Quality of Life Analysis with WHOQOL-BREF in Disaster Preparedness for Flood-Prone Areas in Makassar City, Indonesia

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ABSTRACT

Floods are recurring disasters in urban areas, particularly in flood-prone regions, such as Makassar City, Indonesia. The preparation of residents for such events is crucial for reducing risks and enhancing resilience. This study aims to analyze the relationship between Quality of Life (QoL), as measured by the World Health Organization Quality of Life-BREF (WHOQOL-BREF), and disaster preparedness in flood-prone areas of Makassar City. A combination of conventional statistical methods and Structural Equation Modeling- Partial Least Squares (SEM-PLS) was used to analyze the data collected from 409 respondents across four sub-districts: Biringkanaya, Tamalanrea, Panakkukang, and Manggala. The findings indicate that a higher QoL correlates with improved disaster preparedness, suggesting that efforts to enhance residents' well-being can positively influence their readiness for floods. Based on these results, this study proposes integrating QoL factors into disaster preparedness programs to increase community resilience.

Keywords-Quality of Life; WHOQOL-BREF; disaster preparedness; flood-prone areas; SEM-PLS; Makassar City

I. INTRODUCTION

Floods have become a significant concern in urban areas worldwide because of their frequency and destructive potential [1]. The former are an immediate threat to life and property but can also have long-term socio-economic and environmental consequences. The frequency of floods in Southeast Asia, including Indonesia, highlights the urgent need for effective disaster management and preparation [2]. In Indonesia cities located in coastal areas, such as Makassar, are at high risk of flooding and addressing these concerns through sustainable solutions is challenging. The ability of a population to prepare and respond to floods is a critical factor in minimizing the impact of these events and this capacity often depends on the residents' QoL [3].

QoL is a multidimensional concept that includes various aspects of an individual's well-being, such as physical health, psychological state, social relationships, and environmental conditions. The WHOQOL-BREF is a standardized tool

developed by the World Health Organization (WHO) and is widely used to evaluate QoL across different populations and settings [4]. In disaster-prone areas, QoL can significantly impact the readiness and resilience of communities when facing disasters, as individuals with better QoL may be better equipped to respond effectively [5, 6].

Previous studies have shown that QoL and disaster preparedness are interrelated in areas vulnerable to natural disasters. For example, studies regarding Japan and Philippines have demonstrated that individuals with higher perceived QoL tend to have a stronger sense of responsibility toward disaster preparedness and are more likely to take proactive measures [7, 8]. Furthermore, the social, economic, and environmental factors that influence QoL often intersect with flood-risk management strategies. In this context, local authorities and policymakers have recognized the importance of fostering a sense of well-being to enhance disaster preparedness in the community. However, a gap remains on the understanding of how specific aspects of QoL relate to disaster preparedness behaviors in Indonesian urban settings [9].

Makassar, located in the South Sulawesi province, faces significant flood risks owing to its geographical location and climatic conditions. The vulnerability of Makassar to flooding has increased owing to rapid urbanization, inadequate drainage systems, and climate change. Despite the growing recognition of flood risk, disaster preparedness in the city remains insufficient, and many residents remain unprepared for flood events. Previous studies in Makassar and Indonesia have primarily focused on physical preparedness measures, such as infrastructure development and early warning systems. However, little attention has been paid to the social and psychological factors that influence individuals' preparedness.

This study aims to fill this research gap by analyzing the relationship between QoL, as measured by the WHOQOL-BREF, and disaster preparedness in flood-prone areas of Makassar. Specifically, it explores how different dimensions of QoL—physical health, psychological well-being, social relationships, and environmental conditions—affect residents' disaster preparedness. To this end, the current work investigated the impact of QoL on disaster preparedness in four sub-districts in Makassar City: Biringkanaya, Tamalanrea, Panakkukang, and Manggala, by examining a sample of 409 respondents. By employing both conventional statistical methods and SEM-PLS, this research contributes to a deeper understanding of how subjective well-being influences disaster preparedness, offering valuable insights for policymakers and practitioners involved in flood risk management.

II. MATERIALS AND METHODS

A. Conceptual Framework

The extreme climate change has contributed to a rising trend of natural disasters, the frequency and intensity of which are likely to increase in the future. The risk of flooding and climate variability is expected to increase, which, in turn, will increase the vulnerability of developing countries [10].

Except for WHOQOL, few QoL measurement tools have been developed to meet the specific needs of Indonesia. Therefore, there is a need for a QoL measurement tool that aligns with the Indonesian values and culture. The creation of such a tool can assist researchers in more accurately assessing QoL in Indonesia, which can, in turn, inform policy decisions aimed at improving the welfare of the Indonesian population. Consequently, a preliminary study was conducted to develop a QoL measurement tool for Indonesia. Figure 1 illustrates the conceptual framework of this study.

