Impact of climate capacities and leadership effectiveness on organizational climate resilience: empirical evidence from UAE construction sector

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Abstract

Purpose – *There are significant concerns about climate change adaptation issues in the construction industry, thus climate capacities – both relevant and specific – as well as leadership effectiveness are needed to strengthen organizational climate resilience. Despite their importance, empirical studies on these themes, particularly in the construction industry, are lacking. This study aims to fill this gap by providing evidence on a set of relationships among climate-specific capacity (CSC), climate-relevant capacity (CRC), leadership effectiveness (LE) in climate actions, and organizational climate resilience (OCR) in the construction sector of the UAE.*

Design/methodology/approach – *Building on transformational leadership theory and the dynamic capabilities perspective, this paper builds and validates a conceptual model that tests how climate capacities (i.e. CSC and CRC) and LE impact the development of OCR. Particularly, the authors tested their conceptual model through structural equation modeling (SEM) using the SPSS AMOS path analysis on the survey data collected from 420 employees in the UAE construction industry.*

Findings – *The study finds a direct and positive relationship among climate capacities, LE and OCR. Moreover, LE positively moderates the relationship between CRC and OCR, whereas it negatively moderates the CSC–OCR relationship.*

Practical implications – *The research findings advocate that managers should consider CSC and CRC along with LE while managing climate change efforts to improve OCR.*

Originality/value – *To the best of the authors' knowledge, this article is the first to offer an empirical insight on a set of relationships among climate capacities, LE in climate actions and OCR. The new conceptual framework has both practical and research implications for managing climate change responses.*

Keywords *Climate capacity, Leadership effectiveness, Climate resilience, Dynamic capability, Construction sector*

Paper type *Research paper*

1. Introduction

The UAE construction industry is expected to reach $133.53[1] billion in investment by 2027. These results are in line with governmental aspirations to achieve the ambitious foreign direct investment target of $149.8 billion over the next ten years (Global Data, 2024). Currently, the construction industry employs 1.2 million construction workers (20% of the total workforce) and contributes approximately 14% to the UAE's GDP, making it the third largest contributor to the economy (Albattah *et al.*, 2021). Given the sheer size of the industry in terms of employment and economic contribution as well as the impact that the construction industry has on the environment (Rajabi *et al.*, 2022), examining the impact of climate change and capability on organizational resilience is increasingly important for sustained success.

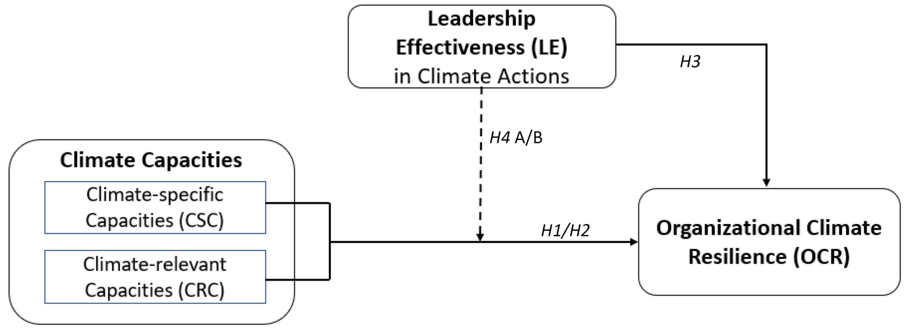
Indeed, climate change has resulted in severe disruptions in ecological systems, resulting in deterioration of human health on the one hand and negative ramifications on organizational performance on the other (Denny-Smith *et al.*, 2021). In this context, Gui *et al.* (2024) argued for the necessity to build among workers both "climate-specific" and "climate-relevant" knowledge and capacities. Climate-specific capacity is a capacity that is specifically devoted to climate change issues, while climate-relevant capacity supports the vast number of "nonclimate" actions that may help to mitigate or adapt to climate change. Overall, an ongoing emphasis on building climate capacities through strategic planning and implementation can assist a business in adaptation, mitigation and lowering the risk of disaster in a climate change context (De Leon and Pittock, 2017). Considering the significant impact of the construction sector on climate change, and the importance of leadership in building capacity and knowledge among workers, *this study aims to investigate the impact of climate capacities on organizational climate resilience in construction projects.*

Moreover, leadership plays a crucial role in mitigating and responding to climate change (Karamidehkordi *et al.*, 2024). It is widely acknowledged that leadership effectiveness has many facets and contributes to the advancement of environmental responsibility, sustainability and climate action within organizations (Wamsler *et al.*, 2024; Abraham-Dukuma *et al.*, 2022). Studies have found that leadership development is essential for developing capable leaders who can effectively handle organizational challenges (Kozminski *et al.*, 2022). As the implications of global warming affecting climate change become more apparent, developing climate resilience as a response requires leadership that is aware and willing to take climate action (Grint, 2024). In the context of our study, leadership effectiveness is linked to enhancing construction workers' well-being and overall organizational performance (Li *et al.*, 2022). While existing literature has explored various aspects of leadership in the context of climate action, there appears to be a gap in research specifically focusing on the effectiveness of leadership strategies in driving climate action initiatives among employees (Gram-Hanssen, 2021). *Thus, an empirical examination of the* role *of leadership effectiveness in addressing climate change, considering factors such as capacity building for climate resilience is necessary.*

Accordingly, this research study focusses on addressing the following research questions: 1) To what extent do climate capacities and leadership effectiveness impact organizational climate resilience? and 2) To what extent does leadership effectiveness moderate the relationship between climate capacities and organizational climate resilience?

To address these questions, our study first draws on transformational leadership theory and the dynamic capabilities perspective to build the theoretical model (Figure 1). This model is then tested through SEM using survey data collected from 420 employees in the UAE construction industry.

