significant, both show an adequate adjustment and very similar goodness-of-fit values.

As for the 12-item version, the procedure was identical. More specifically, a CFA was conducted assuming a single-factor structure, and the results revealed that it was not an acceptable solution (see Table 3). Then, we performed a CFA to test the four-factor structure of the scale, which revealed an adequate level of overall adjustment [χ^2 (48) = 294.33, $p < .001$, CFI = .95, TLI = .93, SRMR = .04, RMSEA = .08, $p = .000$, 90% CI [.07, .08] and loadings between .43 and .82 (see Figure 3). In the 12-item scale (Figure 3), while the correlations between dimensions are lower than the correlations observed in the 21-item version, they still exhibit large and positive relationships, ranging between .56 and .79. In general, the correlation patterns in the 12-item scale align with those in the 21-item scale, though with slightly reduced magnitudes. Finally, a CFA was also computed with the 12 items and team psychological capital as a second-order factor [χ^2 (50) = 302.68, $p < .001$, CFI = .95, TLI = .93, SRMR = .05, RMSEA = .07, $p = .000$, 90% CI [.07, .08]. The loadings range from 0.44 to 0.82 (see Figure 4). Similarly to the 21-item version, the 12-item scale also shows a statistically significant difference in the chi-square values between the four-factor and second-order factor structures; however, both structures demonstrate an adequate level of adjustment and very similar goodness-of-fit values. The results of each model are summarized in Table 3.

Table 3
Concurrent Models Goodness-of-Fit

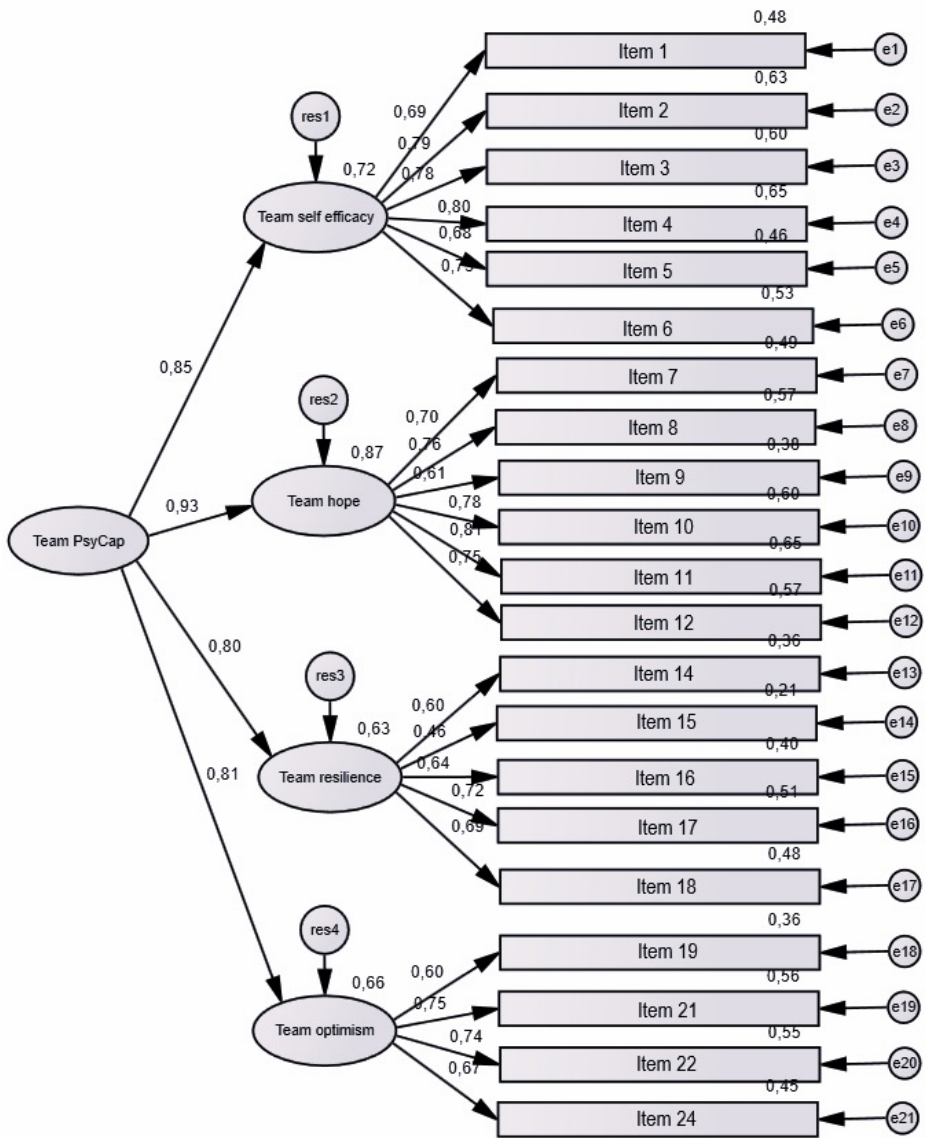
Models	χ^2	df	$\Delta \chi^2$	CFI	TLI	SRMR	RMSEA (90% CI)
Team PCQ - Extended Version (24 items)							
1. Single-Factor 24 Items	2509.15	252		.77	.75	.072	.10 [.10, .10]
2. Four-Factor 24 Items	1543.90*	246	965.25***	.87	.85	.064	.08 [.07, .08]
3. Single-Factor 21 Items	1896.52	189		.82	.79	.063	.10 [.10, .10]
4. Four-Factor 21 Items	894.99	183	1001.53***	.92	.91	.046	.07 [.06, .07]
5. Second-Order 21 Items	906.61	185	11.62**	.92	.91	.047	.07 [.06, .07]
Team PCQ - Short Version (12 items)							
1. Single-Factor 12 Items	750.74	54		.85	.81	.064	.12 [.11, .13]
2. Four-Factor 12 Items	294.33	48	456.40***	.95	.93	.045	.08 [.07, .08]
3. Second-Order 12 Items	302.68	50	8.35*	.95	.93	.046	.08 [.07, .08]