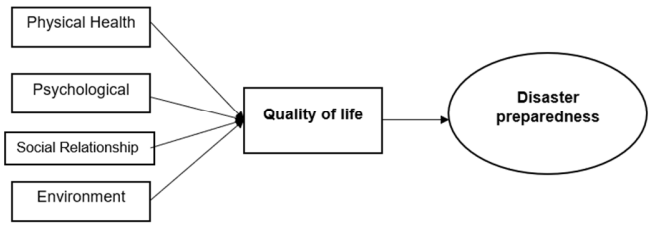

Fig. 1. Conceptual framework.

B. World Health Organization Quality of Life-BREF and Structural Equation Modeling- Partial Least Squares

The WHOQOL-BREF is a widely recognized tool designed to measure overall QoL in diverse populations. It was developed by the WHO as a shorter version of the original WHOQOL-100 to provide a practical and reliable tool for assessing health and well-being across different cultural contexts. WHOQOL-BREF consists of 26 items that assess four broad domains: physical health, psychological health, social relationships, and environmental factors. These domains are intended to capture the multidimensional nature of QoL, encompassing not only physical health and functioning, but also emotional well-being, social support, and the surrounding environment, all of which can significantly influence an individual's overall life satisfaction.

WHOQOL-BREF is based on a comprehensive biopsychosocial model that recognizes the complex interactions between physical health, psychological state, and social circumstances. It has been validated in various languages and cultures, making it adaptable to diverse populations globally. The instrument's design emphasizes the subjective experience of individuals, allowing for a holistic view of their well-being. By addressing both tangible aspects, such as health and living conditions, and more intangible elements, such as emotional health and social connections, the WHOQOL-BREF provides valuable insights into how individuals perceive their overall QoL. This makes it a crucial tool in research, healthcare, and public policy, especially in studies examining the impact of health, environmental factors, or disasters on individuals' well-being [11].

SEM is a statistical technique used to analyze complex relationships between variables, with PLS being a variation that is especially useful for exploring predictive relationships in models with complex structures and small sample sizes. SEM-PLS is widely applied in fields, such as the social sciences and marketing, to evaluate how different factors (both observed and latent) influence each other, even with non-normally distributed data or limited samples. It focuses on maximizing the variance in the dependent variables, making it ideal for exploratory

studies. SEM-PLS can handle both reflective and formative measurement models, making it a flexible tool for understanding and predicting the relationships between variables, such as those involved in QoL and disaster preparedness.

C. Study Area

Every rainy season, Makassar faces persistent flooding issues. Due to the flat topography and poor drainage system of Makassar, heavy rainfall lasting more than five hours often causes flooding on several roads and residential areas. This situation significantly disrupts the development of Makassar, as it leads to material losses, creates discomfort, and interrupts daily activities. Although flooding in Makassar does not result in fatalities, there is a clear need for mitigation measures to reduce its impact. Four sub-districts, Tamalanrea, Biringkanaya, Manggala, and Panakkukang, are particularly vulnerable to flooding, and are thus the focus of monitoring efforts.

Disaster risk mapping provides essential information about high-risk areas based on three characteristics: hazard, vulnerability, and capacity. Information on these three aspects in each region is crucial for assessing the level of disaster risk. Therefore, actions must be taken to reduce risks according to the specific challenges faced. Current disaster mitigation efforts in Makassar have not been sufficiently responsive to flood risks, as considerable losses continue to occur during these events. Therefore, it is necessary to implement policies that can help reduce potential losses when disasters occur. The flood-prone areas in Makassar City were derived from [12].

III. RESULTS AND DISCUSSION

A. Respondent Characteristics

Table I presents the respondents' characteristics. The total population of the four subdistricts in the study area was 626, 752. To determine a representative sample size, two methods can be used: the Slovin and Lameshow formulas. Based on these methods, the proposed sample size for this study ranged from 384 to 400 respondents. Selecting a sample size within this range ensured a high level of confidence in the study results regarding QoL and disaster preparedness in flood-prone areas of Makassar.

The demographic characteristics of the respondents in the present study revealed key insights into the population living in flood-prone areas. The majority of the respondents were female (62.3%), since women tend to have a higher perception of risk and are more likely to take preventive measures in disaster-prone areas than men [13]. Additionally, the predominance of respondents in the productive age range (31-50 years) aligns with previous findings suggesting that individuals in this age group are more engaged in economic and social activities, which influences their level of preparedness and resilience in facing disasters [14].

The education level of the respondents also plays a crucial role in disaster preparedness. Most respondents have a high school education (55.0%), followed by those with a diploma or bachelor's degree (29.1%). Studies have shown that education significantly affects an individual's ability to understand disaster risks and to adopt preparedness measures. Higher levels of education are associated with better access to information, greater awareness of environmental hazards, and improved decision making in emergency situations [15]. However, the presence of respondents with lower education levels (elementary and junior high school) suggests that information dissemination regarding disaster preparedness must be tailored to different educational backgrounds to ensure effective communication and understanding.