Our findings contribute to climate change, leadership, and resilience literature by proposing and validating new empirical measures for climate capacities, leadership effectiveness and climate resilience. By integrating the literature on leadership and climate capacities and linking it to the organizational climate resilience capacity, our findings show key insights that advance our knowledge on how micro-leadership factors and meso-organizational factors converge to affect the resilience capacity of organizations facing climate change. Our findings advocate that managers can improve climate resilience by taking climate capacities and leadership attributes into consideration while managing climate change initiatives. This is particularly important when attempting to achieve the Sustainable Development Goals (SDGs) that the United Nations has set forth, such as SDG 13 on combating climate change and its effects and SDG 9 on building resilient and sustainable infrastructure.



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2. Theoretical framework

The current study builds on the transformational leadership theory and the dynamic capability perspective to investigate potential links between climate capacity, leadership attributes and organizational resilience capability. Transformational leadership has been found to have a positive impact on organizational resilience, employee well-being and the workplace environment, even though several leadership theories, including ethical, authentic and transformational leadership, are important in promoting climate action and building resilience within organizations (Wang *et al.*, 2023). Furthermore, firms must be able to recognize, exploit, and transform opportunities to adapt to changing circumstances to gain sustained competitive advantage. This is highlighted by the dynamic capabilities perspective (Teece, 2007). Therefore, utilizing dynamic capacities to promote climate action and strengthen organizational resilience may need leadership effectiveness.

2.1 Capacity building for climate actions

2.1.1 Climate-relevant capacities. Climate-relevant capacities (CRC) refer to the use of organizational resources, knowledge, and skills for controlling and reducing the negative effects of climate change issues (Schmitz, 2017). The use of environmentally friendly materials, energy efficiency and pro-environmental certifications are examples of how CRC supports the development of technical competencies among workers for promoting sustainability in construction projects. Organizations can effectively adapt to climate-related disruptions by utilizing CRC's dynamic and analytical capabilities in project management and climate risk assessment (Nash *et al.*, 2020). We argue that the sector's overall capacity to positively contribute to climate resilience efforts is enhanced when effective leadership is demonstrated in these areas. Accordingly, a climate governance model that synchronized already-existing capacities with newly assigned climate responsibilities may offer the basis for meaningful climate action (Hochstetler, 2021).

2.1.2 Climate-specific capacities. While CRC refer to the ability of organization to respond to more general social, economic, political and ecological stressors like physical assets, income and access to health, and education and social capital (Mekonnen and Kassa, 2019), climate-specific capacities (CSC) are defined as the "manifestations of the ability to respond to and manage an identified specific climate hazard (e.g. drought emergency response plans, hurricane warning systems, climate forecasting, design and construction of protective infrastructure such as irrigation and public works such as reservoirs)" (Lemos *et al.*, 2016, p.2). Thus, CSC is crucial for effectively predicting, preparing for, and responding to specific climatic threats. Accordingly, identifying specific climate change adaptive capacity needs at the organizational level is essential for designing effective policies and interventions for adaptation (Mfitumukiza *et al.*, 2024).

2.2 Organizational climate resilience

Resilience is the organizational capacity to withstand the effects of and recover back from the actual occurrence of an extreme weather event (Polonenko *et al.*, 2020). As a capability, organizational climate resilience (OCR) is an asset in managing the intricacies of the construction sector, which is susceptible to various aspects of climate change (Murtagh *et al.*, 2020). According to Argyroudis *et al.* (2022), OCR is the ability of the businesses to detect, design, and deploy resources in managing climate related disruptions to mitigate its long-term impact on strategic performance and adjust to changing conditions. Within the framework of dynamic capability perspective, climate resilience seeks to proactively examine the changing complex environmental dynamics and simultaneously develop and integrate internal & external competencies for minimizing climatic disruptions (Arshad *et al.*, 2023). As a result of the challenges posed by weather fluctuations in the construction industry, OCR has become an essential part of organizational strategy.

2.3 Leadership effectiveness in climate actions

Leadership effectiveness (LE) is the capacity of a leader to inspire, motivate, and influence individuals or groups toward achieving common goals and objectives as well as organization's preparedness to deal with challenges or crisis (Oleksa-Marewska and Tokar, 2022). It includes aspects like empowering others, acting morally, adding value to the community, and encouraging the development and success of subordinates (Liden *et al.*, 2008). It is widely acknowledged that a key element in improving LE in climate actions is transformational leadership, which centers on influencing followers' self-concepts and motivating them to achieve synergies in climate actions (Wolfgramm and Tuazon, 2020). Additionally, through innovative and creative leadership practices, LE is linked to the promotion of organizational learning, adaptation, and adaptive performance (DiSegni *et al.*, 2015).

To develop successful leadership interventions that improve organizational resilience capabilities, it is necessary to know the mechanisms through which resilience-building initiatives are influenced by leadership. In their discussion of resilient leadership in the context of crisis management, Giustiniano *et al.* (2020), for instance, highlight the importance of leadership in fostering organizational resilience during challenging times. More recently, the study by Sankar and Anandh (2024) focuses on safety leadership styles, highlighting the importance of transactional and transformational leadership in promoting safety behaviors. In the context of climate change, Wurzel *et al.* (2020) highlighted climate pioneership and leadership in disadvantaged maritime port cities, touching on the concept of transactional climate leadership in enhancing resilience. However, the empirical evidence on leadership competency in the context of climate resilience that explores the interplay between leadership effectiveness and organizational resilience is scant. In Table 1, we provide a comprehensive review of existing literature that clearly highlights gaps in the literature particularly regarding the dearth of studies in the construction industry.

3. Hypotheses development

A conceptual framework has been proposed by integrating constructs such as climate capacities, leadership attributes in climate actions and organizational resilience, as shown in Figure 1.

