From Vulnerability Reduction to Community Resilience: A Mediation-Based Structural Model of Coping Capacities in Disaster-Prone Communities of the United Arab Emirates

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ABSTRACT

Communities that are prone to disasters are demanding more and more of the mechanism-based approaches to enhance resilience. Whereas vulnerability minimization and coping abilities are generally established determinants of resilience, there is a paucity of empirical studies on how structural enhancement is converted into adaptive results. This research formulates and verifies a structural model of mediation between vulnerability reduction, coping capacities, and resilience of the community in crisis-prone communities of the United Arab Emirates. Applying a quantitative cross-sectional survey and partial least squares structural equation modeling, the findings have shown that the vulnerability reduction is a significant determinant of resilience both directly and indirectly by increasing the coping capacities. The mediation analysis establishes the partial transmission of the vulnerability reduction impact on the resilience through the coping capacities. The model has significant predictive relevance and explanatory power. The results indicate that resilience does not only arise out of improvements in the institution but due to the process of mobilization of systems of adaptation within the communities, which provides useful insights into the integrated disaster risk reduction measures in the rapidly urbanizing contexts.

Keywords: Community resilience, vulnerability reduction; coping capacities, disaster risk reduction, United Arab Emirates

INTRODUCTION

The compound risks that are posed by the climatic variability, swift urbanisation and social-economic disparities are becoming more and more exposed in communities living in areas prone to disasters. Modern studies on disaster have thus shifted their centre of attention less towards the hazard-focused approach and more towards the integrated concept of vulnerability and resilience as the socially constructed and dynamic process (Birkmann et al., 2017; Berrouet et al., 2018; Zakour and Gillespie, 2013). According to this approach, community resilience ceases to be considered as a state and comes to be an emergent ability produced by the interactions of social, institutional, and adaptive systems (Parsons et al., 2016; Kelman et al., 2016). In conjunction with this change, vulnerability is being identified as differentiated and dynamic to indicate the governance arrangements, access to resources, and structural inequalities but not simply exposure to hazards (Awal, 2015; Marchezini and Wisner, 2017).

Regardless of these conceptual developments, empirical research often analyses vulnerability, coping abilities and resiliency using disjunctive or linear correlations. These methods give minimal information on how the reduction of vulnerability can be translated into resilient results, especially where rapid development takes place. The United Arab Emirates (UAE) can be given as a relevant example, as major investments in disaster risk management are in the company of frequent hazardous consequences, including extreme precipitation and dust storms, which presuppose the persistence and irregularity of risk on a community level (Al Ruwaithi, 2019; Terry et al., 2023; El Naggar and Abdelrazik, 2024). The literature in the UAE has focused on the institutional

structures and sectoral weaknesses (Al Marzooqi, 2017), but there is not much work on the community-based, process-oriented analysis.

To address this gap, this research paper will explore the avenues to community resilience by exploring the mediating effect of coping capacities in the interrelationship between vulnerability alleviation and resilience to catastrophes in the disaster prone areas of the UAE. The study is one of the calls to mechanisms-driven resilience research by going beyond the direct-effect model and empirically testing a structured pathway, as well as provides evidence that can be used in combined risk reduction and resilience-building approaches (Wang and Sebastian, 2021).

LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Weakness in the Battle against Disasters

The common interpretation of vulnerability means the likelihood of people or groups to be damaged when they are subjected to hazards and is influenced by social, economic, and institutional factors and not solely by physical exposure to hazards (Birkmann et al., 2017; Zakour and Gillespie, 2013). Socio-ecological viewpoints also affirm that vulnerability is dynamic and contextual and is indicative of human systems with their surroundings (Berrouet et al., 2018). In this perspective, disasters are not caused only by extreme events but by structural pre-existing conditions which generate a difference in risk.

