17% Overall Similarity

The combined total of all matches, including overlapping sources, for each database.

Filtered from the Report

- Bibliography

Match Groups

45 Not Cited or Quoted 15%
Matches with neither in-text citation nor quotation marks

6 Missing Quotations 1%
Matches that are still very similar to source material

2 Missing Citation 1%
Matches that have quotation marks, but no in-text citation

0 Cited and Quoted 0%
Matches with in-text citation present, but no quotation marks

Top Sources

15% Internet sources
8% Publications
5% Submitted works (Student Papers)

Match Groups

- **45** Not Cited or Quoted 15%
  Matches with neither in-text citation nor quotation marks
- **6** Missing Quotations 1%
  Matches that are still very similar to source material
- **2** Missing Citation 1%
  Matches that have quotation marks, but no in-text citation
- **0** Cited and Quoted 0%
  Matches with in-text citation present, but no quotation marks

Top Sources

15% Internet sources
8% Publications
5% Submitted works (Student Papers)

Top Sources

The sources with the highest number of matches within the submission. Overlapping sources will not be displayed.

1	Internet	ojs.stieamkop.ac.id 3%
2	Publication	John Kenedy, Ade Nurul Hidayat, Adi Rusdi Widya. "The Influence of Price, Driving... 1%
3	Internet	jurnal2.untagsmg.ac.id 1%
4	Internet	jhss-lppmunpak.id <1%
5	Internet	ilomata.org <1%
6	Internet	journal-gehu.com <1%
7	Internet	wsj.westsciences.com <1%
8	Internet	www.ijsrm.net <1%
9	Internet	eprint.stieww.ac.id <1%
10	Internet	journal.iaincurup.ac.id <1%

11	Internet	
www.jurnal.stmikiba.ac.id		<1%
12	Student papers	
University of Witwatersrand		<1%
13	Internet	
amanahpublishing.com		<1%
14	Internet	
www.theseus.fi		<1%
15	Student papers	
Fakultas Teknologi Industri		<1%
16	Internet	
e-journal.trisakti.ac.id		<1%
17	Internet	
jurnal.ut.ac.id		<1%
18	Publication	
Yeremia Heskie Saputra, So Yohanes Jimmy, J. Johny Natu Prihanto. "Analysis of t...		<1%
19	Internet	
ejournal.stiepena.ac.id		<1%
20	Publication	
Badri Munir Sukoco, Rahmat Heru Setianto, Nidya Ayu Arina, Ade Gafar Abdullah,...		<1%
21	Student papers	
Brunel University		<1%
22	Internet	
businessandfinanceanalyst.com		<1%
23	Internet	
ijeais.org		<1%
24	Publication	
Siska Noviaristanti. "Contemporary Research on Business and Management", CR...		<1%

25	Internet	
journal.arepublisher.com		<1%
26	Internet	
journals.researchsynergypress.com		<1%
27	Publication	
Teresa Dieguez, Isabel Diogo. "Its Never Too Late to Become an Entrepreneur: A L...		<1%
28	Internet	
amareview.fekon.unand.ac.id		<1%
29	Internet	
cahaya-ic.com		<1%
30	Internet	
www.elsevier.es		<1%
31	Internet	
www.learning-gate.com		<1%
32	Internet	
dirdosen.budiluhur.ac.id		<1%
33	Internet	
dspace.umkt.ac.id		<1%
34	Internet	
eduvest.greenvest.co.id		<1%
35	Internet	
ejournal.iainpalopo.ac.id		<1%
36	Internet	
international.aritekin.or.id		<1%
37	Internet	
jurnal.ibik.ac.id		<1%
38	Internet	
library.acadlore.com		<1%

39 Internet

www.tandfonline.com <1%

Journal of Mathematics Instruction, Social Research and Opinion
Vol. 5, No. 2, June 2026, pp. 1705 – 1717, https://doi.org/10.58421/misro.v5i2.1685
ISSN 2962-7842

The Impact of the Pentahelix Model of Disaster Management on Community Satisfaction through the Leadership Style of the Mayor of Palu

Erdiyansyah[1], Slamet Riadi[2], Muhammad Nawawi[3], Mohamad Irfan[4]
[1,2,3,4]Universitas Tadulako, Palu, Indonesia

Article Info

Article history:

Received 2026-05-11
Revised 2026-06-13
Accepted 2026-06-14

Keywords:

Disaster
Leadership
Multihelix
Pentahelix
Satisfaction

ABSTRACT

Effective disaster response in Palu City continues to face challenges in multi-stakeholder coordination, which affects community satisfaction. This study aims to analyze the impact of the pentahelix model of disaster management on community satisfaction and to examine the moderating role of the Palu Mayor's leadership style. The study employs a quantitative method with a population of 5,514 stakeholders and affected residents, and a sample of 210 respondents selected via proportional stratified random sampling. Primary data were collected using a Likert-scale questionnaire and analyzed using Structural Equation Modeling-Partial Least Squares (SEM-PLS). The results of the hypothesis testing confirm that the pentahelix model has a positive and significant effect on community satisfaction ($\beta = 0.430$; $p < 0.001$), as does situational leadership style ($\beta = 0.420$; $p < 0.001$). A crucial finding indicates that leadership style significantly strengthens the relationship between the pentahelix model and community satisfaction ($\beta = 0.275$; $p < 0.001$), with the structural model exhibiting strong explanatory power ($R^2 = 0.622$) and adequate predictive relevance ($Q^2 = 0.378$). It is concluded that pentahelix synergy achieves optimal effectiveness only when catalyzed by adaptive, transparent, and goal-oriented leadership. These findings have practical implications for the Palu City Government, which should institutionalize multi-stakeholder collaboration forums, strengthened by situational leadership capacity, to enhance public legitimacy and the resilience of disaster governance.