TABLE I. RESPONDENT CHARACTERISTICS

Respondent characteristics	n	%
Gender		
Women	255	62.3
Men	154	37.7
Age		
≤ 20 Years	59	14.4
21-30 Years	80	19.6
31-40 Years	122	29.8
41-50 Years	119	29.1
> 50 Years	29	7.1
Last education		
Elementary school	30	7.3
Junior high school	27	6.6
Senior high school	225	55.0
Diploma/Bachelor	119	29.1
Other		
Duration of stay in flood prone areas		
< 1 Years	4	1.0
1-5 Years	349	85.3
> 5 Years	56	13.7
Have you ever been affected by floods before?		
No	1	0.2
Yes	408	99.8
Total	409	100

Furthermore, the respondents' long-term exposure to flood-prone environments enhances their ability to provide valuable insights into disaster preparedness. Of the respondents, 85.3% had lived in the area for 1-5 years and 13.7% for more than 5 years, and their experiences align with studies indicating that prolonged residence in disaster-prone areas can increase adaptive capacity and risk awareness [16]. The fact that nearly all respondents (99.8%) had previously experienced flooding further supports the findings of past research, according to which direct disaster experience influences individuals' preparedness behaviors [17]. This suggests that past exposure to floods may shape attitudes and actions related to disaster mitigation, making these respondents highly relevant for understanding preparedness strategies in flood-prone areas.

B. Distribution of Respondents' Answers to Research Variables

The distribution of the respondents' answers to the research variables provided valuable insights into their perceptions, experiences, and behaviors related to QoL and disaster preparedness in flood-prone areas. Analyzing these responses helps to identify trends, patterns, and potential areas for improvement in disaster mitigation efforts. Table II presents the distribution of responses across key research variables, offering a deeper understanding of the factors influencing

community resilience and preparedness in the QoL variable domain.

Based on the survey results across various QoL domains, the majority of respondents provided positive assessments of their physical, psychological, social, and environmental well-being. In the physical domain, most respondents rated their physical condition over the past three months as good (76.0%) and very good (16.4%), while only 7.6% rated it as fair. Respondents also reported having sufficient energy for daily activities, with 76.3% rating it as good and 19.3% as very good. Regarding mobility and the ability to perform daily tasks, 73.8% expressed satisfaction (good), while 18.8% were highly satisfied (very good). Additionally, 76.5% of the respondents rarely experienced pain or discomfort, whereas 15.2% reported not experiencing any discomfort (very good).

In the psychological domain, most respondents were satisfied with themselves, with 72.9% rating their self-perception as good and 22.2% as very good. Their overall psychological state was also generally positive, with 74.6% feeling calm and at peace (good) and 21.0% feeling very good. However, regarding anxiety about flood risks, 74.1% of the respondents experienced anxiety at a manageable level (good), whereas 20.8% reported feeling very good. In terms of emotional support from their surroundings, most respondents (76.3%) felt that they received adequate support (good), whereas 18.3% felt highly supported (very good).

In the social domain, the majority of respondents were satisfied with their social relationships, including those with family, friends, and neighbors, with 75.8% rating them as good and 21.5% as very good. The level of acceptance within the community was also relatively high, with 75.8% of the respondents feeling well accepted and 21.5% feeling highly accepted. Most respondents (79.2%) rated social support during flood disasters as good, and 17.1% expressed a high level of satisfaction.

In the environmental domain, regarding living conditions, the majority of respondents rated facilities, such as clean water, electricity, and sanitation as good (78.2%) and very good (16.4%). The sense of security while living in flood-prone areas was also relatively high, with 76.5% and 20.8% rating it as good and very good, respectively. Access to healthcare services was considered good by 78.0% of the respondents and very good by 18.3%. Meanwhile, air quality and the surrounding environment also received positive assessments, with 78.0% of the respondents rating them as good and 19.1% as very good.

Overall, these results indicate that most respondents had a positive perception of their physical, psychological, social, and environmental conditions. Most respondents feel healthy, receive good social support, and live in a relatively safe environment with adequate access to services. However, concerns about flood risks remained, although for most respondents, these concerns were still manageable. In conclusion, most respondents had a positive view of their health, social support, and living environment. However, concerns regarding flood risks remain, although they are manageable.

