

Artículo de Investigación

Leading Through Change: Psychometric Validation of the Adaptive Capacity Questionnaire

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Información Artículo	ABSTRACT
Recibido: 20-IV-2026 Aceptado: 7-VII-2026 Keywords: Adaptive capacity, Leadership, Organizational Change, Psychometrics, Puerto Rico	This study examined adaptive capacity in organizational leadership and introduced the Adaptive Capacity Questionnaire (ACQ), a psychometric instrument developed for the Puerto Rican context. Grounded in adaptive leadership theory, adaptive capacity refers to leaders' ability to mobilize people, address complex challenges, and thrive during change. The ACQ was administered to 335 organizational leaders from multiple hierarchical levels. Using a cross-sectional design, its psychometric properties were evaluated through exploratory and confirmatory factor analyses, as well as reliability and validity analyses. Results supported the instrument's internal consistency and factorial validity. A second-order model with eight first-order dimensions demonstrated good fit and strong theoretical coherence. Although a bifactor model showed slightly better global fit, bifactor ancillary indices indicated that the second-order structure was more appropriate because the specific factors contributed little reliable variance beyond the general factor. Reliability was satisfactory for the total scale and subscales. These findings provide preliminary evidence supporting the ACQ as a valid measure of adaptive capacity in organizational leadership.

Liderando en medio del cambio: Validación Psicométrica del Cuestionario de Capacidad Adaptativa

Palabras Clave:	RESUMEN
Capacidad Adaptativa, Liderazgo, cambio Organizacional, Psicometría, Puerto Rico	Este estudio examinó la capacidad adaptativa en el liderazgo organizacional y presentó el <i>Adaptive Capacity Questionnaire</i> (ACQ), un instrumento psicométrico desarrollado para el contexto puertorriqueño. Fundamentada en la teoría del liderazgo adaptativo, la capacidad adaptativa se refiere a la habilidad de los líderes para movilizar a las personas, afrontar desafíos complejos y prosperar durante los procesos de cambio. El ACQ se administró a 335 líderes organizacionales de distintos niveles jerárquicos. Mediante un diseño transversal, se evaluaron sus propiedades psicométricas utilizando análisis factoriales exploratorios y confirmatorios, además de análisis de confiabilidad y validez. Los resultados respaldaron la consistencia interna y la validez factorial del instrumento. Un modelo de segundo orden con ocho dimensiones de primer orden mostró buen ajuste y coherencia teórica. Aunque el modelo bifactor presentó un ajuste global ligeramente superior, los índices auxiliares bifactoriales apoyaron la retención del modelo de segundo orden, ya que los factores específicos aportaron poca varianza confiable adicional al factor general. En conjunto, los hallazgos aportan evidencia psicométrica preliminar que respalda el ACQ como una medida válida de la capacidad adaptativa en el liderazgo organizacional.

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Introduction

The world is constantly changing and thus demanding organizations and its leaders to adapt to survive (Heifetz et al., 2009; Seah et al., 2014). According to Heifetz and colleague's adaptive leadership framework (2009), developing such adaptive capacity requires looking backwards and forward at the same time to carry the best from history into the future. This study aimed to explore how to measure adaptive capacity in organizational leaders, particularly in the context of Puerto Rico that has recently faced periods of sustained change driven by different forces.

Puerto Rico's organizational environment has faced persistent instability due to events such as hurricanes, earthquakes, power shortages, the COVID-19 pandemic, and economic crises, forcing many businesses to adapt or shut down. For instance, more than 150 organizations closed after Hurricane Maria (Díaz, 2018), over 1,700 businesses shut down in 2020 due to the COVID-19 pandemic (Gómez, 2021), and more than 450 small and medium enterprises closed in 2023 amid rising operational costs caused by inflation (Metro Puerto Rico, 2024). Despite these disruptions, job growth has been observed in recent years, with 2022 recording the highest number of registered businesses since 2010 (Central Intelligence Agency, 2024; Vocero, 2023). Some of this growth has been attributed to entrepreneurial activity during the pandemic, although the long-term sustainability of these businesses remains uncertain (Vocero, 2023). The Puerto Rican economic context is also strongly shaped by its political relationship with the United States, particularly through policies such as the Jones Act, which restrict maritime transport between the U.S. and Puerto Rico to U.S. flagged vessels, increasing the cost of imported goods, on which the island relies for about 85% of consumption, by 20–60% (Nina, 2016). These structural constraints, combined with vulnerability to natural disasters and crises such as Hurricane Irma and the 2020 Puerto Rico earthquakes, have disrupted supply chains, reduced markets, and created bureaucratic and economic challenges for organizations (Hernández Santiago & Pérez Rivera, 2022). Given this volatile environment, organizations must develop adaptive capacity and leadership capable of responding to ongoing economic, social, political, and psychological changes to achieve sustained organizational resilience (Anderson & Anderson, 2010).

Leadership is a social construct that has been studied since ancient times and, due to its complex and

multidimensional nature, numerous leadership definitions and theories exist (Benmira & Agboola, 2021; Dugan, 2024). Adaptive leadership, specifically, is defined by Heifetz et al. (2009) as “the practice of mobilizing people to tackle tough challenges and thrive” (p. 14). In essence, this framework guides members in matrixed, complex, and interconnected organizations into adapting to environmental changes (Doyle, 2017; London, 2023). Beyond surviving, adaptive leadership emphasizes learning as the best way to thrive (Forbes, 2023; Heifetz et al., 2009; Hernández Santiago, 2023). In this framework, thriving stems from evolutionary biology where DNA undergoes a process of adaptation consisting of three steps. First, DNA is preserved for survival; then, the DNA that no longer serves the current needs is rearranged or discarded; and lastly, arrangements are made, allowing the system to thrive in challenging environments (Heifetz et al., 2009).

Adaptive cultures are characterized by five core features: (a) elephants in the room are named, (b) responsibility for the organization is shared, (c) independent judgement is expected, (d) leadership capacity is developed, and (e) reflection and continuous learning are institutionalized (Heifetz et al., 2009). When elephants in the room are named, no issue is considered too sensitive for discussion, and challenging authority becomes an accepted part of organizational dialogue. Individuals who raise difficult concerns are protected, and hidden perspectives are surfaced quickly to ensure important problems are not ignored. Likewise, when responsibility for the organization is shared, employees look beyond their formal roles and collaborate across functions to address complex challenges. Organizational rewards emphasize collective outcomes, and individuals frequently exchange resources, ideas, and lessons learned through collaborative practices (Heifetz et al., 2009).