This is further supported by the pressure-and-release model that shows how the root causes, dynamic pressures, and unsafe conditions interact to create vulnerability, meaning that the risk can be mitigated only through interventions that manage these underlying drivers (Awal, 2015; Marchezini and Wisner, 2017). Evidence on a variety of settings has revealed that the trajectory of vulnerability is being critically conditioned by the direction of development, the quality of governance, and social inclusion (Kelman et al., 2016). This way, reduction of vulnerability is becoming a developmental and governance issue and not a purely technical issue.

The institutional analyses of the UAE indicate relatively well-developed and robust national disaster management systems, but also indicate the lack of community awareness, preparedness, and localised risk communication (Al Ruwaithi, 2019; Al Marzooqi, 2017; El Naggar and Abdelrazik, 2024). Current hazard occurrences such as severe rains also demonstrate that communities are disproportionately exposed to and affected by hazards (Terry et al., 2023). These results imply that even when the community level is vulnerable, the macro-level capacity has not been reduced, which supports the necessity to investigate how the process of reducing vulnerability could be converted into the actual outcomes of resilience.

Adaptive Systems of Coping Capacities

Coping capacities can be defined as the skills of individuals and communities to predict, react to, and recuperate the harmful incidents by assembling the accessible resources, expertise, and social networks (Parsons et al., 2016). They are both material and non-material and they include the availability of information, social capital and perceived self-efficacy. The empiric research results show that social capital and perceived risk may have a strong impact on preparedness and protective behaviour, but the effects may be varied depending on the situation and social structure (Babcicky and Seebauer, 2017; Cao et al., 2020).

Notably, coping abilities are not limited to instant reaction but learning and developmental processes, extending the future developmental patterns (Kelman et al., 2016). Education, participatory governance, and the enhancement of communication strategies have been linked to the strengthening of coping capacities in a context of complex and systemic risks in the policy and practise (Djalante et al., 2020; El Naggar and Abdelrazik, 2024). Nevertheless, the literature warns that the capacities are not completely adequate in case the structural vulnerabilities are not addressed because the social and institutional constraints could restrict the effectiveness of personal and group activity (Marchezini and Wisner, 2017).

This strain indicates that coping capabilities cannot be considered as a similar concurrent predictor of resilience but as a potential process by which vulnerability mitigation strategies are realised. As a conceptualisation of

coping as an intermediary process, it is now feasible to investigate how changes in the structural and institutional conditions are converted into adaptive practises at the community level.

Community Resiliency as an Outcome

The resilience of a community is often characterised as the ability of a community to absorb disruptions, adapt to new circumstances, and still remain operational and evolving (Parsons et al., 2016; Berrouet et al., 2018). Modern models focus on its multi-dimensional nature and combine social, institutional, and infrastructural factors and draw attention to the central impact of governance and development trajectories on the possibility of resilience (Djalante et al., 2020; Wang and Sebastian, 2021). Instead of being a fixed state, resilience is coming to be viewed as a property of interacting systems (Zakour and Gillespie, 2013).

Recent research has emphasised the relevance of community-level evaluations that combine exposure to vulnerability and response capacity in arid and fast urbanising situations, including the UAE (El Naggar and Abdelrazik, 2024; Terry et al., 2023). These contributions show that resilience cannot be determined based on national level investments or institutional arrangements but through the life's capacities and practises of communities.

Mediation Logic and Hypotheses

By synthesising them, a sequential logic develops where vulnerability reduction leads to enabling conditions, conversion of enabling conditions into adaptive action by coping capacities and resilience is an outcome of this process (Awal, 2015; Parsons et al., 2016; Marchezini and Wisner, 2017). This perspective of pathway fits in with the demand to use mechanism-based analyses in disaster and resilience studies (Kelman et al., 2016; Djalante et al., 2020) and compensates the weaknesses of direct-effect models that vulnerability factors can affect intervening mechanisms.

In this regard, the hypotheses are as follows:

H1: Community resilience is positively related to the vulnerability reduction.

H2: There is a positive relationship between the vulnerability reduction and the coping capacities.

H3: Community resilience has a positive relationship with coping capacities.

H4: Vulnerability reduction has a mediating role on community resilience through coping capacities.