Table 1 Existing research on capacity-leadership-resilience in climate actions

Climate capacity-resilience attribute	*Leadership aspect/attribute*	*Author(s)*	*Theoretical premise*	*Key observation(s)*	*Gap(s) need to be addressed*
Climate Change Adaptation	Leadership Functions and Theories	Karamidehkordi *et al.* (2024)	Policy Leadership Theory, Sustainability/ Network Leadership	Network and communication leadership theories and sustainable leadership perspectives respectively, have the highest priority among leadership theories and are crucial for establishing participatory decision-making among relevant stakeholders	Future researchers can create an integrated framework on climate change resilience, adaptation, responsiveness and governance for climate sustainability
Global Climate Governance	Leadership Evaluation Index: Directional, Structural, Cognitive	Wang *et al.* (2023)	Leadership Theory	The findings suggest that policies centered around climate governance stand out as viable strategies for enhancing leadership effectiveness and climate capability	The study fails to capture the dynamic nature of climate and nonclimate capacities over time
Climate Change Mitigation and Environmental Sustainability	Leadership Effectiveness	Fragouli (2020)	Sustainable Leadership Theory	The paper contributes to understanding that sustainable leadership could be a leadership style which can contribute to an effective mitigation of the influence of climate change and environmental pollution	This research study utilized case-based methodology for analysis which can be extended to developing frameworks around how leaders can develop an "innovation culture" for climate risk assessment and resilience management
Climate Change Mitigation and Disaster	Ethical Leadership	Crosweller and Tschakert (2020)	______	A conceptual framework is used to show how the rise of modernity, today's risk society, neoliberalism, and governmentality converge to constrain disaster leadership and climate management	Future researchers can explore the impact of leader's ability to climate centric research partnerships and capacity building efforts to mitigate climate emergency
Regional governance networks dealing with climate adaptation	Complexity Leadership	Stiller and Meijerink (2016)	Complexity leadership theory	The research findings addressed that climate adaptation officers raised awareness for climate adaptation and helped to shape and implement a number of climate projects highlighting impeding and enabling factors	The way forward is to use the framework also in comparative analysis of network capacity, cooperative capacity, research capacity of governance networks in managing climate adaptation
Business Resilience and Performance	Sustainable Leadership	Avery and Bergsteiner (2011)	Capacity perspective	Leadership practices have been arranged in the form of a pyramid and divided into four groups: foundation practices, higher-level specific capacities, performance drivers and performance outcomes contributing to sustainability	Future researchers can explore the influence of capacity-culture-leadership practices of different groups on sustainability
Climate Change Education	Leadership Competence	Wu and Otsuka (2022)	Climate change perspective	The findings reveal significant positive associations between leadership competence in climate change, self-reported pro-climate behavior, and certain life experience have also been found	Future researchers can strengthen the theoretical model by including the impact of non-climate actions of leadership competence on climate change

Source(s): Authors' own work

4. Conceptual framework

4.1 Climate capacities and organizational climate resilience

In organizational studies, the idea of capacity driving capability is essential. Capacity is defined as organization's potential or accessible resources, whereas capability refers to the ability to use those resources effectively and efficiently to achieve strategic goals (Donnelly and Wickham, 2021; Famiyeh, 2017). Several studies have emphasized the importance of capacity building to enhance organizational capability. The dynamic capability perspective has highlighted the significance of firms' abilities to adapt and reconfigure their resources in response to the changing conditions (Teece, 2007). Similarly, Xie *et al.* (2018) argue for the necessity of absorptive capacity for realizing innovation potential while Karman (2020) reported coping capacity for achieving resilience during the change management. In a similar vein, organizational resilience framework put forward by Duchek *et al.* (2020) indicate the underlying capacities (i.e. knowledge-base, resource availability and social resources) and capabilities (i.e. anticipation, coping and adaptation) that together make up organizational resilience as a meta-capability.

In the context of climate change, resilience is defined as the organizational capability to withstand the effects of and recover from the actual occurrence of an extreme weather event (Polonenko *et al.*, 2020). Studies have suggested the importance of assessing and enhancing capacities (i.e. adaptive, absorptive and transformative) to increase resilience to the effects of climate change. For example, Simane *et al.* (2012) present a framework for building climate resilience in a similar manner, emphasizing the importance of strong adaptive capacity in fostering resilience to climate change.

In this study, climate capacities are defined as a combination of climate-specific and climate-relevant capacities (Gui *et al.*, 2024; Schmitz, 2017; Lemos *et al.*, 2016). The current body of research has demonstrated a limited empirical understanding of organizational climate capacities, highlighting the need to build these capacities to improve resilience and adaptability to climate change (Mekonnen and Kassa, 2019). Organizations may increase their resilience to respond to and resist the effects of climate change by identifying and improving capacities that are specific to and relevant to climate change.

Based on the above discussion the following hypotheses have been proposed:

H1. CSC is positively associated with the OCR.

H2. CRC is positively associated with the OCR.

4.2 Leadership effectiveness in climate actions and organizational climate resilience

Integrating actions for both adaptation and mitigation of climate change into leadership strategy is important for the organization to be resilient (Singh *et al.*, 2019). Improving leadership effectiveness (LE) is essential to increasing capability for climate resilience. Wang *et al.* (2023) argue for transformational leadership effectiveness that considerably boosts organizational resilience in the face of challenges such as climate change. Resilience is also viewed as a set of dynamic capabilities that strategic managers need to develop and maintain through ongoing innovation, learning, and orchestration of the resources and capacities (Shobande *et al.*, 2024; Singh and Goyal, 2023; Rubbio *et al.*, 2020). Similarly, Huiskamp *et al.* (2022) discuss the idea of the 'climate resilience cycle' as an organizational routine that helps in the growth of dynamic capabilities necessary for incorporating climate resilience measures into overall business goals. Studies further suggest that collaborative management and organizational leadership fosters a climate encouraging robustness and resourcefulness can lead to increased resilience within organizations (Achebelema and Achebelema, 2021). LE in climate actions through multi-stakeholder dialogue and partnerships has been found to be crucial for building climate resilience, particularly in regions facing structural constraints due to climate change (Graham, 2020). Consequently, to increase climate resilience, LE in climate action is essential.

Based on the above discussion the following hypothesis has been proposed:

H3. LE in climate actions has a positive effect on the OCR.