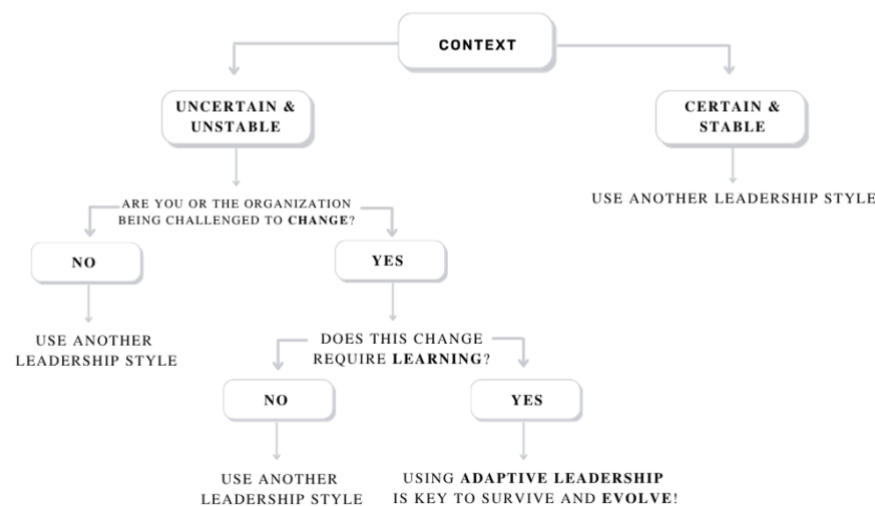
In addition, when independent judgement is expected, leaders are not required to have all the answers; instead, decision-making and idea generation are distributed across the organization to encourage initiative and resourcefulness. When leadership capacity is developed, organizations invest in professional growth to maintain a strong pipeline of leaders, allowing individuals to recognize and contribute their potential. Finally, when reflection and continuous learning are institutionalized, organizations cultivate openness and commitment by supporting risk-taking and treating mistakes as opportunities for learning rather than grounds for marginalization. Coaching is encouraged, and strategic plans are regularly revisited and refined as

new information emerges, and the organization evolves (Heifetz et al., 2009). Fostering these five characteristics strengthens an adaptive culture that enables organizations to navigate crises through continuous action and experimentation (Hernández

Santiago, 2023), although the disruptive nature of adaptive leadership suggests it should be applied selectively in appropriate contexts, as illustrated in Figure 1.

Figure 1

When is adaptive leadership useful?



Adaptive Capacity: The Key to Leading Change

Adaptive capacity is essential for organizations facing complex and evolving challenges, particularly within the framework of adaptive leadership. While an adaptive culture can facilitate transformation, adaptive capacity allows organizations to manage the disruption and tension that arise during change processes (Heifetz et al., 2009). Successful adaptation depends on available resources and collaborators, as well as leaders' ability to guide individuals through uncomfortable transitions (London, 2023). This process often involves "living in disequilibrium," where individuals are pushed beyond their comfort zones to address underlying problems. Leaders must ensure that organizations operate within the productive zone of disequilibrium (PZD), a level of tension high enough to encourage engagement with difficult challenges but not so overwhelming that it becomes disabling. While technical problems typically see disequilibrium peak early and decline as solutions are applied, adaptive challenges follow a less predictable

pattern, requiring leaders to continuously regulate stress and guide teams so that they remain between the threshold of change and the limit of tolerance (Heifetz et al., 2009). Achieving this balance requires effective leadership, an adaptive culture, and compassion toward those navigating the change process.

Leaders play a central role as change enablers by guiding innovation and actively involving employees in organizational transformation (Hernández Santiago, 2023). To do so effectively, they must develop skills such as motivation, agility, versatility, and resilience, which can be strengthened through experience, training, and increased self-awareness (London, 2023). Leaders who remain attentive to feedback, maintain a bias for action, and cultivate a strong sense of self-efficacy are better equipped to help organizations move from merely surviving to thriving in volatile environments. Empirical evidence supports the effectiveness of adaptive leadership in contexts of instability. For example, research in Colombia's electric sector found a strong relationship between adaptive leadership practices and decision-making during the COVID-19 pandemic (Santiago Torner,

2020). Similarly, studies in Puerto Rico's food industry showed that organizations used adaptive leadership to overcome disruptions caused by hurricanes, earthquakes, and the pandemic (Hernández Santiago & Pérez Rivera, 2022). Although adaptive leadership is particularly useful in addressing unprecedented change, scholars emphasize that no single leadership style is sufficient for every situation, making it beneficial for leaders to adopt multiple approaches depending on organizational needs (Hernández Santiago, 2023).

Considering the absence of validated instruments and evidence-based interventions designed to assess and develop adaptive capacity within the Puerto Rican context, this study represents a meaningful contribution to both research and practice. Specifically, it introduces a novel psychometric instrument for assessing adaptive capacity among Puerto Rican populations, addressing an important gap in the leadership and organizational change literature.

As organizations increasingly face complex and rapidly evolving environments, the availability of a culturally relevant measure of adaptive capacity offers opportunities to better understand, assess, and cultivate this critical leadership competency. Consequently, following further validation research, the implications of this study could extend beyond advancing scientific knowledge; potentially providing a foundation for evidence-based organizational practices in Puerto Rico, with the potential for adaptation and application in other cultural and national contexts.

Beyond its theoretical contributions, the Adaptive Capacity Questionnaire (ACQ) has the potential to inform practical organizational processes. Once further evidence of predictive validity is established, the instrument could later prove valuable in identifying individuals with the potential to lead effectively through periods of uncertainty and transformation thereby likely strengthening leadership selection and recruitment efforts. Additionally, the ACQ may provide a framework for designing targeted interventions, training programs, and leadership development initiatives aimed at further developing adaptive capacity before and during organizational change.