TABLE II. DISTRIBUTION OF RESPONDENTS' ANSWERS IN THE DOMAIN OF QOL VARIABLES

QoL variable statement	Very good (%)	Good (%)	Enough (%)	Bad (%)	Very bad (%)
Physical domain					
How has your physical health been in the last three months?	67 (16.4)	311 (76.0)	31 (7.6)	0 (0.0)	0 (0.0)
Do you feel energetic enough to carry out your daily activities?	79 (19.3)	312 (76.3)	18 (4.4)	0 (0.0)	0 (0.0)
How satisfied are you with your ability to move or be active?	77 (18.8)	302 (73.8)	30 (7.3)	0 (0.0)	0 (0.0)
How often do you feel bothered by pain or discomfort?	62 (15.2)	313 (76.5)	34 (8.3)	0 (0.0)	0 (0.0)
Psychology domain					
How satisfied are you with yourself?	91 (22.2)	298 (72.9)	20 (4.9)	0 (0.0)	0 (0.0)
Do you feel psychologically calm and peaceful?	86 (21.0)	305 (74.6)	18 (4.4)	0 (0.0)	0 (0.0)
How often do you feel anxious about the risk of flooding in your area?	85 (20.8)	303 (74.1)	21 (5.1)	0 (0.0)	0 (0.0)
Do you have emotional support from the people around you?	75 (18.3)	312 (76.3)	22 (5.4)	0 (0.0)	0 (0.0)
Social domain					
How satisfied are you with your social relationships (family, friends, neighbors)?	88 (21.5)	310 (75.8)	10 (2.4)	0 (0.0)	1 (0.2)
Do you feel accepted in the community where you live?	88 (21.5)	310 (75.8)	10 (2.4)	0 (0.0)	1 (0.2)
How satisfied are you with social support when facing a flood disaster?	70 (17.1)	324 (79.2)	15 (3.7)	0 (0.0)	0 (0.0)
Environmental domain					
What are the conditions of your residence (clean water, electricity, sanitation)?	67 (16.4)	320 (78.2)	22 (5.4)	0 (0.0)	0 (0.0)
How safe do you feel living in this area?	85 (20.8)	313 (76.5)	10 (2.4)	1 (0.2)	0 (0.0)
How satisfied are you with access to health services in your area?	75 (18.3)	319 (78.0)	15 (3.7)	0 (0.0)	0 (0.0)
How do you rate the quality of air and the surrounding environment?	78 (19.1)	319 (78.0)	12 (2.9)	0 (0.0)	0 (0.0)

C. Distribution of Respondents' Answers on Disaster Preparedness Variables

The distribution of respondents' answers on the disaster preparedness variables provides valuable insights into their level of awareness, readiness, and perception of flood risks. Analyzing these responses helps to identify the strengths and weaknesses of community preparedness strategies. Table III presents the distribution of responses across key disaster preparedness factors, offering a deeper understanding of the factors influencing resilience in flood-prone areas.

Based on the survey results regarding disaster preparedness, the majority of respondents demonstrated a high level of readiness to face flood risks, covering aspects, such as knowledge and understanding, preparedness planning, preparedness behavior, and external support. In the domain of knowledge and understanding, most respondents had a good understanding of the flood risks in their area, with 78.7% agreeing and 16.4% strongly agreeing. Additionally, 76.3% of the respondents agreed that they knew the evacuation routes, while 18.8% strongly agreed. Regarding flood management training, most respondents (78.5%) reported having attended training and 18.1% strongly agreed with this statement.

TABLE III. DISTRIBUTION OF RESPONDENTS' ANSWERS ON DISASTER PREPAREDNESS VARIABLES

Disaster preparedness variable statement	Strongly agree (%)	Agree (%)	Neutral (%)	Don't agree (%)	Strongly disagree (%)
Knowledge and understanding					
I understand the flood risks in the area where I live.	67 (16.4)	322 (78.7)	20 (4.9)	0 (0.0)	0 (0.0)
I know the evacuation routes or safe places when a flood occurs.	77 (18.8)	312 (76.3)	20 (4.9)	0 (0.0)	0 (0.0)
I have received training related to flood disaster management.	74 (18.1)	321 (78.5)	14 (3.4)	0 (0.0)	0 (0.0)
Preparedness planning					
I have an emergency evacuation plan ready to use in the event of a flood.	75 (18.3)	323 (79.0)	11 (2.7)	0 (0.0)	0 (0.0)
I prepare emergency items, such as food, water, and medicine.	73 (17.8)	319 (78.0)	17 (4.2)	0 (0.0)	0 (0.0)
I have emergency contact information, such as BPBD numbers or local authorities.	73 (17.8)	323 (79.0)	12 (2.9)	1 (0.2)	0 (0.0)
Preparedness behavior					
I follow the latest information regarding the weather or potential flooding.	69 (16.9)	325 (79.5)	15 (3.7)	0 (0.0)	0 (0.0)
I am involved in community activities for disaster preparedness.	77 (18.8)	320 (78.2)	11 (2.7)	0 (0.0)	1 (0.2)
I am willing to participate in disaster training or simulations if held.	84 (20.5)	317 (77.5)	8 (2.0)	0 (0.0)	0 (0.0)
External support					
I feel that the local government provides adequate preparedness facilities.	79 (19.3)	318 (77.8)	12 (2.9)	0 (0.0)	0 (0.0)
I received sufficient assistance (information, goods) during the previous flood.	89 (21.8)	305 (74.6)	15 (3.7)	0 (0.0)	0 (0.0)
I feel that my community is united in facing the flood risk.	86 (21.0)	315 (77.0)	8 (2.0)	0 (0.0)	0 (0.0)