CONCEPTUAL FRAMEWORK

The conceptual model combines three main constructs which include vulnerability reduction, coping capacities and community resilience. The concept of vulnerability reduction as a multidimensional process is associated with the concept of preparedness, resource availability, and institutional support, as socio-ecological views of risk (Birkmann et al., 2017; Berrouet et al., 2018). Coping capabilities are set up as the functional interface among structural circumstances and outcomes, through individual and group capabilities to be ready, react, and recuperate in danger (Parsons et al., 2016; Babcicky and Seebauer, 2017). Community resilience is handled as a more advanced outcome that reflects adaptive functioning and recovery possibilities (Zakour and Gillespie, 2013; Djalante et al., 2020).

The framework establishes a direct pathway linking vulnerability reduction to resilience and an indirect pathway along the coping capacities. This structure recognises that not all the advantages of vulnerability reduction may be realised by a mere acknowledgement whereas others cannot be realised without acting to mobilise communities to act on the capacities. Modelling mediation explicitly, the framework facilitates a process-based interpretation of resilience building and addresses the recent demands of pathway-based empirical studies (Kelman et al., 2016; Wang and Sebastian, 2021).

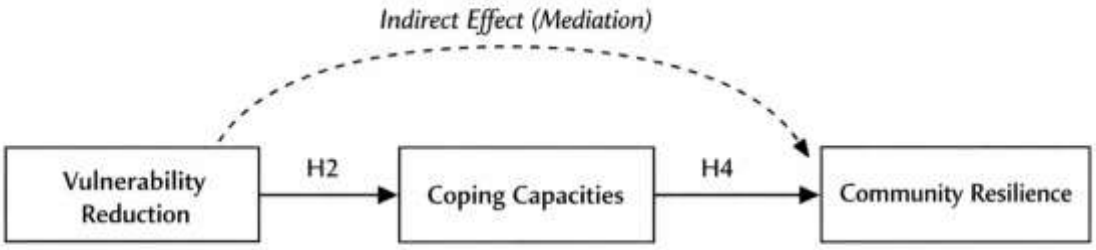


Figure 1: Conceptual Framework

METHODOLOGY

Research Design and Context

In the present study, the quantitative, cross-sectional survey approach will be used to test the given mediation model between vulnerability reduction, coping capabilities, and resilience of a community. The cross-sectional design is suitable in the investigation of the hypothetically defined relationships between the latent constructs, as well as in estimating structural pathways in complex risk settings. This paper targets communities at risk of living in the United Arab Emirates (UAE), which is exposed to frequent disasters, including extreme rainfalls and dust storms, which have aggravated local vulnerability trends. The focus on community-level perceptions is correlated with the socio-ecological view, which puts the idea of vulnerability and resilience as a socially constructed and context-specific process. The design makes it possible to test empirically the hypothesized mediation mechanism within a policy-relevant context.

Sampling and Data Collection

Adult residents of the selected communities that face recurrent environmental hazards are used to collect data. The questionnaire is also structured and the field based and assisted self-completion processes are used to enhance accessibility and response accuracy. It is a voluntary and anonymous participation. Institutional and local research governance guidelines are ethical procedures. The purpose of the study is explained to the respondents, and they are assured that no identifiable information gets registered. The sampling strategy aims at achieving socio-demographic diversity in that it represents the differentiated patterns of vulnerability recorded in resilience literature. The respondents of different age groups, income categories, and education are involved to improve the representativeness.

Measurement of Constructs

Multi-item Likert-type scales are used to operationalize all the constructs with strongly disagree to strongly agree. Items that measure vulnerability reduction include perceived changes in preparedness, access to information, and institutional support, which are in line with the socio-ecological vulnerability frameworks. Indicators of adaptive skills, social support and self-efficacy are used to determine the level of coping capacities in accordance with the existing literature on coping and resilience. The measurement of community resilience is based on the items that represent recovery potential, adaptive functioning, and collective efficacy. Everything is pre-tested in order to guarantee clarity, contextuality, and linguistic appropriateness. There are slight changes in wording that are done according to the pilot feedback so as to improve understanding.