To address this need and establish an empirical foundation for the assessment of adaptive capacity, the Adaptive Capacity Questionnaire (ACQ) was developed and administered to a sample of $N = 335$. Additionally, its psychometric properties were assessed. The study's objectives were: (1) to assess the

psychometric properties of the ACQ, including its factor structure and model fit, in order to determine whether the proposed measurement model is supported, and (2) to examine potential differences in ACQ scores across leadership categories (team leaders, supervisors, managers, and executives).

Method

This study explored the psychometric properties of the ACQ using a non-experimental quantitative approach, which involves collecting data in a natural setting without manipulating variables and testing hypotheses through statistical analysis (Hernández-Sampieri & Mendoza-Torres, 2018). More specifically, the study employed a cross-sectional design, meaning that data were collected at a single point in time (Creswell & Creswell, 2022). This research builds upon a prior pilot study that developed the ACQ and conducted an initial evaluation of its psychometric properties with a small sample and assessed its correlation with successful change management.

Through this design and a broader sample, this study sought to provide a clearer understanding of the psychometric properties of the ACQ as a tool to assess adaptive leadership in managing change within the Puerto Rican organizational context. The study focused on full-time employees in Puerto Rico who had experienced organizational change, with the goal of recruiting individuals who held a formal leadership role within their organizations. Given that literature recommends that structural equation models have an estimate of 10 participants per item, and the instrument consists of 32 items, the projected sample size was of around 320 participants, to allow for stability of results (Kline, 2015).

Participants

Participants were recruited through non-probability convenience sampling using professional networks, organizational contacts, and online distribution of the survey and had to meet the following inclusion criteria: (a) hold formal full-time employment in Puerto Rico, (b) occupy a formal leadership role at any level (e.g., team leader, supervisor, manager, or executive), (c) have led a change event in their current role, (d) be at least 21 years old, (e) have access to an electronic device with internet connectivity, and (f) be able to read in Spanish. Change events could include those driven by internal factors, such as shifts in culture, structure, operations, or technology, or external forces, including

hurricanes, pandemics, economic crises, or changes in government. It is worth noting that the pilot study employed broader inclusion criteria by also incorporating individuals who did not hold formal leadership positions but met all remaining eligibility requirements. These participants were included to facilitate preliminary comparisons between leaders and nonleaders. Although such comparisons were beyond the scope of the present study, future research should examine differences between these groups to provide additional evidence of the ACQ's ability to discriminate between individuals occupying leadership and nonleadership roles.

Demographic Data

After administering the questionnaire, a total of 340 responses were collected. Subsequently, data was screened and participants that answered less than 50% of the questions were removed from the sample. This resulted in a sample size of $N = 335$ organizational leaders in different categories. More specifically, $n = 85$ participants were executives, $n = 89$; managers, $n = 82$; supervisors and, $n = 79$; team leaders. Out of these, $n = 251$ were female and $n = 83$ male. Ages ranged from 23 to 73 years old, with a mean of $\bar{x} = 44.79$ ($SD = 9.41$). In average, participants had spent an average of $\bar{x} = 13.34$ ($SD = 9.43$) years in their organization and $\bar{x} = 7.25$ ($SD = 6.86$) years in their role. The level of education is shown in Table 1.

In terms of sector, $n = 224$ participants worked for the private sector while $n = 108$ for the public sector. Out of the organizations represented, $n = 190$ pertained to large organizations (with over 250+ employees) while $n = 139$ to small and medium enterprises (SMEs; with less than 250 employees) spanning multiple industries. The most predominant changes experienced were the global pandemic, hurricanes, changes in management, reductions in force, earthquakes, structure changes, inflation & economic crisis, technology changes, and internal policy changes.

Table 1
Level of education of participants

Highest Level Achieved	Total participants	Percentage (%)
High School Diploma	2	0.6
Associate's Degree	15	4.5
Undergraduate level credits	16	4.8
Bachelor's Degree	73	21.8
Graduate level credits	14	4.2
Masters' Degree	151	45.1
Doctorate Degree	57	17.0
Post-Doctorate Program	4	1.2

Instrument

An instrument titled the Adaptive Capacity Questionnaire (ACQ) was previously developed to measure the presence of adaptive capacity among individuals who have experienced or managed periods of organizational change. The construct underlying the instrument is adaptive leadership, which Heifetz et al. (2009, p. 14) define as “the practice of mobilizing people to meet difficult challenges and thrive.” This concept emphasizes identifying innovative ways to sustain growth in the face of challenges while discarding outdated methods and practices that no longer align with the current organizational context. The dimensions of the test were informed by a study conducted by Hernández Santiago and Pérez Rivera (2022) with leaders in Puerto Rico, which identified eight (8) key characteristics leaders should possess to effectively adapt to and manage change. The test dimensions were defined as follows:

1. Ability to manage difficult conversations: Being able to effectively manage conversations whose outcome can have a great impact on relationships or results that affect the individual or the organization (Grenny et al., 2022).
2. Adaptation to change (hyperlearning): The human capacity to continuously learn, unlearn and relearn to adapt to the speed of change (Hess, 2020).
3. Admitting and learning from mistakes: Learning from mistakes involves acknowledging that unexpected and unintended effects have occurred and leads to reflecting on these experiences to reduce the likelihood of their occurrence in the future (Cannon & Edmondson, 2001 cited in Tjosvold et al., 2004).
4. Decision-making ability: Knowing what to do in a particular situation and identifying how to carry out that action (Noyes et al., 2007).
5. Set an example: Leaders demonstrate character by modeling values, adhering to principles, and upholding both in their daily routines (Baldoni, 2008).
6. Effective communication: It is the tool with which we influence others, cause changes in the attitudes and opinions of our associates, motivate them, and establish and maintain relationships with them (Rai & Rai, 2008).
7. Flexibility: Having the ability to understand that it is necessary to adapt to circumstances to achieve better results and, therefore,

organizational designs must be easily modifiable (Neufville & Scholtes, 2011).

8. Crisis Management: Minimizing the harmful effects of a crisis event using limited resources under extreme time constraints (Waryjas, 1999).