In the domain of preparedness planning regarding evacuation plans, most respondents (79.0%) stated that they had an emergency plan ready to use, whereas 18.3% were very confident about their readiness. Additionally, 78.0% of respondents had prepared emergency items, such as food, water, and medications, and 17.8% expressed that they were very well prepared. Furthermore, most respondents (79.0%) had emergency contact information available for use during a flood, and 17.8% were very confident about the accuracy of the information they had.

In terms of preparedness behavior, most respondents actively followed weather and flood risk information, with 79.5% agreeing and 16.9% strongly agreeing. Additionally, 78.2% of the respondents actively participated in community activities related to disaster preparedness, with 18.8% strongly agreeing with their involvement. Regarding readiness to attend disaster training or simulations, the participation rate was very high, with 77.5% of the respondents agreeing and 20.5% strongly agreeing.

In terms of external support, most respondents felt that the local government provided adequate preparedness facilities, with 77.8% agreeing and 19.3% strongly agreeing. Additionally, most respondents (74.6%) reported having received sufficient assistance, both in the form of information and supplies, during previous floods, and 21.8% expressed high satisfaction with the aid they received. Regarding community support, most respondents (77.0%) felt that their community was united in facing flood risks, with 21.0% strongly agreeing.

Overall, the results indicate that the community's level of preparedness for flooding is relatively high. The majority of respondents had a good understanding of flood risks, they had prepared evacuation plans and emergency supplies, and were actively engaged in following information and participating in preparedness activities. Additionally, support from the government and community was also rated positively, demonstrating that flood preparedness has become a serious concern in the respondents' living environment.

D. Measurement Model Test Results (Outer Model)

Before a model is used, it is important to assess the validity and reliability of an item from the research variable construct. Therefore, the validity and reliability of a model can be evaluated based on the results of the outer model measurement of the research construct. Figure 2 portrays the outer model of the item construct for the research variables.

Figure 2 shows that all indicators of each variable have an outer loading greater than 0.70 and are significant, meaning that all indicators are strongly and reliably correlated in measuring their respective variables/constructs. Therefore, it can be concluded that the outer loading in this study meets the rule of thumb outlined in [18], where the outer loading must exceed 0.70 and be significant, as significant outer loadings may be still weak.

Next, to assess the reliability of the construct indicators, this study examined the internal consistency reliability, as presented in Table IV. Internal consistency reliability was used to determine whether the indicators/items measuring a variable/construct had similar/strong scores. Authors in [18] included three measures to assess internal consistency

reliability: Cronbach's alpha, composite reliability (Rho C), and reliability coefficient (Rhoa A). Meanwhile, convergent validity is a measurement that shows how well the indicators are correlated with each other within the same construct and is typically measured using the Average Variance Extracted (AVE) calculation at the construct level to determine how much a variable/construct explains the variance of its indicators/measurement tools.