Corresponding Author:

Erdiyansyah
Universitas Tadulako, Palu, Indonesia
Email: erdiyansyahwahab@gmail.com

1. INTRODUCTION

The urgency of an effective and efficient disaster response has become a pressing global issue as the material losses and loss of life caused by natural disasters have increased significantly in various parts of the world [1]. As an archipelagic nation located within the Pacific Ring of Fire, Indonesia faces a high risk of earthquakes, tsunamis, and soil

liquefaction, necessitating a responsive, adaptive, and collaborative governance system. In recent decades, decentralized disaster governance has garnered increasing academic and practical attention, driven primarily by the complexity of disasters in densely populated areas and massive urbanization [2]. Conventional approaches that rely solely on vertical government responses are no longer considered adequate to address the dynamics of contemporary crises. Therefore, a multi-stakeholder collaboration framework is needed that integrates five strategic actors: the government, the public, the business sector, academia, and the media. Disaster management must be addressed in an integrated, holistic, and comprehensive manner; thus, the pentahelix model is believed to serve as a strategic bridge to facilitate synergy among these actors in responding to crises and improving the quality of post-disaster public services [3].

The implementation of the pentahelix model at the local level still faces significant challenges, as reflected in the disaster response in Palu. In the aftermath of the 2018 earthquake, tsunami, and soil liquefaction, public complaints about the performance of disaster management efforts continue to surface across various public channels. The public has highlighted the slow distribution of relief supplies and the lack of adequate medical facilities [4], as well as poor coordination among agencies, which has led to delays in emergency response [5]. This phenomenon has directly led to a decline in community satisfaction with post-disaster public services. On the regulatory front, Law No. 24 of 2007 on Disaster Management continues to exhibit implementation gaps, including insufficient budgetary support, slow disbursement mechanisms, and overlapping jurisdictions. Delays in declaring disaster status by both the central and local governments in the Palu case further exacerbated operational uncertainty on the ground [5]. This situation indicates that multi-stakeholder collaboration cannot function optimally without clear governance mechanisms and leadership capable of making swift and decisive decisions.

An effective disaster response requires cross-sectoral coordination in dynamic and uncertain conditions, making multi-agency collaboration an absolute prerequisite [6]. However, bureaucratic obstacles, procedural complexities, and a lack of readiness for resources often undermine the effectiveness of such collaboration. In this context, adaptive leadership becomes crucial. As emphasized in various post-disaster analyses of Palu, the absence of a leadership figure capable of proportionally consolidating civilian and military forces actually triggers panic and a leadership vacuum [7]. In fact, leadership for collaboration remains a relatively unexplored area in the public administration literature [8]. Poor inter-organizational communication and inefficiencies in aid delivery systematically undermine emergency response performance [1]. Therefore, disaster management mechanisms and local leadership approaches need to be critically evaluated not only during the emergency response phase but also on an ongoing basis throughout the rehabilitation and reconstruction phases.

The reality on the ground shows that the paralysis of local governments not only leads to technical delays but also triggers social disasters, such as the mass looting that occurred the day after the natural disaster [9]. To date, recovery programs such as the construction of Permanent Housing have not yet been completed as originally planned [10]. Land disputes exacerbate these challenges, uncertainty regarding the clear and

unencumbered status of land ownership, and the critical issue of clean water availability [11], [12], [13]. In fact, the provision of basic infrastructure such as water, telecommunications, electricity, and health services is vital for restoring the social and economic functioning of communities [14], [15]. On the other hand, strengthening local resilience through public participation remains a long-term mitigation strategy [16], [17], [18], [19], [20]. The dynamic relationship between the government, society, and the private sector has direct implications for the effectiveness of disaster management [21]. Although collaboration has been recognized as a new era in public administration [22], the continued weakness in collaborative performance calls for more in-depth research on the role of public leadership in facilitating collaboration, with a view to designing effective policy interventions [23].

To date, there has been a scarcity of empirical studies linking local government leadership styles to levels of community satisfaction within the pentahelix model. Most of the existing literature tends to separate leadership analysis from community satisfaction variables or to focus solely on the technical aspects of disaster management, without addressing the dimensions of collaborative governance. In fact, the effectiveness of pentahelix synergy heavily depends on local leaders' capacity to orchestrate resources, bridge the interests of multiple stakeholders, and ensure transparency in services. This study aims to address this gap by analyzing the impact of the pentahelix disaster management model on community satisfaction, with a focus on the strategic role of the Mayor of Palu's leadership style. These findings are expected not only to enrich the theoretical framework of collaborative disaster governance but also to provide practical recommendations for strengthening local leadership capacity in optimizing multi-stakeholder synergy to achieve responsive, accountable, and public-satisfaction-oriented disaster management services.