Based on this construct and dimensions, preliminary items were developed to build the test. Seven items were created for each dimension, anticipating that at least three might need to be eliminated during the content validation process. As a result, the initial version of the instrument consisted of 56 items. A Likert scale was used due to its simplicity and its ability to assign numerical values to phenomena that are not directly quantifiable. The instrument then underwent a content validation process involving 10 judges, including six (6) professors in Psychology or Management, one (1) graduate student in Organizational Psychology, and three (3) practitioner IO psychologists working in industry roles. For an item to be accepted, at least eight (8) judges had to classify it as essential, which, according to Lawshe's formula, corresponds to a Content Validity Ratio (CVR) of 0.60 or higher. In dimensions where more than four items met this criterion, the final selection was guided by the judges' qualitative feedback. The resulting instrument contains 32 items, with four items per dimension.

All items are phrased as affirmative statements, and participants respond using a four-point scale ranging from 1 (to no extent) to 4 (completely). Accordingly, the maximum possible score is 128. For the purposes of this study, the questionnaire is designed to be self-administered, allowing participants to evaluate their own performance across each dimension. This approach was chosen primarily for practicality given the study's time constraints. However, an alternative version of the instrument also exists in which an external evaluator administers and completes the assessment, which may be particularly advantageous in organizational recruitment and selection processes.

Procedure

After the test was constructed and content validity was assessed, the ACQ was digitized. Then, the approval (#2425-158) of the Institutional Review Board of the University of Puerto Rico, Río Piedras Campus was obtained to ensure the process followed guidelines and did not violate ethical principles. Afterwards, the recruitment phase took place through social media, specifically through LinkedIn,

Facebook, Instagram, and WhatsApp in a span of three months where participants provided informed consent prior to completing the online survey.

Data Analysis

Once data were collected, analyses were conducted using the Statistical Package for the Social Sciences (SPSS) and RStudio. To evaluate the psychometric properties of the ACQ, exploratory and confirmatory factor analyses were performed for three (3) different models. To further evaluate dimensionality, bifactor ancillary indices (ECV, PUC, ω H, and ω HS) were computed following current recommendations for the evaluation and interpretation of bifactor models (Reise, 2012; Reise et al., 2013; Rodriguez et al., 2016a, 2016b). Reliability was assessed using Cronbach's alpha, McDonald's omega, and composite reliability (CR), while convergent validity was evaluated through the calculation of average variance extracted (AVE). Additional analyses were conducted using t-tests and analyses of variance (ANOVA) to examine potential differences in ACQ scores across leadership roles and various sociodemographic characteristics, including gender, industry, age, tenure, and other relevant variables.

Normality tests

Normality was assessed using the Kolmogorov-Smirnov test. The ACQ resulted in $D(335) = .136$, $p < .001$ and, although the normality assumption was violated, the large sample size ($N = 335$) reduces the impact of non-normality due to the Central Limit Theorem (Field, 2024). Therefore, parametric tests were deemed appropriate and thus utilized.

Results

The following results evaluate the psychometric properties of the ACQ and test the study's objectives. Reliability, exploratory factor analysis, and confirmatory factor analysis were conducted to examine the instrument's structure. Additionally, differences in ACQ scores were analyzed across sociodemographic variables to assess the consistency of adaptive capacity measurement across participant groups. Overall, the results provide evidence regarding both the measurement properties of the ACQ and its applicability for use in leadership assessment contexts.

In terms of the first objective, results were expected given that initial validity and reliability were previously assessed with a smaller sample through a pilot study in 2023 where the general scale had a

reliability score of $\alpha = .963$ and all subscales had a score higher than $\alpha = .80$. In this case, a bigger sample allowed for further analyses where reliability was confirmed, and exploratory and confirmatory factor analysis allowed for representation of a second order model after contrasting three different models. These results provide preliminary evidence supporting psychometric appropriateness.

Regarding the second objective, no statistically significant differences in ACQ scores were observed across leadership category, organizational tenure, tenure in role, age, or educational level. Similar results were obtained for the additional sociodemographic variables examined, including gender, sector, organizational size, and industry. Although the analysis of variance for industry indicated small differences in mean scores across groups, these differences were not statistically significant. Overall, ACQ scores were comparable across the leadership, demographic, and organizational characteristics evaluated in this study.

ACQ's Psychometric Properties

Given that a prior study had already assessed and discussed the content validity for the ACQ through a pilot, this study focused on further exploring the psychometric properties (Hernández Santiago, 2023). To do so, exploratory factor analysis (EFA), confirmatory factor analysis (CFA), and reliability analyses were conducted. The dataset was randomly split into 2 subsamples to ensure that the factor structure identified through EFA could be validated on an independent dataset. Sample 1 ($n = 168$) was used for the EFA and sample 2 ($n = 162$), for the CFA.

For the EFA, the determinant of the correlation matrix was 4.34×10^{-9} , suggesting the presence of multicollinearity; however, the Kaiser-Meyer-Olkin measure was .894, and Bartlett's test was significant ($\chi^2(496) = 2994.057, p < .001$), indicating sampling adequacy. Principal axis factoring suggested an eight-factor solution, consistent with theoretical expectations. The eight factors accounted for 59.067% of the variance.

Subsequently, to examine the factor structure of the ACQ, three CFA models were tested: (a) an eight-factor correlated first-order model, (b) a second-order model in which the eight first-order factors loaded onto a higher-order adaptive capacity construct, and (c) a bifactor model comprising a general adaptive capacity factor that loaded directly onto all items, alongside eight orthogonal domain-specific factors representing the instrument's dimensions.

All three models demonstrated good fit to the data. The correlated first-order model yielded good fit indices of $\chi^2(436) = 560.41, p < .001, CFI = .953, TLI = .947, RMSEA = .029$, and $SRMR = .042$. The second-order model also demonstrated good fit, $\chi^2(456) = 589.44, p < .001, CFI = .950, TLI = .945, RMSEA = .030$, and $SRMR = .047$. Similarly, the bifactor model exhibited good fit: $\chi^2(432) = 554.70, p < .001, CFI = .954, TLI = .947, RMSEA = .029$, and $SRMR = .044$. To further examine the dimensionality of the instrument, bifactor ancillary indices were computed to evaluate the strength of the general factor and assess the appropriateness of bifactor and higher-order representations, as recommended in the psychometric literature (Reise, 2012; Rodriguez et al., 2016a). The Percent of Uncontaminated Correlations (PUC) was .90, indicating that most item correlations reflected the influence of the general factor. The Explained Common Variance (ECV) for the general factor was .78, and the general hierarchical omega (ω_H) was .74, suggesting that a substantial proportion of the reliable variance was attributable to the general adaptive capacity construct. In contrast, hierarchical omega coefficients for the specific factors (ω_{HS}) ranged from .24 to .38, indicating that the domain-specific factors contributed relatively little reliable variance beyond the general factor.