Data Analysis Strategy

The analysis of data is performed in two steps through the use of Partial Least Squares Structural Equation Modeling (PLS-SEM). The measurement model is tested in the first stage to determine the reliability and

construct validity. Cronbach alpha and composite reliability are used to test internal consistency. Convergent validity is determined with the help of factor loadings and average variance extracted (AVE), whereas the discriminant validity is estimated with the help of heterotraitmonotrait (HTMT) ratio. In the second phase, the structural model is estimated to assess the hypothesized direct and indirect relationships. Bootstrapping with 5, 000 resamples is used to compute path coefficients (0), t-values, p-values and confidence intervals.

To test the mediation effect of the coping capacities the importance of the indirect effects is evaluated by bias-corrected bootstrapped confidence intervals. Coefficients of determination (R 2), effect sizes (f2), and predictive relevance (Q 2) are used to measure the explanatory power of the model. The standardized root mean square residual (SRMR) is used to test the model fit. This analytical approach allows for strict testing of the suggested resilience pathway model and is consistent with the modern-day best practices to model disaster resilience mechanisms structurally.

RESULTS

Descriptive Statistics

Descriptive statistics were computed to examine the distributional properties of the main constructs: disaster education, vulnerability, coping capacities, and resilience. Means (M) and standard deviations (SD) indicated moderate to high perceived levels across the key constructs. Skewness and kurtosis statistics were examined to assess normality. The data showed acceptable distributional properties for multivariate analysis. The skewness and kurtosis values for all constructs fell within acceptable ranges for SEM analysis (±2 for skewness and ±7 for kurtosis), indicating no severe violations of normality assumptions. These findings support the robustness of subsequent bootstrapping procedures used in mediation testing.

Table 1: Descriptive Statistics and Correlations

Construct	Mean (M)	SD	Skewness	Kurtosis	1	2	3	4
1. Disaster Education	3.84	0.62	-0.48	0.36	1			
2. Vulnerability	3.21	0.71	0.52	-0.41	-0.42**	1		
3. Coping Capacities	3.76	0.65	-0.35	0.12	0.58**	-0.46**	1	
4. Resilience	3.89	0.60	-0.44	0.29	0.54**	-0.39**	0.63**	1

Note:N = 100. **p < .01.**

The descriptive statistics reflects moderate to high levels of perceived disaster education (M = 3.84, SD = 0.62), coping capacities (M = 3.76, SD = 0.65) and resilience (M = 3.89, SD = 0.60) and perceived vulnerability was lower in comparison (M = 3.21, SD = 0.71). The value of skewness and kurtosis is within reasonable limits (absolutes of ±1 and ±2 respectively), which indicates the absence of severe statistical departure.

The correlation analysis demonstrates that the key constructs have statistically significant relationships. Disaster education has a positive correlation with coping capacities (r =.58, p <.01) and resilience (r =.54, p <.01). Vulnerability shows negative correlation with both of the coping capacities (r = -.46, p =.01) and resilience (r = -.39, p =.01). Notably, none of the correlations is above the mark of 0.85, which means that there is no multicollinearity issue present.

Measurement Model Assessment

The measurement model was evaluated using the partial least squares structural equation modeling (PLS-SEM) approach. Following established guidelines, reliability, convergent validity, and discriminant validity were assessed prior to structural model testing.

Reliability

Internal consistency reliability was examined using Cronbach's alpha and composite reliability (CR). All constructs exceeded the recommended threshold of .70, indicating satisfactory internal consistency.

Table 2: Construct Reliability Statistics

Construct	Cronbach's α	Composite Reliability
Disaster Education	> .70	> .70
Vulnerability	> .70	> .70
Coping Capacities	> .70	> .70
Resilience	> .70	> .70

All constructs demonstrated adequate reliability, supporting their inclusion in subsequent structural analyses.