2. METHOD

This study employs a quantitative approach with an explanatory-causal design to examine the causal relationships among latent variables. A survey method was used to obtain a systematic overview of respondents' perceptions regarding the implementation of the pentahelix model, leadership styles, and community satisfaction in the context of disaster management in Palu City. The choice of a causal approach is based on the research objective, which is not only to describe phenomena but also to validate the direction and magnitude of structural influences among constructs.

The study population included all stakeholders directly affected by and involved in the disaster management ecosystem in Palu City following the 2018 earthquake, tsunami, and liquefaction, comprising 5,514 respondents distributed across the five components of the pentahelix model. The sample selection was based on SEM-PLS guidelines, which recommend a minimum sample size of 5–10 times the number of observed indicators [24], [25]. This study measured 42 indicators, so the minimum sample size was set at 210 respondents. The sampling technique used was simple random sampling with proportional allocation (proportional stratified sampling), based on the composition of each pentahelix element's population. A sampling fraction formula was applied to ensure the representativeness of each stratum [26].

Data were collected using three main instruments: a structured questionnaire, field observations, and a document review. The questionnaire served as the primary instrument; it was designed based on dimensions and indicators that had been theoretically validated and measured using a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree). Before the main distribution, a pilot test of the instrument was conducted with 30 respondents outside the research sample to ensure item clarity, response consistency, and initial reliability.

The data collection procedure was carried out in the following sequence: (1) development and expert validation of the instrument; (2) pilot testing and item revision; (3) distribution of the questionnaire offline and online to stratified respondents; (4) data screening to detect missing values, outliers, and response bias; and (5) coding and importing data into analysis software (SmartPLS 4). All procedures adhered to research ethics principles, including informed consent, anonymization of identities, and data confidentiality. Data analysis was conducted in stages using SmartPLS 4 software following the standard evaluation workflow of Partial Least Squares-based Structural Equation Modeling (SEM-PLS), by evaluating the measurement model (outer model) and an evaluation of the structural model (inner model) [27].

Next is the hypothesis testing. The hypothesis is accepted if the t-statistic value is > 1.96 and the p-value is < 0.05 ($\alpha = 5\%$). The testing includes: (1) the direct effects of the Pentahelix Model and Leadership Style on Community Satisfaction; and (2) the moderating effect of Leadership Style on the Pentahelix → Community Satisfaction path. The interpretation of the results is calibrated using path coefficients (β) and effect sizes to provide substantive implications for collaborative disaster governance.

3. RESULTS AND DISCUSSION

3.1. Results

The results of this study present an assessment of the measurement model, an assessment of the structural models, and hypothesis testing.

1. Measurement Model Assessment

   Convergent validity is assessed by the factor loadings of a latent variable and its indicators; these values are expected to be greater than 0.7, an the AVE is expected to be greater than 0.5. The results indicate that all indicators in this study are valid, as their factor loadings exceed 0.7. Figure 1 below shows the results of the factor-loading test conducted with SmartPLS.