Overall, the fit indices indicated that the ACQ may be represented as a set of correlated dimensions, as a higher-order adaptive capacity construct, or as a bifactor structure, with only negligible differences in model fit across specifications. Although the bifactor model demonstrated slightly superior global fit, these differences were minimal. Moreover, while the bifactor indices supported the presence of a strong general factor, the relatively low ω_{HS} values indicated that the specific dimensions contributed limited reliable variance after accounting for general adaptive capacity. Given the comparable fit across models, model selection was guided by considerations of theoretical parsimony, interpretability, and alignment with the conceptualization of adaptive capacity as an overarching integrative construct. Taken together, the magnitude of the general factor indices (ECV, PUC, ω_H) and the low reliability of the specific factors (ω_{HS}) support the conclusion that the ACQ is best conceptualized as a hierarchical general construct with subordinate dimensions that are more appropriately represented within a hierarchical second-order framework than as a bifactor solution. Accordingly, the second-order model was retained because it provides a more parsimonious and conceptually coherent representation of adaptive capacity while

avoiding the additional interpretive complexity of the bifactor model.

The second-order model encompasses eight factors: (F1) ability to manage difficult conversations, (F2) adaptation to change, (F3) admitting and learning from mistakes, (F4) decision-making ability, (F5) setting an example, (F6) effective communication, (F7) flexibility, and (F8) crisis management. Standardized factor loadings for the first-order factors were strong ($\lambda = .74-.97$), and the second-order loadings onto the general adaptive capacity factor

were also substantial ($\lambda = .80-.89$), indicating a well-defined hierarchical structure. Additionally, item-level R^2 values ranged from moderate to high, suggesting that the indicators were well explained by their respective latent constructs. Table 2 presents standardized first-order factor loadings for items and second-order loadings for dimensions onto the general factor.

Table 2
Standardized Factor Loadings for Second Order Model

Dimension	Factor Loading	R ²
1. ability to manage difficult conversations	.811	.658
item 1	.758	.575
item 2	.747	.557
item 3	.969	.939
item 4	.838	.702
2. adaptation to change (hyperlearning)	.841	.708
item 5	.872	.761
item 6	.803	.644
item 7	.945	.893
item 8	.811	.658
3. admitting and learning from mistakes	.835	.698
item 9	.853	.727
item 10	.944	.891
item 11	.781	.610
item 12	.770	.592
4. decision-making ability	.850	.722
item 13	.896	.803
item 14	.846	.715
item 15	.913	.834
item 16	.878	.771
5. setting an example	.887	.786
item 17	.888	.788
item 18	.781	.610
item 19	.912	.832
item 20	.859	.738
6. effective communication	.800	.639
item 21	.864	.747
item 22	.830	.688
item 23	.756	.571
item 24	.813	.662
7. flexibility	.824	.679
item 25	.870	.757
item 26	.922	.849
item 27	.790	.624
item 28	.800	.640
8. crisis management	.830	.689
item 29	.737	.543
item 30	.849	.721
item 31	.900	.811
item 32	.824	.679

Note. Standardized factor loadings are reported. First-order loadings represent the relationships between items and their respective latent dimensions. Second-order loadings represent the relationships between the eight first-order dimensions and the higher-order Adaptive Capacity factor. R^2 coefficients indicate the proportion of variance explained in each observed indicator and latent dimension.

Overall, these results support a robust hierarchical model of adaptive capacity characterized by a strong

general factor underlying eight highly reliable dimensions, as outlined in Figure 2.

Lastly, the instrument demonstrated good internal consistency for the overall scale ($\alpha = .946$; $\omega = .946$) and subscale reliabilities ranged from $\alpha = .806$ to $\alpha = .846$ and $\omega = .801$ to $\omega = .853$ as shown in Table 3.

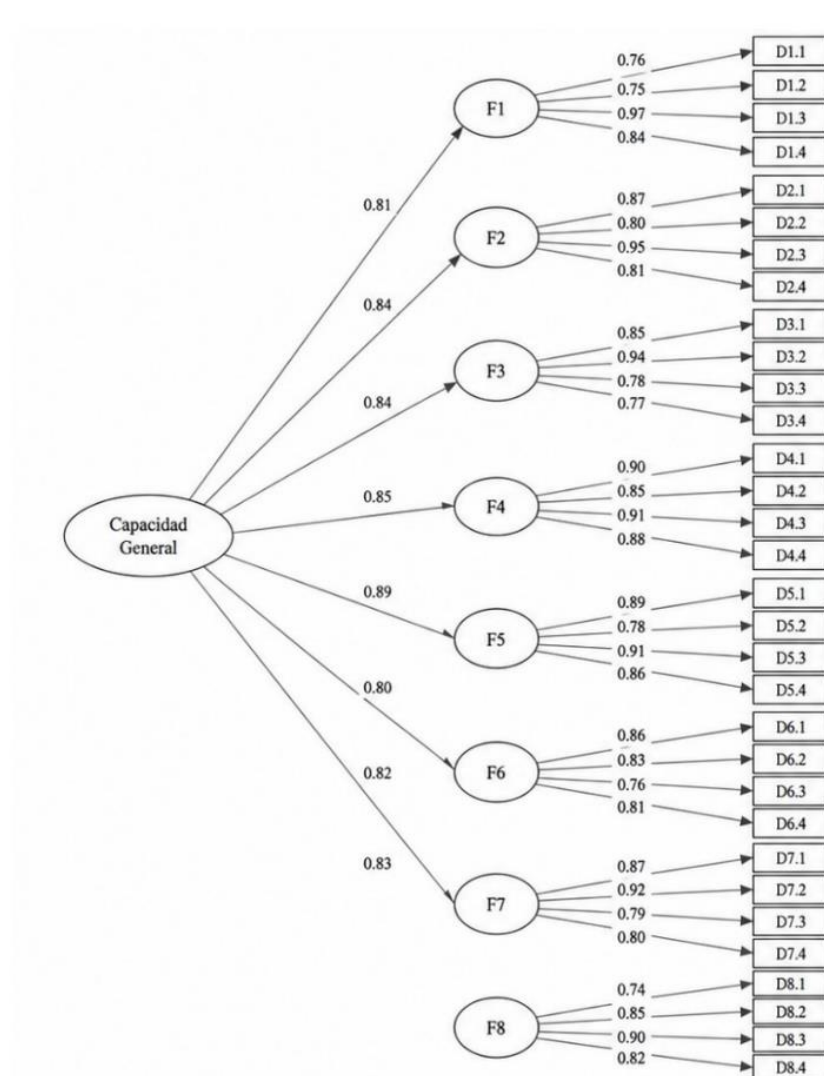
To further evaluate the psychometric properties of the second-order Adaptive Capacity Questionnaire (ACQ) model, composite reliability (CR), average variance extracted (AVE), and indices of discriminant validity were computed. The second-order adaptive capacity factor demonstrated excellent internal consistency, with a composite reliability of $CR = .93$,