Note: Statistics: Chi-square (χ^2); Comparative fit index (CFI); Tucker and Lewis Index (TLI); Standardized Root Mean Squared Residual (SRMR); Root Mean Square Error of Approximation (RMSEA). * $p < .05$. ** $p < .01$. *** $p < .001$.

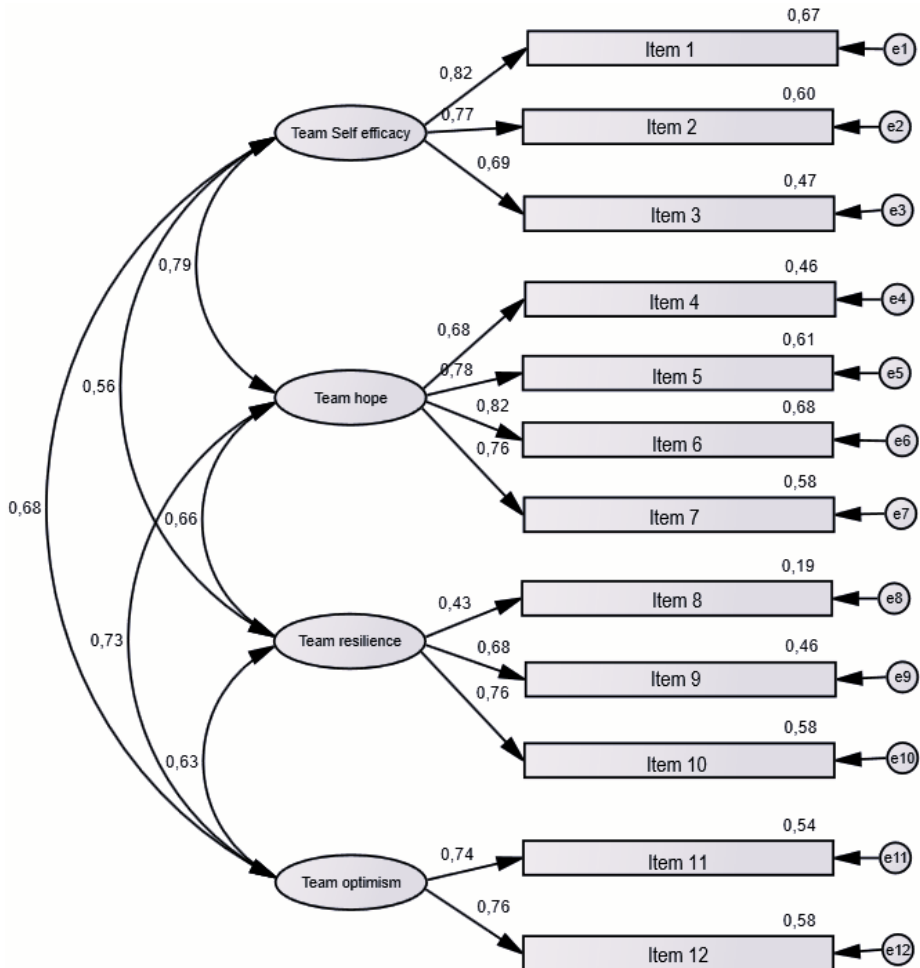
Figure 1*21-Item Four-Factor Model Standardized Solution*

Note: Standardized factor loadings and R squares of the observed variables.