https://doi.org/10.58421/misro.v5i2.1685 1709

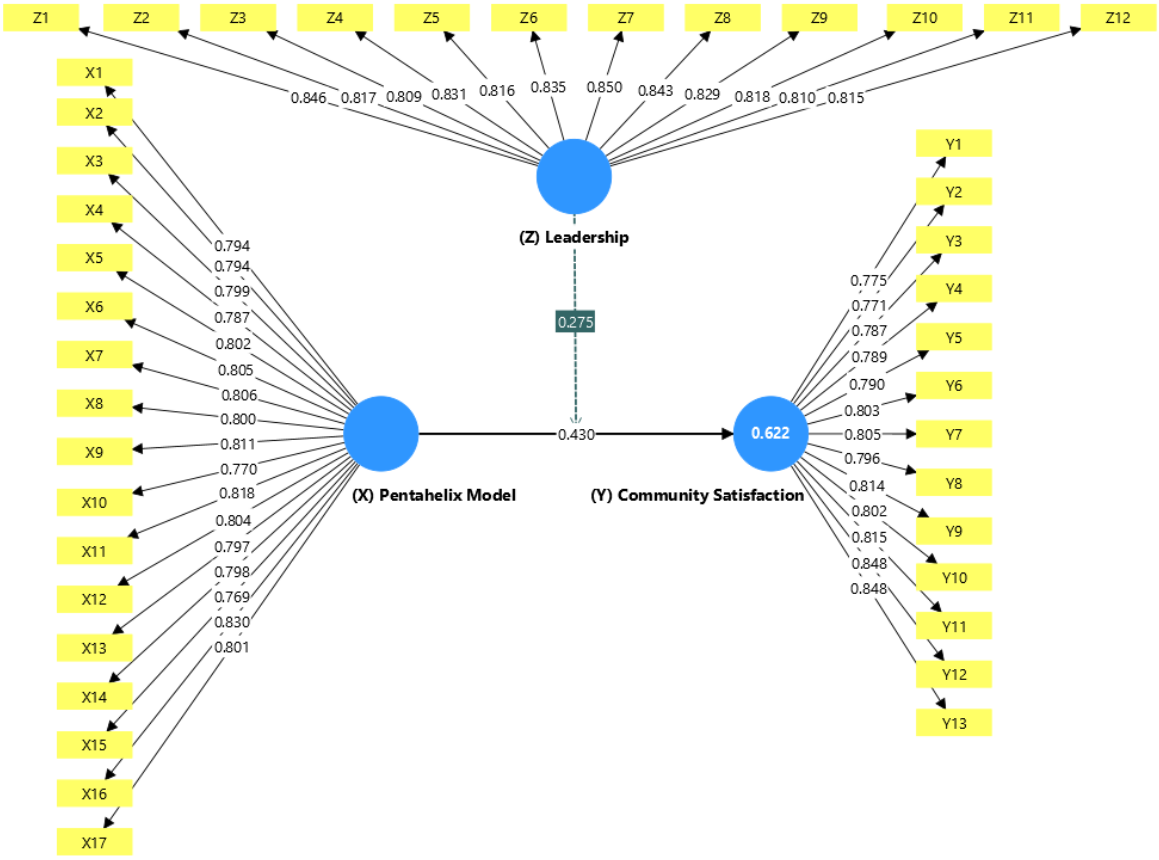

Figure 1. Factor Loading Test Results

Another validity measure is the AVE (Average Variance Extracted). The AVE value must be greater than 0.5. As shown in the table below, the leadership style variable has the highest AVE value, at 0.683. Meanwhile, the Pentahelix Model variable has the lowest AVE value, at 0.639.

Table 1. Average Variance Extracted (AVE) Values

Variable	Average variance extracted (AVE)
(X) Pentahelix Model	0,639
(Y) Community Satisfaction	0,646
(Z) Leadership Styles	0,683

The values obtained from Table 1 show that the AVE values for each variable are all greater than 0.5. These results indicate that the factor loadings and AVE values meet the criteria for convergent validity.

Next, discriminant validity was assessed through several tests, specifically by examining Fornell-Larcker and cross-loadings. The Fornell-Larcker criterion values and AVE values for each indicator from the SmartPLS output are presented in Table 2.

Table 2. Fornel-Larcker Values

Variable	(X) Pentahelix Model	(Y) Community Satisfaction
(X) Pentahelix Model	0,799	
(Y) Community Satisfaction	0,588	0,804
(Z) Leadership Styles	0,269	0,603

The validity test of the characteristics, as shown in Table 2 using the Fornell-Larcker criteria, indicates that the first variable's value must be higher within each construct, as seen in the table above. The pentahelix model variable has a value of 0.799, which is greater than the constructs of the other variables, and the community satisfaction variable has a value of 0.804, which is greater than the constructs of the other variables. Therefore, it can be concluded that the constructs of all variables have met the requirements of the discriminant validity test.

Table 3 presents the cross-loadings for each variable. Based on these values, the data in Table 3 indicate that each variable has a cross-loading factor value greater than 0.7, meaning that the variables in this study meet the criteria.

Table 3. Cross-Loading Values

Indicator	(X) Pentahelix Model	(Y) Community Satisfaction	(Z) Leadership Styles	(Z) Leadership Styles x (X) Pentahelix Model
X1	0,794	0,476	0,217	0,152
X2	0,794	0,463	0,196	0,135
X3	0,799	0,510	0,186	0,153
X4	0,787	0,460	0,122	0,135
X5	0,802	0,473	0,209	0,143
X6	0,805	0,446	0,234	0,150
X7	0,806	0,547	0,251	0,103
X8	0,800	0,461	0,220	0,139
X9	0,811	0,448	0,222	0,170
X10	0,770	0,405	0,206	0,125
X11	0,818	0,453	0,220	0,167
X12	0,804	0,448	0,273	0,160
X13	0,797	0,440	0,154	0,095
X14	0,798	0,450	0,240	0,108
X15	0,769	0,469	0,239	0,060
X16	0,830	0,496	0,238	0,172
X17	0,801	0,505	0,220	0,170
Y1	0,528	0,775	0,438	0,324
Y2	0,435	0,771	0,386	0,305
Y3	0,496	0,787	0,400	0,354
Y4	0,472	0,789	0,434	0,395
Y5	0,558	0,790	0,456	0,365
Y6	0,520	0,803	0,461	0,359

https://doi.org/10.58421/misro.v5i2.1685 1711

Indicator	(X) Pentahelix Model	(Y) Community Satisfaction	(Z) Leadership Styles	(Z) Leadership Styles x (X) Pentahelix Model
Y7	0,435	0,805	0,445	0,363
Y8	0,435	0,796	0,488	0,377
Y9	0,472	0,814	0,464	0,379
Y10	0,405	0,802	0,584	0,385
Y11	0,434	0,815	0,517	0,340
Y12	0,448	0,848	0,614	0,310
Y13	0,497	0,848	0,566	0,379
Z1	0,208	0,531	0,846	0,198
Z2	0,203	0,446	0,817	0,159
Z3	0,167	0,444	0,809	0,165
Z4	0,250	0,476	0,831	0,226
Z5	0,183	0,510	0,816	0,259
Z6	0,301	0,583	0,835	0,214
Z7	0,238	0,532	0,850	0,317
Z8	0,189	0,476	0,843	0,256
Z9	0,287	0,525	0,829	0,223
Z10	0,188	0,471	0,818	0,229
Z11	0,212	0,453	0,810	0,145
Z12	0,215	0,498	0,815	0,124
(Z) Leadership Styles x (X) Pentahelix Model	0,172	0,444	0,255	1,000