exceeding the recommended threshold of .70. This indicates that the higher-order construct reliably accounts for the shared variance among the eight dimensions.

Convergent validity was also supported, as the average variance extracted for the higher-order construct was $AVE = .63$, surpassing the recommended cutoff of .50. This suggests that the Adaptive Capacity factor explains a substantial proportion of variance across its lower-order dimensions, providing evidence of adequate convergence among indicators. In

Figure 2

ACQ's structure for a second order model



contrast, maximum shared variance (MSV) and average shared variance (ASV) could not be meaningfully computed in the present model due to the hierarchical structure of the CFA. Because the second-order model specifies a single higher-order factor without additional correlated latent constructs, inter-factor squared correlations are not available for comparison. As such, traditional MSV and ASV indices are not informative in this context. Instead, discriminant validity is supported indirectly through the model's structural specification, in which the higher-order factor accounts for covariance among first-order dimensions without redundancy among competing higher-order constructs. Overall, the reliability and convergent validity indices support the adequacy of the second-order representation of adaptive capacity.

Score Differences

The ACQ consisted of 32 items, each scored on a 4-point scale, yielding a maximum total score of 128. The average score for the total sample was 110.394 ($SD = 1.048$). Nonetheless, these were analyzed more in depth across different sociodemographic variables.

Table 3
Reliability analyses for the ACQ

Scale	α	ω
ACQ Scale (overall)	.946	.946
Subscale 1	.809	.828
Subscale 2	.827	.838
Subscale 3	.821	.824
Subscale 4	.846	.853
Subscale 5	.839	.831
Subscale 6	.806	.801
Subscale 7	.829	.829
Subscale 8	.827	.836

Leadership category

A one-way ANOVA was conducted to examine differences in ACQ scores across leadership categories: team leaders, supervisors, managers, and executives. Levene's test indicated that the assumption of homogeneity of variances was met: $F(3, 331) = 1.79, p = .149$.

Table 4
Test scores based on leadership category

Leadership Category	ACQ
Team Leaders	$\bar{x} = 113.127 (SD = 11.816)$
Supervisors	$\bar{x} = 109.232 (SD = 14.563)$
Managers	$\bar{x} = 109.809 (SD = 13.161)$
Executives	$\bar{x} = 109.588 (SD = 13.580)$

The one-way ANOVA for ACQ revealed no significant differences among leadership categories, $F(3, 331) = 1.49, p = .218, \eta^2 = .013$.

Time in Organization and Time in Role

In terms of time in the organization and time in role, participants were grouped into categories based on equal percentiles, each representing approximately 16.67% of the sample. Subsequently, a One-way ANOVA was conducted for each variable. Descriptive statistics are summarized in Tables 5 and 6.

Table 5
Test scores based on time in organization

Time in organization (years)	ACQ
0 to 4	$\bar{x} = 113.565 (SD = 10.820)$
5 to 7	$\bar{x} = 109.841 (SD = 12.533)$
8 to 11	$\bar{x} = 109.362 (SD = 14.270)$
12 to 17	$\bar{x} = 109.482 (SD = 13.388)$
18 to 23	$\bar{x} = 108.778 (SD = 14.017)$
23+	$\bar{x} = 110.245 (SD = 14.806)$

Table 6
Test scores based on time in role

Time in role (years)	ACQ
less than 2	$\bar{x} = 112.217 (SD = 11.465)$
2 to 3	$\bar{x} = 108.844 (SD = 12.996)$
4 to 5	$\bar{x} = 110.813 (SD = 12.693)$
6 to 8	$\bar{x} = 110.304 (SD = 14.555)$
9 to 12	$\bar{x} = 109.861 (SD = 13.208)$
13+	$\bar{x} = 108.660 (SD = 15.924)$

The standard ANOVA indicated no significant differences across time in organization, $F(5, 328) = 1.08, p = .370, \eta^2 = .016$. This finding was corroborated with robust tests of equality of means (Welch $F(5, 147.65) = 1.39, p = .231$; Brown-Forsythe $F(5, 305.53) = 1.07, p = .378$).

For time in role, the assumption of homogeneity of variances was evaluated using Levene's test. The results indicated a violation of this assumption for the ACQ, $F(5, 328) = 3.16, p = .008$. Despite this violation, the standard ANOVA results did not reveal statistically significant differences in ACQ scores across groups based on time in role, $F(5, 328) = 0.636, p = .672, \eta^2 = .010$.

Age

Potential differences based on age were also assessed through a one-way ANOVA. Homogeneity of variances was assessed using Levene's test and results indicated a mild violation for ACQ based on the mean, $F(5, 314) = 3.64, p = .003$. Standard ANOVA showed

no statistically significant differences based on age: $F(5, 314) = 1.35$, $p = .242$, $\eta^2 = .021$. Descriptive statistics are shown in Table 7.