Figure 2
21-Item Second-Order Model Standardized Solution

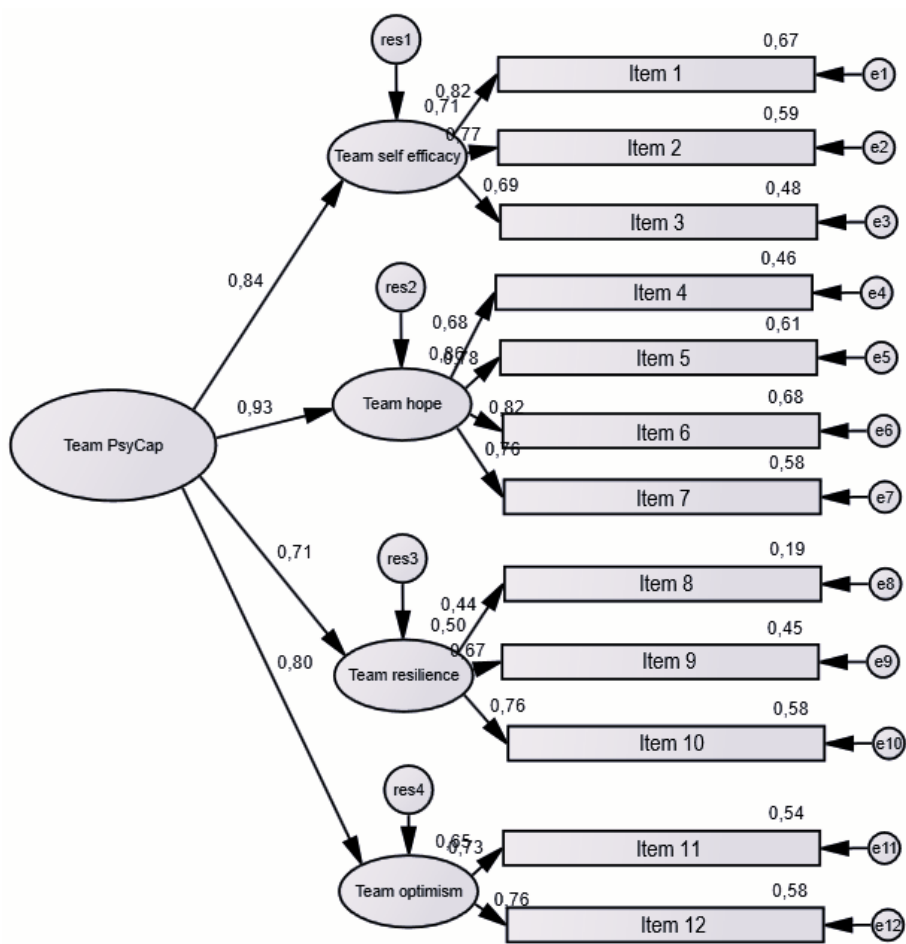


Note: Standardized factor loadings and R squares of the observed variables.

Figure 3*12-Item Four-Factor Model Standardized Solution*

Note: Standardized factor loadings and R squares of the observed variables.

Figure 4
12-Item Second-Order Model Standardized Solution



Note: Standardized factor loadings and R squares of the observed variables.

Reliability of the Team PCQ

The Cronbach's alpha and the McDonald's omega for both scales (12- and 21-item) and their dimensions were estimated. The global score of the 21-item scale presented an alpha and McDonald's omega of .93. Regarding each dimension, team self-efficacy had an $\alpha = .88$ and $\omega = .88$, team hope an $\alpha = .87$ and $\omega = .88$, team resilience an $\alpha = .75$ and $\omega = .75$, and team optimism an $\alpha = .79$ and $\omega = .79$. On the other hand, the 12-item scale global score presented an alpha and McDonald's omega of .89, and the dimensions the following values: team self-efficacy - $\alpha = .80$ and $\omega = .81$; team hope - $\alpha = .84$ and $\omega = .85$; team resilience - $\alpha = .64$ and $\omega = .65$ and team optimism - $\alpha = .72$.

Team PsyCap assessment: Comparing the two versions of the Team PCQ

After assessing the dimensions of both scale versions, the aim was to compare them. Therefore, the correlations between the 12-item and 21-item versions of the scale were calculated, with the results presented in Table 4. All corresponding subscales showed correlations above .90. Among the dimensions, team hope is the most strongly associated with team PsyCap for both scales, followed by team self-efficacy. On the 21-item scale, team optimism is the least associated with team