4.3 Moderating role of leadership effectiveness in climate actions

The relationship between organizational capacity and resilience is significantly influenced by leadership styles and behaviors. Research on how different approaches to leadership affect an organization's capacity-resilience relationship has been carried out through several studies. For example, the significance of organizational resources in enhancing resilience and the role of authentic leadership has been highlighted by Mao *et al.* (2022). In a similar vein, Madi Odeh *et al.* (2023) indicated that managerial capabilities, coupled with benevolent leadership, contribute to increased organizational resilience, particularly in dynamic environments. Moreover, the importance of resilient leadership in fostering organizational resilience by cultivating a resilient culture, enhancing awareness, facilitating learning processes, and strengthening physiological capital was emphasized by Khuan (2024).

A potential moderating impact of leadership trait in the capacity – resilience link was emphasized by Duchek *et al.* (2020) organizational resilience framework. Effective leadership practices are vital for nurturing adaptive capacity, steering climate efforts and fortifying organizational resilience in the face of climate adversities (Oleksa-Marewska and Tokar, 2022). Leadership aids in building the specific resources and technical capacities necessary for effective climate measures, thus stressing the significance of LE in propelling climate adaptive capacities initiatives (Scholten *et al.*, 2015). In a nutshell, LE could moderate the capacity-resilience relationship within organizations, impacting how effectively organizations respond to challenges and build climate resilience. Based on the above discussion the following hypotheses have been proposed:

H4a. The degree of LE in climate actions positively moderates the relationship between CSC and OCR.

H4b. The degree of LE in climate actions positively moderates the relationship between CRC and OCR.

5. Methods

5.1 Sample and data

The study was carried out in two stages: the pilot study was conducted first, and the main study was conducted with the help of Qualtrics. The demographic section of the questionnaire includes inquiries on the type of project being worked on, the number of years of work experience in the United Arab Emirates (UAE), and the job role of the participants. Forty employees were given the pilot study, of whom 37 responded. Of those, 34 were valid, and they were utilized to assess reliability. A random sample of 1,200 firms in the construction industry were chosen from the UAE Ministry of Energy & Infrastructure and the UAE Contractors & Construction Suppliers Directory. Qualtrics assisted in conducting the main study survey, which yielded 420 complete responses (a response rate of approximately 35.0%). This exceeded the required minimum sample size of 200 recommended by Astrachan *et al.* (2014).

5.2 Measures

For this research, new scales were utilized based on a thorough literature review (refer Table 2), as recommended by Deep *et al.* (2023), Chen *et al.* (2017). A five-point

Table 2 Factor loadings, reliability and convergent validity

Variables	*Influencing factors*	*Author(s)*	*Standardized factor loadings*	*Cronbach alpha*[a]	*Composite reliability (CR)> = 0.6*[b]	*Average Variance extracted (AVE) > = 0.5*[c]
Climate-specific Capacities (CSC)	CSC1: Organization has allocated/devoted specific human resources to climate change/ action	(Rowlinson *et al.*, 2014, Moda *et al.*, 2022, Alsharef *et al.*, 2023)	0.760	0.897	0.894	0.584
	CSC2: Organization has capacity to network with many different kinds of organizations on climate change	(Liu *et al.*, 2023a, Liu *et al.*, 2023b, Liu *et al.*, 2023c)	0.771			
	CSC3: Organization has sufficient policy/ framework needed to develop/support a climate strategy	(Chan *et al.*, 2023, Danso *et al.*, 2023)	0.740			
	CSC4: Organization has conducted a climate risk assessment to identify potential climate impacts on operations	(Ibrahim *et al.*, 2023, Liu *et al.*, 2023b)	0.763			
	CSC5: Organization has integrated climate risk management strategies in its planning and decision-making procedures	(Rafindadi *et al.*, 2023, Zhao and Yan, 2023)	0.791			
	CSC6: Organization has integrated climate-related financial planning into its financial management processes	(Melagoda and Rowlinson, 2022, Zhao and Yan, 2023)	0.764			
Climate-relevant Capacities (CRC)	CRC1: Organization has developed an efficient policy to collect relevant information of "non-climate" actions that may help to mitigate or adapt to climate change	(Alsharef *et al.*, 2023, Chan *et al.*, 2023, Liu *et al.*, 2023b)	0.714	0.881	0.880	0.553
	CRC2: Organization has developed an efficient framework for communicating with its stakeholders	(Melagoda and Rowlinson, 2022, Ibrahim *et al.*, 2023, Liu *et al.*, 2023c)	0.761			

(*continued*)

Table 2

Variables	*Influencing factors*	*Author(s)*	*Standardized factor loadings*	*Cronbach alpha*[a]	*Composite reliability (CR)> = 0.6*[b]	*Average Variance extracted (AVE)> = 0.5*[c]
	CRC3: Organization has an ability to network and co-operate with other organizations/ institutions	(Rowlinson *et al.*, 2014)	0.691			
	CRC4: Organization conducts scenario analysis or stress testing to assess climate-related financial risks	(Danso *et al.*, 2023, Rafindadi *et al.*, 2023, Ramos *et al.*, 2023, Susananto *et al.*, 2023)	0.741			
	CRC5: Organization engages with stakeholders on possible climate-related issues/challenges	(Moda *et al.*, 2022, Alsharef *et al.*, 2023, Chan *et al.*, 2023, Danso *et al.*, 2023)	0.771			
	CRC6: Organization incorporates stakeholder feedback into the development of climate strategies	(Rowlinson *et al.*, 2014, Liu *et al.*, 2023b, Liu *et al.*, 2023c, Ramos *et al.*, 2023)	0.782			
Leadership Effectiveness (LE) in Climate Actions	LE1: Leaders inspire and motivate individuals to achieve climate resilience goals	(Ibrahim *et al.*, 2023, Liu *et al.*, 2023c)	0.691	0.887	0.890	0.574
	LE2: Leaders foster a culture of continuous improvement and innovation	(Chan *et al.*, 2023, Liu *et al.*, 2023a)	0.732			
	LE3: Leaders encourage partnerships and collaboration in climate-related research	(Loushine *et al.*, 2006, Rowlinson *et al.*, 2014, Chan *et al.*, 2023, Liu *et al.*, 2023c, Ramos *et al.*, 2023)	0.783			
	LE4: Leaders actively share best practices on climate change and actions with other organizations	(Rowlinson *et al.*, 2014, Liu *et al.*, 2023a, Liu *et al.*, 2023c, Ramos *et al.*, 2023)	0.821			
	LE5: Leaders ensure the organization is prepared and responsive to climate change challenges	(Xu *et al.*, 2023)	0.814			
	LE6: Leaders periodically evaluate the effectiveness of existing capacity building efforts	(Xu and Wu, 2023)	0.711			