Next is the heterotrait-monotrait ratio (HTMT). The HTMT ratio must be less than 1 to meet the criteria for discriminant validity. The results show that all variables have an HTMT value below 1; therefore, they can be concluded to have passed the HTMT test. After conducting the validity test, the next step is the reliability test. The reliability test results showed a Cronbach's alpha value of 0.7 or higher, indicating that the scale is reliable. A scale is considered reliable if its Cronbach's alpha value is greater than 0.7 [28]. Similarly, the composite reliability (rho_a) must also be greater than 0.7. The results indicate that the composite reliability exceeds 0.7; therefore, it is concluded that all variables in this study meet the requirements and that the study can proceed to the internal validity testing phase.

Finally, test the Variance Inflation Factor (VIF). VIF is a measure of the increase in variance of the regression estimate coefficients relative to the orthogonal independent variables that are linearly related. The VIF value increases as the correlation among the independent variables increases. A VIF value > 5 can be used as an indication of multicollinearity. The results show that all indicators have a VIF value < 5, so it can be concluded that all indicators are free from multicollinearity.

2. Structural Models Assessment

1) Coefficient of Determination (R^2)

Table 4. R-Square Values for Endogenous Variables

Endogenous Variables	R^2	Interpretation
Community Satisfaction (Y)	0,622	Strong (62,2%)

The R^2 value of 0.622 indicates that the Pentahelix Model and Leadership Style variables together account for 62.2% of the variation in the Community Satisfaction variable, while the remaining 37.8% is explained by other variables outside the research model.

2) Effect Size (f^2)

Table 5. F-Square Value

Exogenous Variables	f^2 Regarding Community Satisfaction	Category
Pentahelix Model (X)	0,448	Strong (>0,35)
Leadership Styles (Z)	0,413	Strong (>0,35)
Interaction (Z×X)	0,168	Moderate (>0,15)

Criteria: f^2 = 0,02 (weak), 0,15 (moderate), 0,35 (Moderate)

3) Predictive Relevance (Q^2)

Table 6. Q^2 Values Predictive Relevance

Variable	Q^2	Interpretation
Community Satisfaction (Y)	0,378	Relevance (>0) ✓

A Q^2 value of 0.378 (>0) indicates that the research model has good predictive power, meaning that the model can explain 37.8% of the data's variance predictively.

4) Model Fit

Table 7. Index Goodness of Fit

Index	Value	Criteria	Status
SRMR	0,049	< 0,08	Fit
NFI	0,863	> 0,80	Fit
d_ULS	2,164	-	-
d_G	0,986	-	-
Chi-Square	1,087,235	-	-

An SRMR value of 0.049 (< 0.08) and an NFI of 0.863 (close to 1) indicate that the structural model fits the empirical data well.

.

3. Hypothesis Testing

Table 8. Hypothesis Test Results

Hypothesis	Relationship Path	β	t-statistic	p-value	Decision
H_1	Pentahelix Model → Community Satisfaction	0,430	9,610	0,000	Accepted
H_2	Leadership Styles → Community Satisfaction	0,420	9,482	0,000	Accepted
H_3	Interaction (Z×X) → Community Satisfaction	0,275	7,119	0,000	Accepted

Criteria: t-statistic > 1.96 and p-value < 0.05

1. Hypothesis 1 (H_1)
   The Pentahelix Model has a positive and significant effect on Community Satisfaction (β = 0.430; t = 9.610; p = 0.000). These results indicate that increased implementation of the Pentahelix collaboration model (government, academia, business, community, and media) will consistently increase community satisfaction. The coefficient value of 0.430 indicates that every one-standard-unit increase in the Pentahelix Model will increase community satisfaction by 0.430 standard units, assuming all other variables remain constant.
2. Hypothesis 2 (H_2)
   Leadership style has a positive and significant effect on community satisfaction (β = 0.420; t = 9.482; p = 0.000). This finding confirms that effective, visionary, and adaptive leadership styles are key factors in building public trust and satisfaction. The magnitude of the effect, which is nearly equivalent to that of the Pentahelix Model (0.420 vs. 0.430), indicates that leadership plays a role just as important as multisectoral collaboration.
3. Hypothesis 3 (H_3)
   Leadership style moderates the effect of the Pentahelix Model on community satisfaction (β = 0.275; t = 7.119; p = 0.000). These results indicate a significant and positive moderating effect, meaning that the effectiveness of the Pentahelix Model in enhancing community satisfaction is optimized when supported by a strong leadership style. In other words, pentahelix collaboration will have a greater impact on community satisfaction if led by a competent, visionary leader capable of effectively coordinating various stakeholders.