PsyCap, whereas, on the 12-item scale, team resilience shows the weakest association with team PsyCap. The highest correlations were observed between the overall team PsyCap scores of the two scales, with the 12-item scale being highly correlated with the 21-item scale ($r = .98$). This suggests that the short version of the scale can effectively measure team PsyCap with results very similar to those obtained using the longer version.

Table 4

Correlations Between the 21-Item Scale and the 12-Item Scale (N = 907)

Variable	Self-Efficacy (21-Item Scale)	Hope (21-Item Scale)	Resilience (21-Item Scale)	Optimism (21-Item Scale)	PsyCap (21- Item Scale)
1. Self-Efficacy (12-Item Scale)	.96	.69	.51	.54	.83
2. Hope (12-Item Scale)	.71	.97	.59	.60	.87
3. Resilience (12-Item Scale)	.47	.50	.93	.47	.68
4. Optimism (12-Item Scale)	.54	.61	.50	.91	.74
5. PsyCap (12-Item Scale)	.85	.89	.78	.75	.98

Note: The correlations above the diagonal represent the associations between the dimensions of the 21-item scale and the corresponding dimensions of the 12-item scale. The correlations below the diagonal represent the associations between the dimensions of the 12-item scale and the corresponding dimensions of the 21-item scale. All correlations are significant at the level of $p < .001$.

DISCUSSION

This study aimed to extend the validation of the PCQ-24 and PCQ-12 scales at the team level. Our main findings revealed that the original 24-item version did not fit a single-factor model. After excluding three items with low loadings, the remaining 21-item scale showed a good fit with the four-factor structure. Similarly, the 12-item version demonstrated adequate fit, and the high correlations between both versions support that the shorter scale adequately captures the constructs assessed by the longer version.

