Analysis of Community Satisfaction Level on the Road Rehabilitation and Reconstruction Project (Learn from Palu Disasters Area)

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Abstract The rehabilitation and reconstruction project stages after the Palu disaster were almost completed. The massive earthquake disaster followed by the tsunami and the liquefaction required a relatively complex pre-during-past rehabilitation and reconstruction series. These stages will certainly be considered successful if the community affected by the disaster can feel performance satisfied. This research was conducted in the project area of rehabilitation and reconstruction of roads and bridges in Palu, Sigi, and Donggala. The research method was carried out through a questioner distributed to all communities around the project site. The analysis is carried out using a community profile and importance-performance analysis. The results showed that the community got satisfaction above the average (almost 4.00). The community is satisfied with the road's condition and the bridge's current state compared to the past. Meanwhile, essential indicators that must be improved are information and socialization and street lighting.

Keywords Community Satisfaction · Liquefaction · Rehabilitation · Reconstruction

1 Introduction

The earthquake that occurred in Palu—Indonesia, on September 28, 2018, caused severe damage. Until now, this incident still leaves quite a trauma. The earthquake that occurred has quite complete phenomena, including the movement of faults, tsunamis, landslides, and the devastating liquefaction period. Several incidents that took place simultaneously have paralyzed various community activities [1]. In particular, this liquefaction phenomenon has received attention from the world. The mudflow event

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during the liquefaction had devastated infrastructure and housing on a massive scale and simultaneously during the incident.

Palu City and its surroundings based on topographic, geological, and seismological conditions can suffer damage due to earthquakes, including secondary disasters (tsunami, liquefaction, and cliff landslides). A similar earthquake with a magnitude of 7.6 on the Richter scale occurred in Palu in 1938 with many victims [2]. Several records of earthquake events in the last 100 years can be used as a lesson for all stakeholders to be better prepared for earthquakes.

Apart from being a natural occurrence that is destructive and has a devastating impact on human life and property loss, Earthquakes is also a natural laboratory on a full scale. This can provide many benefits; among them is to study earthquakes' characteristics to mitigate disasters in the future. Civil engineering experts have a fundamental relationship to earthquake disasters. Most of the Indonesia's territory is in earthquake-prone areas. Of course, the Palu earthquake that occurred should be used as a valuable lesson for practitioners, especially civil engineering, because it provides a complete picture of natural disasters. Apart from having to evaluate preparing a mitigation plan, we must immediately evaluate the rehabilitation and reconstruction that has been carried out within the past three years. Valuable for the continuation of humans to build an economy and a proper life order [3].

Evaluation of the rehabilitation and reconstruction process is needed to ensure that development direction is on the right track. One of the measuring tools that can be used is the community satisfaction level [4]. This can be used as a measure of accuracy in carrying out trauma healing. The community's existence and involvement can boost the success of the preparation, implementation, and implementation processes in implementing rehabilitation and reconstruction.

One method that is widely used to measure community satisfaction is the Importance Performance Analysis (IPA). The scientific method has proven to be a widely applicable tool that is relatively easy to manage and interpret. Thus, it is widely used among researchers and managers in various industries [5]. However, despite its widespread, this IPA model still has to be correctly ascertained about its method and implementation. The purpose of this study is to determine community satisfaction with rehabilitation and reconstruction using the IPA method.

2 Literature Review

Palu is an active earthquake area where according to the USGS Seismicity Map, it has an epicenter depth of less than 150 km [6]. The earthquake in the Palu region is included in the transform zone type, which is an earthquake caused by sliding two tectonic plates parallel to each other, but in opposite directions. The two of them neither gave each other nor supported each other. The earthquakes in this zone are generally shallow crustal earthquakes caused by the Palu-Koro Fault and the Matano Fault [7].

2.1 Disasters Vulnerability

Palu City is the capital city of Central Sulawesi Province below the equator with an altitude of 0–700 m above sea level. Palu's vulnerability to disasters is primarily the result of the Palu-Koro fault. This fault is the main fault on the island of Sulawesi and is classified as an active fault extending from central Sulawesi to the Karimata Strait [8]. The fault starts from the boundary of Sulawesi waters with the Makassar Strait to the bay of Bone. This fault crosses the city of Palu and reaches the Koro River area. Morphologically, the Palu-Koro Fault is a left-lateral slip [9].

The Palu-Koro fault is very active with a shift in the range of 33 mm/year. Because of its large dimensions, it is also called the Palu-Koro fault zone or system. This land fault with a length of 250 km is the second-longest fault in Indonesia, after the large-Sumatra fault [10]. Initially, this fault was called the Fossa Sarassina fault, and then it was called the Palu-koro fault, Lariang in the Koro River segment (Koro Valley). These geological and geophysical scientists familiar with the Palu-Koro fault agree that the fault is active [11].

2.2 Rehabilitation and Reconstruction

The scope of implementation of post-disaster rehabilitation and reconstruction is carried out through several activities. Among them are improving the environment in the disaster area, repairing public infrastructure and facilities, helping for community housing repairs, social-psychological recovery, health services, reconciliation and conflict resolution, social, economic, and cultural recovery, restoring security and order, restoring government functions, and restoration of public service functions. The main objective of rehabilitation and reconstruction is to restore disturbed community activities and public services [12].