3.2. Discussion

The results of the first hypothesis test confirm that implementing the pentahelix model has a positive and significant effect on community satisfaction, consistent with the premise of collaborative governance that multi-stakeholder synergy is a key prerequisite for the effectiveness of post-disaster public services [29], [30]. In the context of Palu, these findings address the public's long-standing complaints regarding the slow distribution of aid and overlapping institutional responsibilities [4], [5], demonstrating that when the five elements of the pentahelix—government, academia, business, the community, and the media—collaborate in a structured manner, public perception of emergency response performance consistently improves. This collaboration is not merely procedural; rather, it

creates a deliberative space that enables more transparent and responsive resource allocation, thereby reducing the gap between citizens' expectations and the reality of service delivery on the ground [31].

The findings regarding the second hypothesis indicate that the Mayor of Palu's situational leadership style also has a strong and direct impact on community satisfaction, underscoring the crucial role of leadership figures in consolidating the crisis response [32]. In dynamic, uncertain disaster situations, leadership that shifts between a directive style during the emergency response phase and a participatory style during the rehabilitation phase has been shown to increase public trust in governance mechanisms [33]. These findings reinforce the argument that the capacity of frontline bureaucrats to engage in two-way communication, establish clear standards, and delegate authority appropriately is directly correlated with increased accountability and transparency in service delivery, which in turn are key determinants of citizen satisfaction [34].

More strategically, the third hypothesis confirms that leadership style acts as a moderator, strengthening the pentahelix model's influence on community satisfaction, indicating that the effectiveness of multi-stakeholder collaboration depends heavily on the quality of local leadership facilitation. This finding is consistent with [6], which emphasizes that cross-sectoral coordination in disaster management is effective only when led by actors capable of bridging conflicting interests, harmonizing procedures, and maintaining the momentum of collaboration. In practice in Palu, the absence of leadership capable of making quick and clear decisions following the 2018 earthquake led to a leadership vacuum and social disasters such as mass looting [7], [9]; Conversely, when local leaders actively coordinate the pentahelix elements through mechanisms of selling and delegating, collaborative synergy transforms from mere rhetoric into measurable policy interventions that have a direct impact on the psychosocial and economic recovery of the community.

The predictive power of the structural model confirms that the combination of the pentahelix model and leadership style can explain more than half of the variance in community satisfaction, which is classified as strong for both main predictor variables. This achievement exceeds the minimum threshold in public administration studies and indicates that this research model is not only theoretically relevant but also highly predictive in the context of local disaster governance. The results of this study indicate that the collaborative framework tested can represent empirical dynamics in the field without overfitting, enabling policy recommendations derived from it to be relied upon for the formulation of sustainable mitigation and rehabilitation strategies.

These empirical findings also provide a theoretical explanation for the paradox surrounding the implementation of Law No. 24 of 2007 at the local level, where regulatory efforts are often hampered by slow disbursement of funds and a lack of synchronization in vertical and horizontal coordination [5]. The research findings indicate that these bureaucratic obstacles can be minimized when local leaders activate the function of facilitative governance through the pentahelix approach, as suggested by [21] and [2] regarding the importance of decentralizing disaster response supported by a network of non-state actors. Thus, community satisfaction in Palu no longer depends solely on the speed of physical aid, but rather on residents' perceptions of procedural justice, involvement in

decision-making, and clarity regarding land ownership for reconstruction—dimensions directly influenced by the maturity of collaboration and the adaptability of the leadership applied.

Going beyond the conventional pentahelix framework, this study introduces a theoretical innovation in the form of an expansion toward a multihelix model that explicitly integrates vulnerable groups—particularly young children and people with disabilities—as equal collaborative partners. In the literature on inclusive disaster governance, the participation of marginalized groups is often reduced to the status of passive objects of protection, whereas their active involvement in emergency response planning enhances community resilience and the accuracy of aid distribution [16], [18], [20]. By incorporating the voices of children and people with disabilities into the pentahelix framework, the multihelix model not only enriches the dimension of public representation but also ensures that community satisfaction indicators include infrastructure accessibility, emergency school preparedness, and adaptive health services, thereby transforming disaster collaboration from a technocratic approach into a governance ecosystem that is truly humane and socially just.

Implicitly, these findings suggest a paradigm shift in disaster management in Palu City—from a reactive, instruction-based response toward collaborative governance led by adaptive and inclusive leadership. Local governments need to institutionalize multi-helix forums that routinely involve the penta-helix elements plus vulnerable groups in the disaster cycle planning process, while simultaneously strengthening the capacity of the Mayor and the BPBD leadership to apply a measured situational leadership style. For the public administration literature, this study enriches the discourse on collaborative governance by empirically demonstrating that local leadership is not merely a supporting variable but a catalyst that determines the magnitude of collaboration's impact on public legitimacy. Further research is recommended to test the generalizability of the multi-helix model in other disaster-prone regions and to integrate indicators of psychosocial resilience in children and people with disabilities as endogenous variables within a framework of sustainable disaster governance.