(*continued*)

Table 2

Variables	*Influencing factors*	*Author(s)*	*Standardized factor loadings*	*Cronbach alpha*[a]	*Composite reliability (CR)> = 0.6*[b]	*Average Variance extracted (AVE) > = 0.5*[c]
Organizational Climate Resilience (OCR)	OCR1: Organization is equipped with knowledge and information related to climate change and development	(Loushine *et al.*, 2006, Rowlinson *et al.*, 2014, Moda *et al.*, 2022)	0.604	0.790	0.824	0.540
	OCR2: Organization regularly provides opportunities for learning and development to cope with the challenges posed by climate change	(Xu *et al.*, 2023, Liu *et al.*, 2023c)	0.672			
	OCR3: Organization possesses a strong resource base that facilitates the development and implementation of effective climate solutions	(Ramos *et al.*, 2023, Susananto *et al.*, 2023)	0.764			
	OCR4: Organization culture promotes knowledge sharing and collaboration on climate projects within the departments and across the institution	(Loushine *et al.*, 2006, Rowlinson *et al.*, 2014, Hu *et al.*, 2023)	0.671			

Note(s): [a]Nunnally (1978), [b]Bagozzi and Yi (1988), [c]Fornell and Larcker (1981)
Source(s): Authors' own work

Likert-scale was used to capture the extent of the informant's agreement, ranging from 1 (strongly disagree) to 5 (strongly agree) for all four constructs. The individual construct comprised several items following pre-testing through a pilot study with 34 employees working in the construction industry in the UAE. Finally, the survey questionnaire was administered to employees working on various construction projects in the UAE. The items were then evaluated using an exploratory factor analysis (EFA) to check their content validity. AMOS version 23 is used for performing the confirmatory factor analysis (CFA). The model is assessed for testing reliability, convergent validity, and discriminant validity (Table 3).

Independent variables. Based on the existing literature, a new scale for CSC was developed consisting of six items, as reported in Table 2. The Cronbach's alpha 0.89 is above the acceptable minimum (Nunnally, 1978), and the factor loadings varies from 0.71 to 0.79. The value of composite reliability was 0.89, which is regarded as satisfactory (Bagozzi and Yi, 1988). The average variance extracted (AVE) value of 0.58 (>0.5) was likewise deemed to be within a reasonable range (Fornell and Larcker, 1981). Similarly, the new scale of CRC (Table 2), consisting of six items was estimated and found to fall within an acceptable range.

Moderating variables. Factor loadings varied from 0.69 to 0.82, and the calculated Cronbach's alpha for the LE scale was 0.88, above the acceptable minimum (Nunnally, 1978). According to Bagozzi and Yi (1988), 0.89 is considered a reasonable value for composite reliability. Additionally, the average variance extracted (AVE) value was 0.57 (>0.5), which is likewise regarded as falling within an acceptable range (Fornell and Larcker, 1981).

Dependent variables. The new scale of OCR (refer Table 2) consisting of four items was estimated with Cronbach's alpha 0.79 – which is above the acceptable minimum (Nunnally, 1978) and the factor loadings ranged from 0.61 to 0.76. The value of composite reliability was 0.82, which is regarded as satisfactory (Bagozzi and Yi, 1988). Moreover, the value of average variance extracted (AVE) was 0.54 (>0.5), also considered to be in an acceptable range (Fornell and Larcker, 1981).

Control variables. The study additionally considered potentially confounding variables, including firm size, age and affiliation with the business group (BG). The size of the firm constitutes a critical control variable because larger firms possess a greater amount of resources and technical know-how for adaptive capability (Xie *et al*., 2018). Based on previous research, controls were also included in relation to the firm age (Kumar *et al*., 2023). Finally, a firm affiliation to BG has been controlled because firms in BG gain more because of their network positions (Kumar and Dutta, 2017).

Analytical approach and models. The structural equation modeling using the AMOS path analysis was used to test the hypotheses outlined earlier. A test for Kolmogorov-Smirnov validated the univariate normality assumption. Additionally, the skewness and kurtosis of all variables fell within the range of 2X Standard errors (Bouncken *et al*., 2024). We performed collinearity diagnostics by computing tolerance and variance inflation factors (VIFs) for all

Table 3 Discriminant validity

Variables	*CSC*	*CRC*	*LE*	*OCR*
Heterotrait-monotrait value (HTMT) ≤ 0.85[a]				
CSC	—			
CRC	0.81	—		
LE	0.42	0.43	—	
OCR	0.61	0.78	0.47	—

Note(s): [a]HTMT criterions by Henseler *et al.* (2015)
Source(s): Authors' own work

the independent variables, including the moderating item. The range of tolerance value was from 0.28 to 0.84 (i.e. greater than 0.10), while the range of the VIF was from 1.18 to 3.48, with a mean VIF of 2.25 indicating that multicollinearity is not an issue.

6. Findings

6.1 Descriptive analysis

The preliminary analysis of organizational information (in Table 4) revealed that a total of 420 employees participated in the study. Of the study's respondents, 34.52% are women and 65.48% are men. Approximately 76% of the employees had less than 10 years' experience in projects related to the construction sector in UAE. Table 5 shows the mean values, standard deviations, and Pearson correlation coefficients.