In post-disaster management, especially in the handling of reconstruction, a proper reconstruction process is needed. Based on sound planning, so that it is right on target and is also orderly in the use of funds and can increase community resilience to the threat of future disasters [13]. A good post-disaster reconstruction process must recover the community's condition, both physically, mentally, socially, and economically, and reduce vulnerability to disasters, not exacerbate existing vulnerability conditions that lead to disasters.

For the reconstruction and rehabilitation process to run well, a particular standard is needed to manage disaster management. The government (central and regional) and non-governmental organizations and members of the public can carry out the rehabilitation and reconstruction process with planned, on time, on quality and budget, and under the target [14]. Every rehabilitation and reconstruction program must prepare a detailed technical plan, covering aspects of volume, network system, stages of work, the cost, the technical requirements for the implementation, and the actors who can do it.

Each rehabilitation and reconstruction program must meet specific achievement indicators, mainly so that each component of public infrastructure and facilities can adequately support the resumption of the communities' social and economic life in the disaster area. One of the critical indicators that must be considered is the disaster's social-psychological recovery to return to normal functions [15]. This can be achieved by activating community elements so that they can return to normal social functions.

2.3 Community Satisfaction

The main target of rehabilitation and reconstruction is the repair and restoration of all aspects of public services by normalizing all aspects of governance and community life in post-disaster areas [16]. The ability to provide essential services to the community cannot be adequately achieved without proper planning. The shift of authority from the central government to regional government is often not accompanied by the transfer of responsibility for services and protection to the public. As a result, regional government responses tend to be slow and often centrally dependent when disasters occur. This situation becomes even more complicated if the disaster affects more than one area.

As part of overall disaster management, the rehabilitation phase's implementation must be linked to other stages. In this sense, the rehabilitation phase activities relate to the pre-disaster and emergency stages and the reconstruction phase. The relationship and coordination between these stages dramatically determine the effectiveness and efficiency of disaster management. Therefore, disaster management staging should not be positioned as a goal but to achieve efficiency and effectiveness of disaster management as a whole [17]. Based on this definition, synchronization and coordination should be the keywords for disaster management that various parties must implement. The planning, preparation, implementation of post-rehabilitation and reconstruction processes are a series of interrelated activities.

In the implementation of rehabilitation and reconstruction, it is necessary to mobilize resources, including human resources, equipment, materials, and funds, by considering the available local resources. Human resources who understand and have professional skills are indispensable in all post-disaster rehabilitation processes and activities. Resources in the form of equipment, materials, and funds are provided and ready to be allocated to support the rehabilitation process [18]. Recovery activities involving the community are carried out by helping the community to revive and reactivate social, economic, and cultural activities. By actively involving the community, it is hoped that the rehabilitation and reconstruction activities carried out will get a high level of satisfaction.

A community satisfaction survey is needed in connection with some of the above, especially the community satisfaction level. This is a comprehensive measurement of the level of community satisfaction with the quality of rehabilitation and reconstruction services provided by public service providers [19]. The survey needs to

Table 1 Community satisfaction level

Code	Level	Weight
VD	Very dissatisfied	1
NS	Not satisfied	2
QS	Quite satisfied	3
S	Satisfied	4
VS	Very satisfied	5

be carried out to know each indicator's weaknesses or deficiencies in public service providers and determine the performance of the rehabilitation and reconstruction implementation being carried out.

3 Research Method

The research method used in this research is descriptive research. This research is used to answer questions about what or how an event or phenomenon. The intensive field observation of the phenomenon under study is required. This research was conducted on the community and stakeholders in the post-disaster area of Palu. Respondents in the community satisfaction survey were 125 respondents, but those who returned the questionnaire and filled it in completely were 110 respondents.

3.1 Survey Instrument

For demonstration purposes, community and stakeholder data around the rehabilitation and reconstruction sites were collected using a structured questionnaire. The questionnaire consists of two parts. In the first part, respondents are asked to provide information about the respondent's characteristics and information. The second part contains questions about the level of importance and respondent satisfaction with each attribute of the rehabilitation and reconstruction activity. The main attributes of implementing rehabilitation and reconstruction are taken from existing literature and measured by existing and tested scales adapted from several previous studies.

The assessment for the satisfaction level on the guideline using the Likert Scale method can be seen in Table 1.