4. CONCLUSION

Based on the results of the SEM-PLS analysis and the discussion, this study concludes three main findings: (1) The Pentahelix model has a positive and significant effect on community satisfaction, confirming that structured synergy between the government, academia, business, the community, and the media is a strong predictor of the effectiveness of disaster management in Palu City; (2) The Mayor's situational leadership style also has a direct and significant effect, affirming that a leader's capacity to adapt the telling, selling, participating, and delegating styles according to stakeholder readiness is key to public legitimacy; and (3) Leadership style functions as a moderator that strengthens the Pentahelix's influence on community satisfaction, meaning that multi-stakeholder collaboration will yield optimal results only when facilitated by visionary, adaptive, and inclusive leadership.

Theoretically, this study enriches the literature on collaborative governance by empirically demonstrating that local leadership is not merely a supporting variable, but rather

a catalyst that determines the magnitude of collaboration's impact on community satisfaction. Practically, these findings provide a foundation for formulating disaster management policies that are not only technically oriented but also build public trust through transparent, participatory, and responsive governance.

REFERENCES

[1] F. Sun, H. Li, J. Cai, S. Hu, and H. Xing, "Examining organizational collaboration and resource flows of disaster response system based on a time-dynamic perspective," *Int. J. Disaster Risk Reduct.*, vol. 108, p. 104565, Jun. 2024, doi: 10.1016/j.ijdrr.2024.104565.

[2] Y. Bae, Y.-M. Joo, and S.-Y. Won, "Decentralization and collaborative disaster governance: Evidence from South Korea," *Habitat Int.*, vol. 52, pp. 50–56, Mar. 2016, doi: 10.1016/j.habitatint.2015.08.027.

[3] R. S. Astuti, H. Warsono, and A. Rachim, *Collaborative Governance dalam Perspektif Administrasi Publik*. Semarang: Universitas Diponegoro Press, 2020. [Online]. Available: https://doc-pak.undip.ac.id/id/eprint/1143/1/collaborative%20gov%20%20(revisi)_5%207%2020-converted-.pdf

[4] K. Cahyadi, S. Rahmadani, and A. D. Senoaji, "Komunikasi dalam Mitigasi Bencana Gempa dan Tsunami Palu," *Triwikrama J. Ilmu Sos.*, vol. 5, no. 2, pp. 1–13, 2024.

[5] unairnews, "Penderitaan Pasca Bencana Palu: Kegagalan Negara Menerapkan Standar Hak Asasi Manusia dalam Penanggulangan Bencana," Universitas Airlangga Official Website. Accessed: May 06, 2025. [Online]. Available: https://unair.ac.id/penderitaan-pasca-bencana-palu-kegagalan-negara-menerapkan-standar-hak-asasi-manusia-dalam-penanggulangan-bencana/

[6] A. M. Guerrero, Ö. Bodin, D. Nohrstedt, R. Plummer, J. Baird, and R. Summers, "Collaboration and individual performance during disaster response," *Glob. Environ. Change*, vol. 82, p. 102729, Sep. 2023, doi: 10.1016/j.gloenvcha.2023.102729.

[7] CNN Indonesia, "JK Kritik Manajemen Krisis Pemda Tangani Gempa Palu," nasional. Accessed: Feb. 24, 2025. [Online]. Available: https://cnnindonesia.com/nasional/20181008142133-20-336612/jk-kritik-manajemen-krisis-pemda-tangani-gempa-palu

[8] T. F. Buss, R. S. Morse, and National Academy of Public Administration, Eds., *Innovations in public leadership development*. in Transformation trends in governance and democracy. London New York: Routledge, 2015. doi: 10.4324/9781315703435.

[9] Milawaty, "Isu Sosial Pascabencana Alam: Studi Kasus Penjarahan di Kota Palu melalui Pendekatan Pinheiro Principles dan Psikologi Sosial," *J. Adm. Publik*, vol. 16, no. 2, Art. no. 2, Dec. 2020, doi: 10.52316/jap.v16i2.48.

[10] Biro Komunikasi Publik Kementerian Pekerjaan Umum, "Hunian Tetap (HUNTAP) Bagi Korban Bencana Palu Akan Selesai pada Desember 2020," Kementerian PUPR. Accessed: May 07, 2025. [Online]. Available: https://pu.go.id/berita/hunian-tetap-huntap-bagi-korban-bencana-palu-akan-selesai-pada-desember-2020

[11] Indonesia Corruption Watch, "Habis Bencana, Krisis Air Bersih: Mendesak Penyediaan Air Bersih Bagi Warga Huntap Balaroa | ICW." Accessed: May 07, 2025. [Online]. Available: https://antikorupsi.org/id/habis-bencana-krisis-air-bersih-mendesak-penyediaan-air-bersih-bagi-warga-huntap-balaroa

[12] V. Jemali, "Status Lahan Sempat Bermasalah, Hunian Tetap di Palu Dibangun pada November," kompas.id. Accessed: May 07, 2025. [Online]. Available: https://www.kompas.id/baca/nusantara/2022/09/26/lahan-sempat-bermasalah-hunian-tetap-di-palu-dibangun-pada-november

[13] Satgas PUPR, "Masalah Tanah Pembangunan Huntap di Palu Belum Selesai," Monitoring Penyediaan Hunian Tetap di Sulawesi Tengah. Accessed: May 07, 2025. [Online]. Available: https://www.monitoring.skp-ham.org/masalah-tanah-pembangunan-huntap-di-palu-belum-selesai/

[14] B. Arvidsson, J. Johansson, and N. Guldåker, "Critical infrastructure, geographical information science and risk governance: A systematic cross-field review," *Reliab. Eng. Syst. Saf.*, vol. 213, p. 107741, Sep. 2021, doi: 10.1016/j.ress.2021.107741.