6.2 Hypotheses testing (structural model)

To examine the relationship between CSC, CRC, LE and OCR, we used the structural equation modeling using the AMOS path analysis by imputing the Factor Score from CFA using AMOS. As part of hypotheses testing, we tested the LE as a mediator. The following is the graphical representation of structural model (as depicted in Figure 2) followed by results.

The result of CFA further shows that model had good fit statistics including $x2$/df = 2.62, RMSEA of 0.062, RMR of 0.037, and CFI of 0.939. The recommended values are provided in the bracket based on the guidelines of Hu and Bentler (1999) and Cudeck and Browne (1992) (RMSEA $<$ 0.08, RMR $<$ 0.05, CFI $>$ 0.90).

Table 4 Descriptive statistics

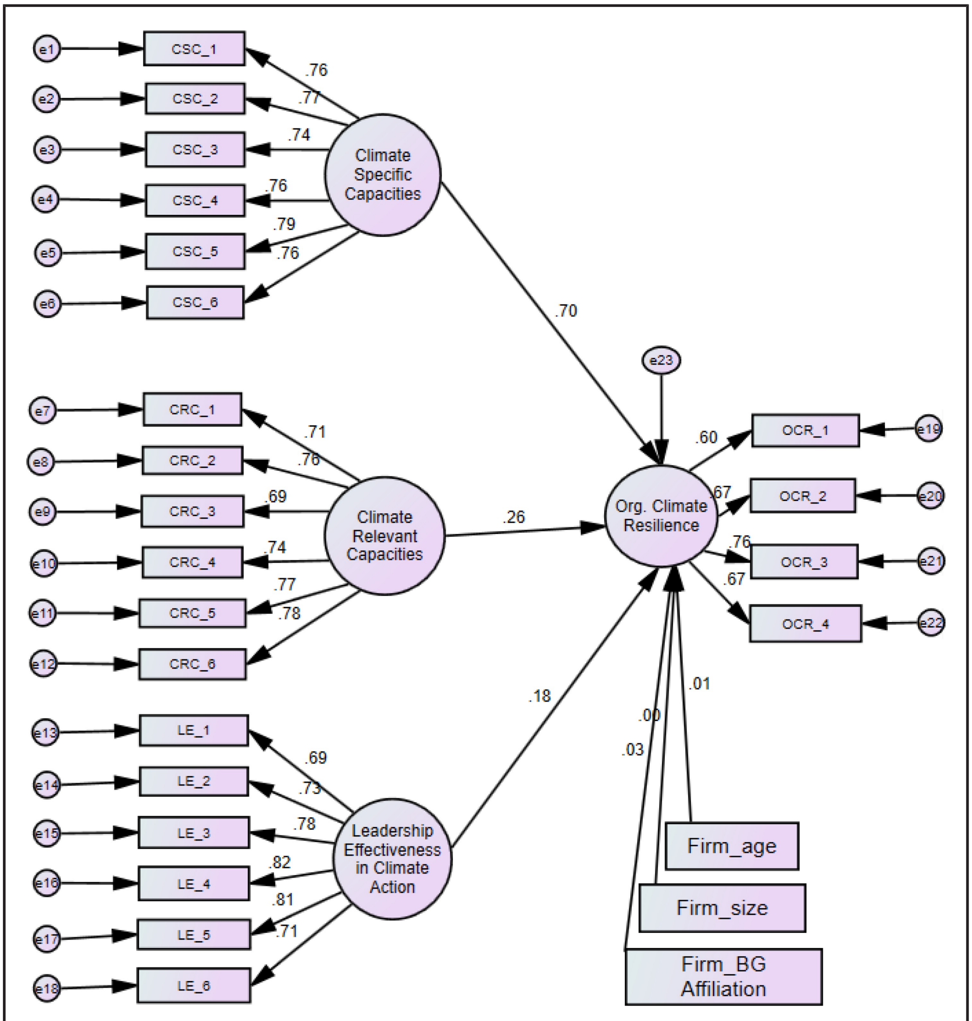
Demographic profile of respondents	*Pilot study*	*Main study*	*Main study (%)*
Gender			
Male	15	275	65.5
Female	19	145	34.5
Age			
20–30 years	21	121	28.8
30–40 years	8	199	47.4
40–50 years	3	87	20.7
Over 50 years	2	13	3.1
Job role			
Site engineer	5	47	11.2
Resident engineer	6	21	5.0
Project manager	16	140	33.3
Safety engineer	3	51	12.1
MEP (mechanical, electrical and plumbing) worker	2	32	7.6
Labour supervisor	1	100	23.8
Architect	1	29	6.9
Work experience in UAE			
Less than 5 years	15	160	38.1
5–10 years	12	160	38.1
11–15 years	4	72	17.1
Over 15 years	3	28	6.7
Project types			
Road/highways projects	5	38	9.1
Residential construction	17	235	55.9
Infrastructure (e.g., water supply pipeline, sewerage etc.)	8	65	15.5
Interior fit outs	4	82	19.5

Source(s): Authors' own work

Table 5 Means, standard deviations and Pearson correlations										
Variables		*Mean*	*SD*	*1*	*2*	*3*	*4*	*5*	*6*
1	CSC	3.72	0.77						
2	CRC	3.73	0.74	0.842**					
3	LE in Climate Actions	3.37	0.78	0.380**	0.380**				
4	OCR	3.82	0.81	0.719**	0.665**	0.400**			
5	Firm age[a]	1.15	0.39	0.028	0.070	0.009	0.041		
6	Firm size[a]	4.73	2.58	0.049	0.047	−0.094	0.020	0.078	
7	Firm BG affiliation	1.36	0.48	−0.087	−0.123*	−0.015	−0.049	−0.010	−0.036

Note(s): [a]Log10, BG = Business Group, $n = 420$, Two-tailed tests. $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$
Source(s): Authors' own work