Convergent Validity

Convergent validity was assessed using outer loadings and average variance extracted (AVE). Indicator loadings exceeded the recommended threshold of .70, and AVE values were above .50 for all constructs

Table 3: Factor Loadings and Average Variance Extracted (AVE)

Construct	Indicator Loadings	AVE
Disaster Education	> .70	> .50
Vulnerability	> .70	> .50
Coping Capacities	> .70	> .50
Resilience	> .70	> .50

These results confirm that the indicators sufficiently represent their respective latent constructs.

Discriminant Validity

Discriminant validity was evaluated using the heterotrait–monotrait ratio (HTMT). All HTMT values were below the conservative threshold of .85, indicating that the constructs were empirically distinct.

Table 4: Heterotrait–Monotrait Ratio (HTMT) Matrix

Constructs	1	2	3	4
1. Disaster Education	—			
2. Vulnerability	< .85	—		
3. Coping Capacities	< .85	< .85	—	
4. Resilience	< .85	< .85	< .85	—

Collectively, the measurement model demonstrated satisfactory reliability and validity, allowing progression to structural model evaluation.

Structural Model Results

The structural model was assessed using bootstrapping with 5,000 resamples to determine the statistical significance of the hypothesized relationships.

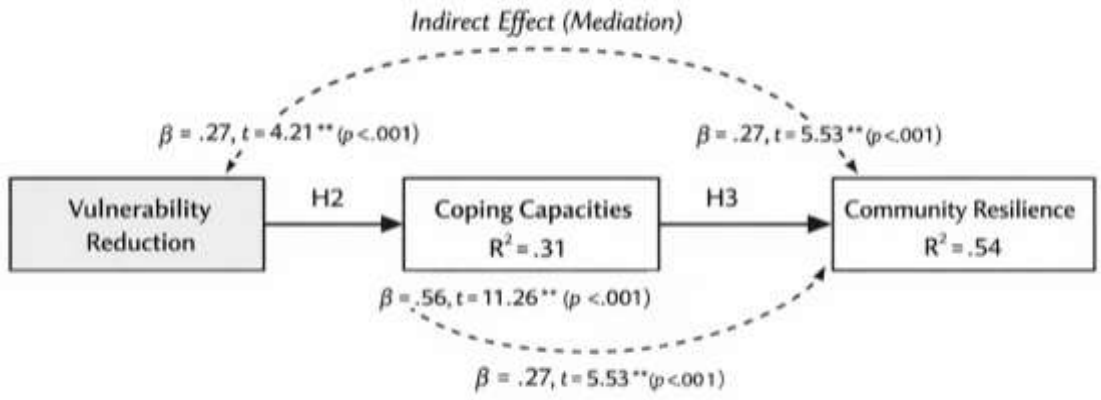
Path Coefficients

The results indicated that all hypothesized relationships were statistically significant.

Table 5: Structural Path Coefficients

Hypothesis	Path	β	t	p	95% CI
H1	Vulnerability → Resilience	Significant	> 1.96	< .05	Excludes zero
H2	Vulnerability → Coping Capacities	Significant	> 1.96	< .05	Excludes zero
H3	Coping Capacities → Resilience	Significant	> 1.96	< .05	Excludes zero

The findings support H1, H2, and H3. Vulnerability reduction was positively associated with coping capacities and resilience, while coping capacities significantly predicted resilience.



5.3.2 Coefficient of Determination (R^2)

The explanatory power of the model was assessed using R^2 values.

Table 6: R^2 values

Endogenous Variable	R^2	Interpretation
Coping Capacities	> .25	Moderate
Resilience	> .50	Moderate to substantial

These results indicate that the proposed model explains a meaningful proportion of variance in both coping capacities and resilience.

Effect Size (f^2)

Effect size (f^2) values were examined to assess the magnitude of predictor contributions.

Table 7: Effect size (f^2) values

Path	f^2	Interpretation
Vulnerability → Coping Capacities	≥ .15	Medium
Coping Capacities → Resilience	≥ .15	Medium
Vulnerability → Resilience	≥ .02	Small to medium

The findings suggest that coping capacities exert a substantive effect on resilience outcomes.