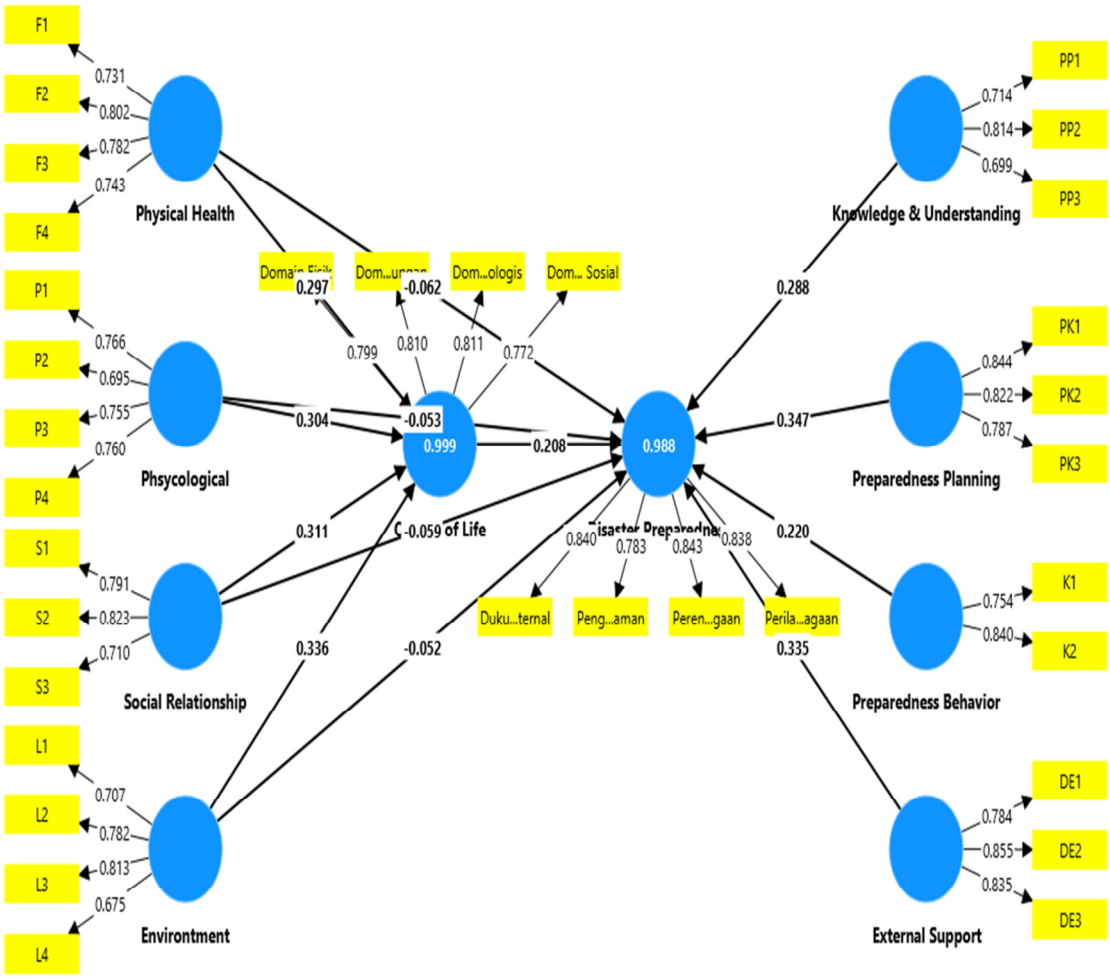

Fig. 2. Regression analysis model using Smart-PLS (outer loading).

TABLE IV. INTERNAL CONSISTENCY RELIABILITY AND CONVERGENT VALIDITY

	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	AVE
Physical domain	0.764	0.769	0.849	0.585
Environmental domain	0.733	0.743	0.833	0.557
Psychology domain	0.732	0.735	0.833	0.555
Social domain	0.667	0.672	0.819	0.602
External support	0.765	0.770	0.865	0.681
Disaster preparedness	0.845	0.846	0.896	0.683
QoL	0.810	0.811	0.875	0.637
Knowledge and understanding	0.593	0.596	0.787	0.553
Preparedness planning	0.752	0.754	0.858	0.669
Preparedness behavior	0.434	0.443	0.778	0.637

Table IV shows that all variables/constructs have a composite reliability (Rho C) value greater than 0.70 and are statistically significant, indicating that all indicators/measurement tools exhibit high internal consistency reliability in measuring their respective variables/constructs. In conclusion, the composite reliability (Rho C) in this study aligns with the guidelines provided in [18]. According to these guidelines, the values of Cronbach's alpha, composite reliability (Rho C), and reliability coefficient (Rhoa A) should surpass 0.70, with an ideal range of 0.70 to 0.90.

The results of the AVE calculation in this study indicate that all variables/constructs have an AVE value greater than

0.50, meaning that all variables/constructs are strongly correlated and possess convergent validity in explaining the variance of their respective indicators/measurement tools. Thus, it can be inferred that the AVE in this study adheres to the guidelines established in [18], which specify that the AVE should exceed 0.50.

E. Hypothesis Testing

Hypothesis testing in this study was conducted using the bootstrapping method in Smart-PLS to assess the significance of the relationships between the variables. The results were evaluated based on the t-values and p-values, where a t-value greater than 1.96 and a p-value less than 0.05 indicate a significant relationship. This analysis helps determine whether the proposed hypotheses are supported, providing insights into the impact of the independent variables on the dependent variable.

To determine the effect of the independent variables on the dependent variable, the data were analyzed using regression testing with the Smart-PLS software. One advantage of using Smart-PLS is that it does not require normally distributed data. Smart-PLS employs the bootstrapping technique to estimate significance and confidence intervals, eliminating the need for normality assumptions of the residuals. The regression model used in this analysis is illustrated in Figure 3.