Figure 2 Structural model for direct effects



Source: Authors' own work

6.3 Regression results

Table 6 presents the findings from the investigation of the three direct relationship hypotheses (*H1, H2*, and *H3*). The hypotheses were statistically significant ($p < 0.001$) all over. Regarding the individual hypotheses, CSC shows a positive and significant coefficient

Table 6 Direct effects of CSC, CRC and LR on OCR

Relationship(s)			Estimate	S.E.	C.R.	P	Label	Hypothesis
OCR	←	CSC	0.550	0.056	9.746	***		*H1* Supported
OCR	←	CRC	0.205	0.039	5.225	***		*H2* Supported
OCR	←	LE	0.151	0.040	3.783	***		*H3* Supported
OCR	←	Firm_age[a]	0.020	0.064	0.319	0.749		
OCR	←	Firm-size[b]	0.000	0.010	0.012	0.991		
OCR	←	Firm_BG Affiliation	0.035	0.053	0.654	0.513		

Note(s): [a,b]Log10, BG = Business Group, Unstandardized regression coefficients are reported, S.E = Standard errors, C.R = Critical ratios, $^{+}p < 0.10$; $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$
Source(s): Authors' own work

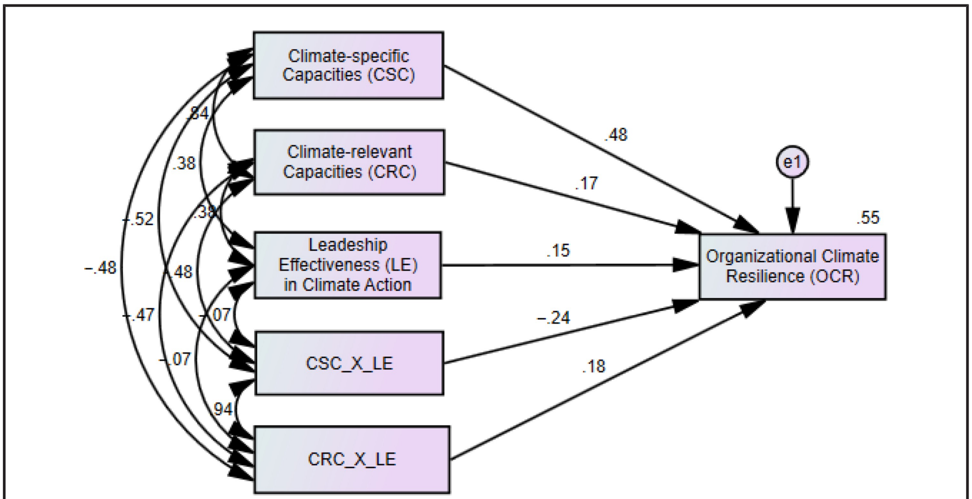
(b = 0.550, $p < 0.001$), indicating that it positively affects firm's climate resilience (i.e. OCR), hence supporting *H1*. Similarly, positive and significant coefficient for CRC (b = 0.205, $p <$ 0.001) confirms *H2*, suggesting that CRC enhances OCR. Finally, LE in climate action supports *H3* since it positively affects OCR (b = 0.151, $p < 0.001$).

Hypotheses *H4a* and *H4b* examine the moderating roles of LE on the relationship between capacity for climate actions and firm's climate resilience (i.e. OCR). To test these hypotheses, the interaction term was added using their z-scores for structural equation modeling using the AMOS path analysis (as depicted in Figure 3).

The results are presented in Table 7. The coefficient for interaction between CSC and LE was negative and significant ($b = -0.158$, $p < 0.05$) indicating that LE negatively moderate CSC and OCR (i.e. supporting *H4a*). Support was also found for *H4b* because the interaction between CRC and LE was positive and significant ($b = 0.119$, $p < 0.10$). Hence, LE positively moderates the CRC – OCR relationship.

Further, two-way interaction effects for variables are analyzed (as shown in Figure 4). The findings indicated that LE dampens the positive relationship between CSC and OCR whereas LE strengthens the positive relationship between CRC and OCR. These findings suggest that firms with relevant capacities in climate change gain more when a high level of LE is evident compared to low level. However, LE minimizes the positive correlation between specific capacities in climate change and organizational resilience.

Figure 3 Structural model for moderating effects



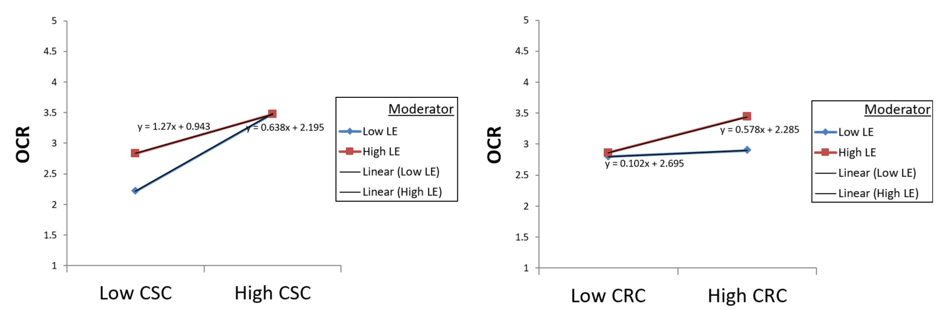
Source(s): Authors' own work

Table 7 Moderating effect of LE

Relationship(s)			Estimate	S.E.	C.R.	P	Label	Hypothesis
[a]OCR	←	[a]CSC	0.477	0.064	7.392	***		*H1* Supported
[a]OCR	←	[a]CRC	0.170	0.062	2.728	0.006		*H2* Supported
[a]OCR	←	[a]LE	0.152	0.036	4.195	***		*H3* Supported
[a]OCR	←	[a]CSC_X_[a]LE	−0.158	0.062	-2.431	0.015		*H4a* Supported
[a]OCR	←	[a]CRC_X_[a]LE	0.119	0.064	1.864	0.062		*H4b* Supported