[15] M. Rothery, "Critical Infrastructure Protection and the Role of Emergency Services," . *May*, vol. 20, no. 2, 2005.

[16] A. Cho, "Post-tsunami recovery and reconstruction: governance issues and implications of the Great East Japan Earthquake," *Disasters*, vol. 38, no. s2, pp. s157–s178, 2014, doi: 10.1111/disa.12068.

[17] I. Davis, *Disaster Risk Management in Asia and the Pacific*. Routledge, 2014.

[18] Y. Jabareen, "Planning the resilient city: Concepts and strategies for coping with climate change and environmental risk," *Cities*, vol. 31, pp. 220–229, Apr. 2013, doi: 10.1016/j.cities.2012.05.004.

[19] S. Jones, K. Aryal, and A. Collins, "Local-level governance of risk and resilience in Nepal," *Disasters*, vol. 37, no. 3, pp. 442–467, 2013, doi: 10.1111/disa.12006.
[20] L. Pearce, "Disaster Management and Community Planning, and Public Participation: How to Achieve Sustainable Hazard Mitigation," *Nat. Hazards*, vol. 28, no. 2, pp. 211–228, Mar. 2003, doi: 10.1023/A:1022917721797.
[21] K. Tierney, "Disaster Governance: Social, Political, and Economic Dimensions," *Annu. Rev. Environ. Resour.*, vol. 37, no. 1, pp. 341–363, Oct. 2012, doi: 10.1146/annurev-environ-020911-095618.
[22] J. O'Flynn and J. Wanna, Eds., *Collaborative governance: a new era of public policy in Australia?* in ANZSOG monography series. Acton, A.C.T: ANU E Press, 2008.
[23] H. Sullivan, P. Williams, and S. Jeffares, "Leadership for Collaboration: Situated agency in practice," *Public Manag. Rev.*, vol. 14, no. 1, pp. 41–66, Jan. 2012, doi: 10.1080/14719037.2011.589617.
[24] A. T. Ferdinan, *Structural Equation Modeling dalam Penelitian Magister dan DIsertasi Doktor*. Semarang: Fakultas Ekonomi dan Bisnis Universitas Diponegoro, 2002.
[25] J. F. Hair, G. T. M. Hult, C. M. Ringle, and M. Sarstedt, Eds., *A primer on partial least squares structural equation modeling (PLS-SEM)*. Los Angeles, Calif.: Sage, 2014.
[26] Nazir, *Metode Penelitian*. Bogor: Ghalia Indonesia, 2011.
[27] J. F. Hair, G. T. M. Hult, C. M. Ringle, and M. Sarstedt, *A primer on partial least squares structural equation modeling (PLS-SEM)*, Third edition. Thousand Oaks: SAGE Publications, Incorporated, 2022.
[28] J. C. Nunnally, "Psychometric Theory— 25 Years Ago and Now," *Educ. Res.*, vol. 4, no. 10, pp. 7–21, Nov. 1975, doi: 10.3102/0013189X004010007.
[29] C. Ansell and A. Gash, "Collaborative governance in theory and practice," *J. Public Adm. Res. Theory*, vol. 18, no. 4, pp. 543–571, 2008.
[30] K. Emerson, T. Nabatchi, and S. Balogh, "An Integrative Framework for Collaborative Governance," *J. Public Adm. Res. Theory*, vol. 22, no. 1, pp. 1–29, Jan. 2012, doi: 10.1093/jopart/mur011.
[31] A. Subagyo, "The implementation of the pentahelix model for the terrorism deradicalization program in Indonesia," *Cogent Soc. Sci.*, vol. 7, no. 1, p. 1964720, Jan. 2021, doi: 10.1080/23311886.2021.1964720.
[32] P. Hersey, K. H. Blanchard, and W. E. Natemeyer, "Situational Leadership, Perception, and the Impact of Power," *Group Organ. Stud.*, vol. 4, no. 4, pp. 418–428, Dec. 1979, doi: 10.1177/105960117900400404.
[33] M. Grossman, "The demand for health turns 50: Reflections," *Health Econ.*, vol. 31, no. 9, pp. 1807–1822, 2022, doi: 10.1002/hec.4563.
[34] S. S. Mishra, "Do Street-Level Bureaucrats Exhibit Transformational Leadership for Influencing Sound Governance and Citizens' Satisfaction?," *Int. J. Public Adm.*, vol. 44, no. 15, pp. 1366–1377, Nov. 2021, doi: 10.1080/01900692.2020.1765798.