The three items were removed from the team PCQ-24 due to their low loadings in the factor analysis. This suggested that they did not contribute effectively to the measured dimension. Despite their low loadings, it is important to note that these items were not entirely negligible; their removal was based on the overall pattern of loadings. The items in question are reverse-coded, which can often make them less consistent with the rest of the scale, as reverse items may lead to response biases or confusion among respondents (DeVellis, 2017). The content of these items, focusing on negative aspects or pessimistic views about work, may not align well with the overall positive orientation of the remaining items in the scale. This misalignment could contribute to the observed lower loadings. When comparing other adaptations of the PCQ-24, such as those by Rebelo et al. (2018) at the team level and Cid et al. (2020) at the individual level, we observe that these adaptations also faced challenges with reverse items. For instance, Rebelo et al. (2018) removed reverse items due to similar issues, reinforcing our decision to exclude them. This approach aligns with previous research, which suggests that reverse items may reduce the overall scale reliability (Peterson & Chang, 2002, cited in Luthans & Youssef-Morgan, 2017). It is also important to note that when analyzing the total-item correlation, there was no indication that any more items should be dropped. Nonetheless, item 15, from the resilience dimension, had lower loadings on both scale versions. Although its loading was below .50, it was not removed due to its unique content and relevance, and the overall adequate model fit. However, it is important to note the changes in Cronbach's alpha and McDonald's omega values for the resilience dimension if the item is excluded: .75 in both reliability indicators for the 21-item scale and a Cronbach's alpha of .67 for the 12-item scale. Future research should closely monitor the performance of this item in various contexts.

On the other hand, team PCQ-12 showed consistent results without the need to drop any items, though some authors have suggested removing items in their analyses (e.g., Mathe et al., 2014). Our study retained all items, preserving the theoretical breadth of the dimensions.

In terms of internal consistency, both Cronbach's alpha and McDonald's omega coefficients indicated adequate internal consistency for both scale versions, with a noteworthy exception being the alpha of .64 and the McDonald's omega of .65 for the resilience dimension in the 12-item scale. This value, although lower than the typically recommended threshold of .70, is close to a less conservative criterion of .65 used by some researchers (DeVellis, 2012). This suggests that while the PCQ-12 remains a reliable tool, ongoing evaluation is necessary to ensure its robustness, namely in the resilience dimension.

PsyCap is generally perceived as an integrated construct, a higher-order latent variable; that is, PsyCap provides an additional contribution to the four dimensions that comprise it (Luthans et al., 2007). Our findings support the idea that PsyCap should be perceived as a higher-order construct comprising four dimensions – team self-efficacy, resilience, hope, and optimism – rather than a single-factor solution. This aligns with the theoretical framework proposed by Luthans et al. (2007). The first-order factors – self-efficacy, hope, resilience, and optimism – showed strong intercorrelations, highlighting their interconnected nature and reinforcing the theoretical framework of PsyCap. The high correlations between these factors indicate that, while they are distinct constructs, they are closely related and collectively contribute to the overall measure of team PsyCap. The second-order factor model, which conceptualizes PsyCap as an integrated higher-order construct, aligns with the theoretical perspective proposed by Luthans et al. (2007). This model supports that team PsyCap is best understood as a composite of the four first-order dimensions, providing a comprehensive view of psychological capital at the team level. The similarity in fit between the first-order and second-order models underscores the flexibility of the PCQ and its utility in capturing both the specific dimensions and the overarching construct of team PsyCap. Researchers and companies can choose to use either version depending on their goals and the depth of analysis required. For instance, if a particular dimension is found to be weak, the four-factor structure enables targeted interventions to address specific areas of need. Otherwise, a company may want to measure the levels of psychological capital of its teams, using one of the versions of the scale for this purpose and, thus, as a higher-order construct.