Table 7

Test scores for based on age

Age (years)	ACQ
35 or less	$\bar{x} = 111.441$ ($SD = 12.350$)
36 to 41	$\bar{x} = 113.431$ ($SD = 11.582$)
42 to 45	$\bar{x} = 110.157$ ($SD = 13.713$)
46 to 50	$\bar{x} = 107.547$ ($SD = 12.891$)
51 to 55	$\bar{x} = 110.350$ ($SD = 13.963$)
56 or more	$\bar{x} = 108.256$ ($SD = 16.340$)

A Levene's test was conducted to examine the homogeneity of variance assumption. It was confirmed through the Levene's test that the homogeneity of variance assumption was not violated: $F(8, 325) = 1.65$, $p = .109$. Hence, differences were assessed through a one-way ANOVA that showed no statistically significant differences for the ACQ, $F(8, 325) = 1.85$, $p = .067$, $\eta^2 = .044$, based on educational level.

Table 8

Test scores based on education level

Education Level	ACQ
High School Diploma	$\bar{x} = 118.000$ ($SD = .000$)
Associate's Degree	$\bar{x} = 111.667$ ($SD = 14.080$)
Undergraduate level credits	$\bar{x} = 104.875$ ($SD = 15.500$)
Bachelor's Degree	$\bar{x} = 111.795$ ($SD = 11.814$)
Graduate level credits	$\bar{x} = 102.929$ ($SD = 16.795$)
Masters' Degree	$\bar{x} = 110.868$ ($SD = 12.878$)
Doctorate Degree	$\bar{x} = 110.298$ ($SD = 13.962$)
Post-Doctorate Program	$\bar{x} = 117.500$ ($SD = 14.177$)

Additional sociodemographic variables

Further analyses with additional sociodemographic data, such as t-tests for gender, sector, and organizational size, as well as ANOVA for the industry variable were performed. In terms of gender, sector, and organizational size, no statistically significant differences were found. For industry, however, the one-way ANOVA results suggested potential differences for the ACQ: $F(11, 322) = 1.825$, $p = .049$, $\eta^2 = .059$. However, post hoc tests did not support this result. Results for all four categories are summarized below.

Table 9

Test scores based on gender

Gender	ACQ
Females	$\bar{x} = 110.550$ ($SD = 13.265$)
Males	$\bar{x} = 110.121$ ($SD = 13.440$)

Table 10

Test scores based on sector

Sector	ACQ
Public	$\bar{x} = 112.824$ ($SD = 13.223$)
Private	$\bar{x} = 109.397$ ($SD = 13.168$)
Unknown	$\bar{x} = 101.600$ ($SD = 13.831$)

Table 11

Test scores Organizational Size

Organizational size	ACQ
SMEs	$\bar{x} = 110.971$ ($SD = 12.839$)
Large	$\bar{x} = 110.311$ ($SD = 13.554$)

Table 12

Test scores based on industry

Industry	ACQ
Food	$\bar{x} = 105.313$ ($SD = 15.374$)
Automobile	$\bar{x} = 105.400$ ($SD = 11.109$)
Education	$\bar{x} = 109.500$ ($SD = 24.749$)
Entertainment	$\bar{x} = 106.214$ ($SD = 10.956$)
Pharmaceutical	$\bar{x} = 118.000$ ($SD = 6.899$)
Finance	$\bar{x} = 110.250$ ($SD = 13.977$)
Manufacture	$\bar{x} = 113.014$ ($SD = 12.942$)
Services	$\bar{x} = 103.857$ ($SD = 22.041$)
Non-governmental (NGO)	$\bar{x} = 99.167$ ($SD = 7.600$)
Tourism	$\bar{x} = 111.051$ ($SD = 12.865$)
Other	$\bar{x} = 110.512$ ($SD = 13.070$)

Discussion

These findings are interpreted in light of their theoretical and practical implications for adaptive leadership and organizational psychology. The discussion highlights the contribution of operationalizing adaptive capacity as a measurable construct, examines the applicability of the ACQ for leadership assessment, and considers its potential use in organizational settings. Limitations of the study are addressed, followed by recommendations for future research to further validate and expand the use of the instrument in practical organizational contexts.

Theoretical Contributions

The greatest contribution of this study to organizational psychology theory is the operationalization of adaptive capacity as a measurable construct through the development of the ACQ. Conceptualizing adaptive capacity through a second-order model deepens the theoretical understanding of adaptive leadership by offering a structured representation of said construct along with eight proposed dimensions. Its psychometric robustness provides empirical validation within the Puerto Rican organizational context and supports adaptive capacity as a measurable leadership competency that warrants further examination across demographic groups. These findings expand on

Heifetz and colleagues' (2009) positioning of adaptability as central to managing organizational complexity.

The bifactor analyses further refined the interpretation of the ACQ's dimensionality. Although the bifactor model demonstrated slightly superior global fit, ancillary bifactor indices indicated that the instrument is dominated by a strong general adaptive capacity factor, while the specific dimensions contributed relatively little reliable variance beyond that general construct. Consistent with contemporary recommendations for bifactor interpretation (Reise, 2012; Rodriguez et al., 2016a), these findings support representing adaptive capacity as a hierarchical construct in which the eight dimensions function as interrelated manifestations of a broader adaptive capacity factor rather than as largely independent domains. This interpretation strengthens the theoretical coherence of the adaptive leadership framework while providing empirical support for the retention of the second-order model.

Given the increasingly dynamic and unpredictable nature of today's organizational environment, the availability of a psychometrically validated measure of adaptive capacity is particularly valuable. Such an instrument contributes to the growing body of knowledge on adaptive leadership while providing organizations with a potentially useful tool for leadership assessment and development.

Although significant group differences are often anticipated in leadership research, the absence of meaningful differences across sociodemographic characteristics in ACQ scores is noteworthy. Pending the results of measurement invariance analyses, these findings may suggest that adaptive capacity is assessed consistently across individuals regardless of leadership level, industry, sector, gender, age, educational attainment, organizational tenure, or organizational size. If supported by further validation studies, this pattern could provide preliminary evidence of fairness and strengthen the instrument's potential suitability for personnel selection and leadership development applications.