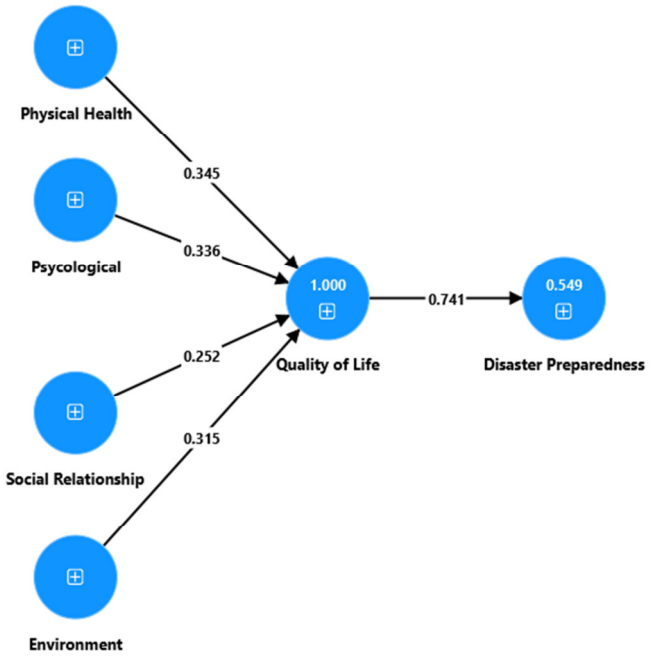

Fig. 3. Regression analysis model using Smart-PLS.

1) Collinearity Test on Structural Models

Collinearity testing of the structural model at the construct level was conducted to ensure that there were no collinearity issues among the constructs forming the path model. Collinearity assessment was performed by calculating the inner Variance Inflation Factor (VIF). The results of the VIF evaluation for the research variables are presented in Table V which shows that the inner VIF values for all variables/constructs are below five and below three. Therefore, it can be concluded that none of the variables/constructs in this study have collinearity issues among their predictor constructs and comply with the recommendations of [18] for an inner VIF value below five, preferably below three, to ensure that collinearity does not have a substantial effect on the structural model estimation.

TABLE V. INNER VIF

	VIF
Physical domain	1.000
Environmental domain	1.000
Psychological domain	1.000
Social domain	1.000
Disaster preparedness	1.000
QoL	1.000

2) Coefficient of Determination (R^2)

The coefficient of determination (R^2) indicates the extent to which the variation in the endogenous variable can be explained by the exogenous and/or endogenous variables in the model, as demonstrated in Table VI which presents the results of the coefficient of determination (R^2) test, showing that the physical, psychological, social, and environmental domains collectively influenced QoL by 1.000 or 100%. Meanwhile, the disaster preparedness variable was influenced by QoL and its domains by 0.549 or 54.9%, with the remaining 45.1% being influenced by other variables outside the scope of this study.

TABLE VI. R-SQUARE AND R-SQUARE ADJUSTED

	R-square	**R-square adjusted**
Disaster preparedness	0.549	0.548
QoL	1.000	1.000

3) Path Coefficients

The following are the results of the hypothesis testing to support the discussion of each variable in this study, specifically the influence of QoL and its domains on disaster preparedness. The results of the analysis model are outlined in Figure 4 and Table VII.

TABLE VII. PATH COEFFICIENTS

	Original sample	**Sample mean**	**Standard deviation**	**T statistics**	**P values**
Physical domain -> QoL	0.345	0.346	0.013	27.110	0.000
Environmental domain -> QoL	0.315	0.315	0.012	26.466	0.000
Psychological domain -> QoL	0.336	0.336	0.012	29.003	0.000
Social domain -> QoL	0.252	0.253	0.010	25.357	0.000
QoL -> disaster preparedness	0.741	0.740	0.034	21.897	0.000

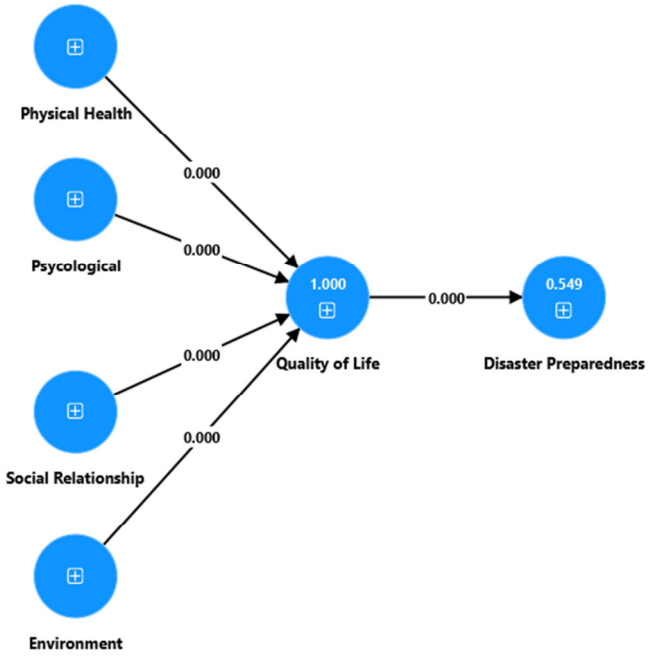

Fig. 4. Hypothesis testing model using Smart-PLS.