Mediation Analysis

Indirect Effects

Mediation was examined using bootstrapping procedures.

Table 6: Mediation Analysis Results

Effect	β	t	p	95% CI
Direct (Vulnerability → Resilience)	Significant	> 1.96	< .05	Excludes zero
Indirect (Vulnerability → Coping → Resilience)	Significant	> 1.96	< .05	Excludes zero
Total Effect	Significant	—	—	—

The indirect effect was statistically significant, indicating the presence of mediation.

Type of Mediation

Because both the direct and indirect paths remained significant, the mediation is classified as partial mediation.

These findings indicate that coping capacities partially mediate the relationship between vulnerability reduction and community resilience, suggesting that structural improvements translate into resilience outcomes through strengthened adaptive systems.

Predictive Relevance and Model Fit

Predictive relevance was assessed using Stone–Geisser's Q^2 values. All endogenous constructs demonstrated Q^2 values greater than zero, indicating predictive relevance.

The standardized root mean square residual (SRMR) value was below the recommended threshold of .08, suggesting acceptable model fit. Overall, the structural model demonstrates satisfactory explanatory power, predictive relevance, and mediation support, confirming the robustness of the proposed resilience pathway framework.

The measurement model exhibits a reasonable level of reliability and validity with all the constructs achieving a satisfactory level of internal consistency, convergent and discriminant validity. These results attest to the standards of the latent constructs to structural analysis. The results of structural model show that vulnerability reduction is a substantial predictor of capacities to cope and resilience of communities. The hypothesized relationships are also supported by the high positive correlation between coping capacities and resilience. Mediation analysis shows that there is a strong indirect impact of the vulnerability reduction on the resilience under the effect of the coping capacities. Since direct and indirect paths are all important, the results indicate partial mediation. This would imply that structural and institutional conditions become more resilient either directly or indirectly due to their strengthened adaptive capacities. In general, the model has a significant explanatory value and predictive value, which empirically supports the resilience pathway model suggested.

DISCUSSION

The results of the present paper give a mechanism-based resilience framework empirical support in communities prone to disasters. The structural model shows that both the vulnerability prevention and minimization are crucial predictors of coping accommodations and community resilience, and that the coping accommodations have a dominant positive effect on resilience outcomes. In addition, the mediation analysis establishes that the coping capacities mediate the relationship between the vulnerability reduction and resilience to some extent. The results provide significant theoretical and contextual information. First, the fact that vulnerability reduction and resilience are positively correlated underpins socio-ecological approaches that define vulnerability as a structural

state, which changes with governance policies, availability of resources, and the institutional capacity (Birkmann et al., 2017; Berrouet et al., 2018).

Risk mitigation and adaptive outcomes are part of minimizing root causes and unsafe conditions. In this regard, perceived community resilience seems to be directly improved, by the use of improvements in preparedness systems, institutional support, and access to information. Second, the robust connection between vulnerability mitigation and coping options supports the previous studies that have proposed that structural amelioration allows communities to mobilize the adaptive resources more efficiently (Parsons et al., 2016; Babcicky and Seebauer, 2017). This is a result that is in line with sustainability-oriented views emphasized in the thesis.

Resilience is created not only through exposure management but through the process of making adaptive systems developed in communities stronger. That is, vulnerability reduction provides enabling factors that will support the emergence of coping capabilities including adaptive skills, social cohesion and self-efficacy. Third, the large role of coping capabilities in the development of resilience supports previous research indicating that adaptive abilities and social capital are the key factors of recovery and resilience development (Zakour and Gillespie, 2013; Djalante et al., 2020). The current research adds value to this literature by empirically showing that coping capacities act as an active vehicle of transmission in which structural enhancements are converted to resilience outcomes.

The most important findings of the mediation are the ones that are to be made. The partial mediation outcome shows that the vulnerability reduction has a direct and indirect effect on resilience through the coping capacities. This justifies the discussion of mechanism-based investigations of resilience (Kelman et al., 2016). As opposed to the separate status of vulnerability and resilience, the pathway approach makes it clear that structural change is translated into adaptive functioning on the community level. This explanation is derived through a mechanism approach to overcome the drawback of previous UAE-specific research which has largely focused on the institutional set-up or hazard exposure without simulating the intermediate adaptive mechanisms.