Future research should focus on expanding the evidence base for the ACQ through cross-validation studies and formal tests of measurement invariance across relevant demographic and organizational groups. Additionally, the development of a comprehensive user manual is recommended. Such a guide should include administration and scoring procedures, interpretation guidelines, normative information, self-report and rater-based versions of the

instrument, and empirically derived benchmarks or cut scores tailored to different leadership roles and organizational contexts.

Practical Contributions

In addition, the ACQ may provide a useful framework for future research aimed at identifying and understanding competencies associated with adaptive capacity among current and emerging leaders. As further evidence regarding its validity accumulates, the instrument could potentially inform the development of training initiatives and leadership development designed to strengthen the skills reflected in its dimensions. Likewise, future research may explore how adaptive capacity operates at the team and organizational levels and whether interventions targeting these competencies contribute to organizational adaptability during periods of change.

The broader implications of this work remain preliminary and warrant additional investigation. Future studies should examine the relationship between adaptive capacity and outcomes associated with organizational change management and leadership effectiveness. Establishing such relationships would provide a stronger empirical basis for evaluating the practical utility of the ACQ across organizational contexts. Furthermore, research conducted in diverse cultural and organizational settings could help determine the extent to which the construct and its measurement generalize beyond Puerto Rico. Such efforts would contribute to a more comprehensive understanding of adaptive capacity and its potential relevance in contexts characterized by uncertainty, disruption, and ongoing transformation.

Limitations

This study had three main limitations: (1) the sample's homogeneity, (2) the drawbacks of self-administration, and (3) limited time and resources. Not having non-leaders as part of the sample, skewed the data towards higher scores. Future studies with a more heterogeneous sample could allow for more conclusive results in terms of item discrimination.

Additionally, this study faced the drawbacks of self-administration or self-reporting as it has been linked to response biases given people try to present themselves in a more favorable light, even when responses don't reflect their behavior or way of thinking (McDonald, 2008). Nonetheless, it should be highlighted that different versions of the ACQ are available, where it could be auto administered or

administered by a rater. Hence, when used as a personnel selection tool, the rater-administered version could counteract the limitations of self-reporting.

Lastly, limited time and resources impacted the study, as a larger and more diverse sample that included non-leaders could've been recruited with additional time. Similarly, better resources could have enabled the use of alternative methodologies. For instance, a longitudinal design could involve administering the tests to job candidates for leadership roles within a specific organization and subsequently correlating the results with performance appraisals of the selected candidates in the short, medium, and long-term, contributing to predictive validity. Another potential approach would be to complement self-reports with external evaluations by supervisors, direct reports, colleagues, and other relevant raters, thereby allowing for a more comprehensive analysis. While such proposals are feasible, they require substantial resources and logistical coordination, including organizational consent and commitment. Therefore, a more practical approach was adopted for the present study. Nonetheless, future research should consider these alternatives, as they could address the limitations identified and provide a more holistic understanding of the variables under study.

Recommendations

It is suggested that future studies include employees in general rather than focusing exclusively on leaders, as this could provide a broader perspective on organizational dynamics. Since all employees contribute to shaping organizational culture, their perspectives may influence the effectiveness of change processes. Including non-leaders would also diversify the participant profile, increasing heterogeneity in the sample and enabling more robust comparisons between groups.

Although this study focused on the Puerto Rican population, whose recent context has been shaped by challenges such as economic instability, recurring natural disasters, and other significant changes, it would be valuable to identify other countries that might benefit from the use of the ACQ, given its psychometric robustness. Since the instrument was originally developed in Spanish, an initial step could involve its application in other Spanish-speaking countries or Latin American cultures that share similarities with Puerto Rico in terms of sociocultural dynamics and exposure to economic, sociopolitical, geographic, and meteorological instability. Pilot studies in these contexts would help determine the

cultural adequacy of the instrument and guide any necessary adaptations. To facilitate broader international use, the ACQ should subsequently undergo a rigorous process of translation and back-translation as part of cross-cultural adaptation and validation in other languages. This process would ensure semantic and conceptual equivalence across versions, followed by psychometric testing to confirm the instrument's reliability and validity across cultural contexts.

Concluding Remarks

The present study contributes to the literature on adaptive leadership by offering preliminary psychometric evidence for the Adaptive Capacity Questionnaire (ACQ) as a structured measure of adaptive capacity. Through exploratory and confirmatory factor analyses, the instrument demonstrated an interpretable factor structure consisting of eight related dimensions organized under a higher-order construct.

The results further indicated that although multiple structural representations were plausible, the bifactor model demonstrated slightly superior global fit. Nevertheless, bifactor ancillary indices suggested that the specific factors contributed limited reliable variance beyond the dominant general adaptive capacity factor. Consequently, the construct is most appropriately interpreted within a hierarchical second-order framework, which provides a more parsimonious and conceptually coherent representation for both theoretical and applied purposes. Internal consistency indices supported the reliability of both the overall scale and its subscales, suggesting that the ACQ may serve as a coherent measure of the proposed construct within the studied sample.

The findings also indicated similar ACQ score distributions across leadership levels and sociodemographic groups. However, in the absence of measurement invariance testing, these results should be interpreted cautiously and are not sufficient to support conclusions regarding equivalence of measurement across groups. As such, the present evidence should be considered preliminary and primarily descriptive in nature.

From a theoretical perspective, this study supports the conceptualization of adaptive capacity as a multidimensional construct that can be empirically operationalized within organizational research. At the same time, further work is needed to strengthen the validity evidence base, particularly through formal

tests of measurement invariance, predictive validity, and cross-sample replication.

Future research should also focus on evaluating the ACQ in different organizational sectors and cultural contexts to assess its generalizability. Longitudinal and multi-source designs may further contribute to understanding how adaptive capacity relates to organizational processes and outcomes over time. Additionally, the development of user guidelines and continued validation efforts would help clarify appropriate research applications of the instrument.

In sum, the ACQ represents an initial step toward the measurement of adaptive capacity in organizational settings. While the present findings support its structural and internal consistency properties, additional evidence is required before drawing conclusions regarding its broader applied utility or use in organizational decision-making contexts.

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