Note(s): [a]Z Score of variables; Unstandardized regression coefficients are reported, S.E = Standard errors, C.R = Critical ratios, $^{+}p < 0.10$; $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$
Source(s): Authors' own work

Figure 4 Two-way interaction effects for variables



Source: Authors' own work

7. Discussion

This study integrates transformational leadership theory and dynamic capability perspective to understand the impact of climate capacities (both in terms of climate-specific and climate-relevant), in promoting organizational resilience within the context of the UAE construction sector that is experiencing climate change. Additionally, the direct and moderating roles of leadership (i.e. LE) are also examined in this context. The findings of the study establish direct and positive relationship of climate change capacities with OCR. While CSC reflects the coordinated impact of climate actors network, human resource commitment, climate centric financial planning, risk assessment and risk management (Lemos *et al.*, 2016); CRC integrates engagement of climate actors on a vast number of non-climate actions (Hochstetler, 2021), relates to stakeholders communication and feedback strategies (Schmitz, 2017), and promotes cooperation with complementary climate institutions, and climate centric financial risks management (Nash *et al.*, 2020). Thus, the combined climate capacities promote organizational resilience capability in the climate change context. The importance of climate change capacities to organizational resilience is increasingly recognized as organizations face the dual challenges of environmental shifts and the need for sustainable operational practices (Tisch and Galbreath, 2018). As organizations continue to face these challenges, the development of resilience capacities will be essential for their long-term viability and success.

A direct and positive relationship has been found between LE in climate actions and OCR. The study done by Mousa *et al.* (2019) has shown that having responsible leaders in hospitals has a negative effect on the relationship between climate change and the affective, continuance and normative organizational commitment. Our results, however, point in a different direction. Our results are in line with previous studies conducted by

Wang *et al.* (2023), Achebelema and Achebelema (2021), and Scholten *et al.* (2015) who hypothesized that leadership has contributed to the development of new adaptation practices within the context of climate change. Therefore, an emphasis on effectiveness of construction site managers and their impact on climate culture highlights the importance of leadership in ensuring safety and resilience on construction sites.

Furthermore, we find that LE positively moderates the relationship between CRC and OCR, suggesting that effective leadership can optimize the organizational benefits by integrating climate-relevant initiatives/actions into their business operations. Studies by Polonenko *et al.* (2020) and Shaya *et al.* (2023) have highlighted the positive moderating effect of leadership attributes on organizational resources and climate resilience. However, LE negatively moderates CSC–OCR relationship. This finding suggests that leadership's proactivism and effectiveness in financial planning including both climate risk assessment and management, does not confound to capacity building efforts like learning, development, collaboration and knowledge creation for climate change solutions. The novel finding related to negative moderation of LE emphasizes even more that, to fully maximize LE's potential, a careful selection of initiatives and actions may be necessary to address climate change challenges and the targeted emphasis on climate-specific practices. In summary, this study enhances our empirical comprehension of the ways in which climate action capacities and leadership attribute combine to foster climate resilience in organizational settings.

7.1 Contribution

The study contribution is three-fold. *First*, our findings contribute to answering the call for research to explore the roles of climate capacity-building initiatives and LE on OCR capability (Karamidehkordi *et al.*, 2024; Wu and Otsuka, 2022; Mekonnen and Kassa, 2019). Accordingly, the study has proposed a novel conceptual framework combining these constructs/variables. *Second*, we contribute to climate change, leadership, and resilience literature by proposing and validating new empirical measures for CSC, CRC, LE in climate actions and OCR. *Finally*, the findings extend the application of transformational leadership theory and dynamic capability perspective in climate change context of UAE (Wang *et al.*, 2023). Through advancing policies on climate impacts, capacity building, resilience and adaptation, the UAE has shown a significant commitment to sustainable development and climate change (Saradara *et al.*, 2023). Therefore, the research findings advocate that managers should consider climate capacities and leadership attributes for managing climate change initiatives as a way of improving climate resilience capability.

8. Conclusion

The current study was designed to explore climate capacities (both in terms of climate-specific and climate-relevant), concentrating on the relationships between climate capacities and organizational climate resilience (OCR) within the context of the UAE construction sector. Moreover, the direct and moderating roles of leadership effectiveness (LE) are also examined in this context. Our findings confirm a direct and positive relationship of climate capacities with OCR. Moreover, LE positively moderates the relationship between climate-relevant capacities and OCR whereas it negatively moderates the climate-specific capacities–OCR relationship.

8.1 Implications

The research findings related to climate capacities positively influencing climate resilience have significant implications for organizational managers, policy-making, and sustainable development practices. This research presents rich insights for organizational managers and climate actors to develop and deploy capacities both in terms of climate-specific and climate-relevant, as well as emphasizing leadership attribute to achieve climate resilience in construction sector. Enhancing climate capacities requires fostering an environment where stakeholders are encouraged to share knowledge and experiences. Overall, the study findings encourage managers to build necessary climate capacities and develop suitable leadership competence to protect the organization against the adverse effects of climate change. Policymakers should adopt climate-capability design principles that enhance resilience, ensuring that organizations can adapt to changing climatic conditions. Moreover, policymakers should develop comprehensive resilience frameworks that incorporate both short-term and long-term strategies to build sustainable resilience. As a result, this study is unique in that it examines the necessity for construction businesses to become resilient and take safeguards against the negative consequences of climate change.

8.2 Limitation and direction of future research

The study presents a few limitations as well. *First*, the current study addresses the climate specific criticalities of the construction sector in UAE and therefore fails to capture the unique factors and challenges for developing climate resilience in other sectors and industries. *Second*, this study didn't recognize the differences in leadership and technological competencies of different firms within the construction sector. *Finally*, the study does not consider cultural and legal aspects related to managing climate change globally. As a result, future research done in different economic conditions may require the inclusion of additional items.

Note

1. $ indicates the values are in the US dollar term.

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