Moreover, we calculated the correlations between the 21-item and 12-item scales, both the four-factor and the second-order factor structures, revealing very high correlations. This supports that both scale versions measure the same construct, allowing for interchangeable use. All the constructs in the study, the four dimensions, and the integrated latent variable of team PsyCap overlap in both versions. Using team PCQ-12 presents practical advantages, such as enhancing cooperation

and reducing participant fatigue (Luthans & Youssef-Morgan, 2017), as well as, according to those authors, enhancing responsiveness across cultures.

To summarize, this study extends the validation of the PCQ-24 and PCQ-12 for use at the team level. Both versions of the team PCQ are valid and reliable tools for measuring team Psychological Capital, with each version offering unique advantages. The PCQ longer version provides more detailed assessments and targeted interventions, while PCQ-12, as a shorter and more practical version, reduces participant fatigue and enhances cooperation. Its brevity does not compromise its ability to measure the core constructs of PsyCap, making it suitable for contexts where time is typically perceived as a constraint, such as the work environment. Thus, the practical implications of using the team PCQ-12 are notable, particularly in organizations seeking efficient and effective ways to assess and develop team psychological capital.

CONCLUSIONS

The organizational world increasingly depends on the existence of teams that can answer challenges and obstacles (O'Neill & Salas, 2018). In this context, it is relevant to approach team PsyCap not only at a theoretical level but also at a practical and empirical level to understand and intervene in the teams' psychological capital levels. For this, it is essential to have robust and reliable instruments to assure the quality of this assessment. Indeed, the present work reinforces the use at the team level of the PsyCap measurement scale - PCQ 21 and 12-item versions - supporting the idea that psychological capital can be measured at the collective level (Heled et al., 2015). Studies about PsyCap focus particularly on the individual level, and the transition to the team level as a referent is a recent process, which is fully supported by the findings of the present work. This conclusion also results in an important practical contribution for organizations since it supports the fact that they can measure psychological capital to later intervene on its level in their teams. The results support both the four-factor and second-order structures of the team PCQ (21 and 12 items) and that it is possible to use either version, depending on the research and/or organizational goals. Nevertheless, it is worth noting the strong correlations found between the two versions of the scale. These results support the conclusion that it is advisable to preferentially use the shorter version of the scale, as it has equally good psychometric qualities and practical advantages. Within this framework, the present study assumes great importance, as it allowed the validation of the 21-item and 12-item scales with the team as a referent with the benefit of using a short measure. Our study suggests that researchers and organizations can confidently utilize the team PCQ-12 scale, as it effectively evaluates PsyCap and

facilitates increased cooperation and reduced participant fatigue, both of which are crucial for the success of data collection (Luthans & Youssef-Morgan, 2017).

Although this study provides important insights into the psychometric qualities of the team Psychological Capital Questionnaire (PCQ) in both versions, it is crucial to acknowledge its limitations. Specifically, data collection was conducted in two different formats (in-person and online) without controlling for potential variations in responses across these formats. Additionally, the existence of a few subjects per team impairs the adequacy of a multilevel confirmatory factor analysis. As a next step, it would be important to analyze the PCQ scale with this data analysis technique. However, to achieve this, it will be necessary to collect additional data to increase the number of participants per team (Hox et al., 2010).

As a future suggestion, we highlight the relevance of studying the nomological validity of both versions of the scale, relating them to variables of interest, such as team effectiveness. It is also relevant, from our point of view, to carry out invariance tests according to variables that characterize teams, such as team size or team tenure. For an instrument to be widely applied in a heterogeneous population, its psychometric properties must be proved equivalent or invariant in the different subgroups of the population. Thus, it is important to clarify whether the four-factor and second-order structure may be assumed to have invariance in different groups or the same group but at different times of application (Brown, 2015).

Summing up, this work is relevant to research and practice, as it provides empirical support for the measure of PsyCap at the team level using the PCQ in its longer or shorter version.

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