The PLS-SEM analysis results indicated that all tested domains significantly influenced QoL, and QoL significantly impacted disaster preparedness. This is demonstrated by the T-statistic values (original sample/standard deviation|), all of which are well above the significance threshold (1.96), and the P-value of 0.000 (<0.05), indicating that the relationships between the variables are statistically significant.

Specifically, the physical domain had a positive influence on QoL, with a coefficient of 0.345, indicating that better physical conditions led to a higher QoL, with the physical domain contributing 34.5% to QoL. The environmental domain also significantly affected QoL, with a coefficient of 0.315, indicating that better environmental aspects contributed to improved QoL, with an impact of 31.5%. Furthermore, the psychological domain influenced QoL with a coefficient of 0.336, demonstrating that good psychological factors enhanced QoL, contributing to 33.6%. Additionally, the social domain contributes to QoL with a coefficient of 0.252, meaning that a strong social domain can improve QoL, although its impact (25.2%) is smaller compared to other domains.

Additionally, QoL has been proven to have a strong influence on disaster preparedness, with a coefficient value of 0.741, making it the most dominant relationship in this model. This exhibits that the higher a person's QoL is, the better is their preparedness for disasters, with a 74.1% impact.

4) Indirect Influence of Quality of Life Domains on Disaster Preparedness

To determine the indirect influence of the QoL domains on disaster preparedness, with QoL utilized as a mediating variable, the total indirect effects are shown in Table VIII.

TABLE VIII. TOTAL INDIRECT EFFECT RESULTS

	Original sample	**Sample mean**	**Standard deviation**	**T statistics**	**P values**
Physical domain -> disaster preparedness	0.256	0.256	0.012	21.327	0.000
Environmental domain -> disaster preparedness	0.233	0.233	0.013	17.263	0.000
Psychological domain -> disaster preparedness	0.249	0.248	0.013	19.723	0.000
Social domain -> disaster preparedness	0.187	0.187	0.010	18.377	0.000

According to Table VIII, all domains: physical, environmental, psychological, and social have a significant indirect influence on disaster preparedness through QoL as a mediating variable. This is evidenced by the T-statistic values, all of which are well above the significance threshold (>1.96) and the p-value of 0.000 (<0.05), indicating that all indirect effects in this model are significant.

The physical domain had the largest indirect influence on disaster preparedness, with a coefficient value of 0.256, indicating that better physical condition led to higher preparedness through improved QoL, with an indirect effect of 25.6%. The psychological domain also contributed significantly to disaster preparedness, with a coefficient of 0.249, signifying that better psychological aspects/state play an important role in enhancing disaster preparedness through improved QoL, with an indirect effect of 24.9%. The environmental domain had an indirect influence of 0.233, suggesting that better environmental conditions can enhance disaster preparedness through improved QoL, with an indirect effect of 23.3%. Meanwhile, the social domain had a smaller indirect effect than the other domains, with a coefficient of 0.187, but it remained significant, indicating that good social conditions can still enhance disaster preparedness through better QoL, with an indirect effect of 18.7%.

Overall, these results indicate that all four domains not only have a direct impact on QoL, but also exert a significant indirect influence on disaster preparedness. Thus, improving QoL can be a key factor in enhancing community preparedness for disasters.

IV. CONCLUSION

This study highlights the significant role of Quality of Life (QoL) in disaster preparedness in flood-prone areas in Makassar City, Indonesia. The findings indicate that the physical, psychological, social, and environmental domains not only directly influence QoL, but also have an indirect impact on disaster preparedness, with QoL serving as a mediating factor. Among these, the physical domain had the strongest indirect effect, followed by the psychological, environmental, and social domains. Furthermore, QoL has emerged as the most dominant factor influencing disaster preparedness, emphasizing its crucial role in strengthening community resilience.

Comparing these results with previous studies, the current work's findings align with the research in [19, 20], which highlight the importance of social and environmental factors in disaster preparedness. However, the present study further extends the literature by demonstrating that the physical

domain plays the most significant indirect role, a factor often overlooked in disaster resilience models. These findings support the argument that an integrated, multi-domain approach is necessary to enhance disaster preparedness.

Based on these insights, this study proposes strengthening community resilience by improving the physical infrastructure, access to healthcare, mental health support, social networks, and environmental sustainability. Future research should explore longitudinal studies to assess how improvements in QoL influence disaster preparedness over time. Additionally, integrating machine learning or GIS-based spatial analysis can provide deeper insights into region-specific vulnerabilities and targeted disaster risk reduction strategies.

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