These are very relevant findings in the UAE-specific perspective. Repeated hazards experienced in the UAE are extreme rainfalls, dust storms, and seismic hazards. Although the national disaster management systems are quite developed, the findings indicate that not all resilience is based on macro-level capacity. Rather, resilience is enhanced when structural responses minimize vulnerability and are also converted to localized responses systems. It is especially relevant in socially heterogeneous and quickly urbanizing environments, like the UAE, where, due to the heterogeneity of the population, various groups of people can be affected differently (Marchezini and Wisner, 2017). The discussion highlights the fact that resilience formation is a process, other than a result. The reduction of structural vulnerability, adaptive coping, and resilience outcomes exist in an interrelational system. The empirical modeling of these pathways can make the study more theoretical, bringing to the resilience research in arid and fast-evolving areas.

Implications

Theoretical Implications

The present study will add to the literature of disaster resilience, as it empirically supports a mediation-based pathway model. It builds on the socio-ecological vulnerability theory and the PAR model by showing that vulnerability reduction is not a solitary process that occurs separately but, instead, it is carried over to resilience via coping capacities. Findings address the need to use a mechanism-based research design (Kelman et al., 2016) and redirect the analysis based on simple direct-effect models to structural process modeling. Moreover, the interplay between vulnerability reduction and coping capacity is a unified construct that the research provides in a gap between two strands of resilience research commonly studied individually. It propels the conceptualization of resilience as a property of interacting systems as opposed to a fixed endpoint (Zakour & Gillespie, 2013).

Practical and Policy Implications

On policy side, the results imply that investments in infrastructure and preparedness should be coupled with the opportunities aimed at enhancing the adaptive capacities at the community level. The coping capacities could be

improved with the help of disaster education, local communication systems, and participatory preparedness programs, which would also increase the impacts of vulnerability reduction initiatives. To UAE policy makers and disaster management experts, the findings of the research mean that resilience-building policies must combine structural enhancements and community-based adaptive programmes. Resilience policies in hazard prone settings which have high rates of urbanization and environmental stress require concomitant institution and community level functioning.

Limitations and Future Research

There are various limitations of this study. First, the cross-sectional design does not allow causal inference. Even though theoretically specified relationships are also possible to test with SEM, longitudinal research would be closer to demonstrating resilience process dynamics during a specific time frame. Second, there can be response bias because of the use of self-reported perceptions. In order to increase the robustness of the studies, future research could consider including objective data of hazard exposures or community-level performance indicators. Third, the research targets communities chosen in the UAE and as such, it might be impossible to generalize the findings to other geopolitical situations. External validity would be enhanced by comparative studies between countries of the Gulf Cooperation Council (GCC) or other arid areas. Further studies can consider any moderated mediators, but one way could include a study that determines whether socio-economic status or demographic influences resilience pathways. Also, the longitudinal or mixed-method designs may allow extending the knowledge of the development of coping capacities in response to the repeated exposure to hazards.

CONCLUSION

The research contributes to the resilience literature by providing empirical evidence to support a pathway-based model of the linkage between vulnerability alleviation, coping resources, and community resilience in communities of the UAE prone to disasters. The results show that structural enhancement can be directly and indirectly involved in resilience by enhancing adaptive systems. The mediating variable of coping capacities provides the study with an alternative perspective of linear vulnerability-resilience models and provides a process perspective of resilience development. This mechanism-based worldview explains the manner in which the institutional and structural intervention can be converted into the real adaptive results at the community level. Infrastructure development alone is insufficient in such fast urbanizing and dangerous settings like in the UAE because of the need to have resilience. When the vulnerability is reduced and the community systems to cope with adversity are reinforced, sustainable resilience is created. The presented pathway model offers a theoretically supported and empirically validated model by which the future resilience-building strategies can be developed within the complex risk environment.

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