3.2 Data Analysis

The application IPA begins with the identification of attributes that are relevant to the observed choice situation. Attribute lists can be developed using mean, median,

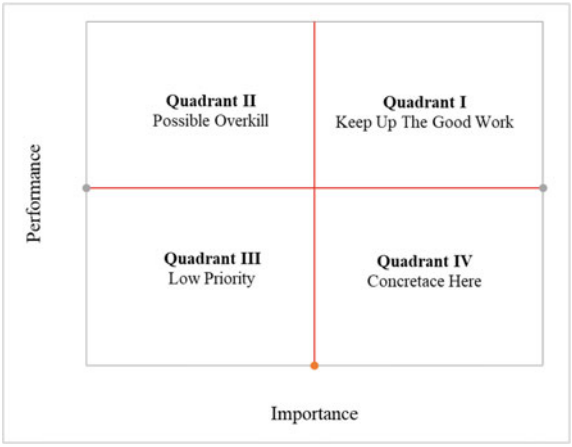

Fig. 1 Importance performance analysis

or ranking measures. The aggregated importance scores and performance attributes are classified into high or low categories; then, each attribute is assigned to one of the four predefined performance interest quadrants by pairing the two rank sets. IPA has been widely applied to evaluate importance and performance value in the market, identify opportunities for improvement, and guide strategic planning efforts. In IPA, service attributes are plotted in a two-dimensional matrix based on each attribute's importance and performance. The average or median importance and performance of all attributes divide the matrix into four quadrants [20]. The priority for improvement is then summarized based on the matrix points' location, which can be seen in Fig. 1.

Quadrant 1 (high importance and high performance) has the management scheme for this quadrant is continuing to work well. Quadrant 2 (low importance and high performance) have a management scheme for this quadrant that is likely to overdo. Quadrant 3 (low importance and low performance): having a management scheme for this quadrant is a low priority. Whereas Quadrant 4 (high importance and low performance) has a management scheme for this quadrant is concentrated here.

4 Data Analysis and Result

The policy for implementing rehabilitation and reconstruction in Palu is the central government's responsibility or local governments affected by the disaster. In carrying out rehabilitation and reconstruction activities in the strategic and national assets, it is directly carried out by the central government. One of them is the rehabilitation and reconstruction of national roads and other strategic roads carried out by the Directorate General of Highway-Indonesia, which loan from the World Bank. The series of stages of the rehabilitation and reconstruction process can be seen in Fig. 2.

Fig. 2 Pre-during-post rehabilitation and reconstruction stage

4.1 Damage Description

The damage that occurred in Palu after the disaster varied greatly but could be classified into several types of damage. Damage due to fault motion, fractures, and earthquake shocks caused by fault motion is an offset where the left side moves north, and the right side shifts south. The length of the most significant shear on the right side is about 4 m, while the left side shifts to the north along 3 m. This shift is visible on the map visible on googles map. Of course, buildings that are traversed by faults will suffer significant damage and soil fractures where fractures can be the impact of the movement of faults (or reactivated faults) with smaller offsets. Earthquake shocks are in the form of vibrations both horizontally and vertically. In Palu City, in general, the impact of damage due to shocks was not too much, except for buildings of low quality.

Furthermore, the damage caused by the tsunami is due to inundation (submerged buildings) and tsunami currents (the speed or force that acts to push or pull the building). The impact of current velocity is mainly the scouring of the subgrade. If it is loose sand, the erosion rate is very high. Generally, buildings with shallow foundations fail because the scour reaches the foundation's base, and the buildings are relatively light, so they are easily carried away by the flow of water. Another damage is due to the tsunami and at the same time carrying debris to cars and ships, so collisions with these objects often result in heavy damage.

Also, there is damage due to massive liquidation with high functionality. There are 4–5 locations that are prominent and wide, namely in Balaroa, Petobo, Jono Oge, Lolu village (also in Jono Oge), and Sibalaya. Although some spots also occur in the sand boil, they are not prominent and are not recorded.

Avalanche damage on several hills. Many locations on the hill suffer from local landslides, and a notable one is in the village of Poi near South Sibalaya. This landslide caused damage and threatened the people below it because the debris in that location was loose and ready to slide due to the rainfall that occurred (it could cause flash floods).

Damage due to liquefaction-induced landslides and landslides on the seabed. Avalanches of this kind are induced by liquefaction. The landslides in Balaroa and Sibalaya were a phenomenon of liquefaction-induced landslides. It is possible that the submarine landslides that occurred in Palu Bay which caused the tsunami impact had the exact mechanism as in Sibalaya.

Table 2 Sample profile

Measure	Items	Frequency	Percentage (%)
Gender	Male	82	74.55
	Female	28	25.45
Age	<21	2	1.82
	21–25	18	16.36
	26–30	15	13.64
	31–35	16	14.55
	36–40	44	40.00
	>41	15	13.64
Education	Diploma degree or lower	23	20.91
	Bachelor's degree	74	67.27
	Master's degree	13	11.82
Profession	Government employees	32	29.09
	Private employees	23	20.91
	Entrepreneur	42	38.18
	Unemployment	3	2.73
	Student	10	9.09

4.2 Sample Profile

Based on the results of the questionnaire, the respondent's profile can be seen in Table 2. Among the respondents, 74.55% were men, and 25.45% were women. Meanwhile, based on age, the respondents were dominated by the 36–40-year-old group, with most of them being undergraduate. Furthermore, based on the type of work, entrepreneurs occupy the most positions.

The questionnaire data obtained from 110 respondents have been tested for instrument reliability using the Cronbach's alpha value. The value of the reliability test results can be used if it exceeds the alpha value of 0.600. Based on the reliability test results, the value of Cronbach's alpha for reliability importance statistics is 0.944 and for reliability performance statistics is 0.909.

4.3 Importance Performance Analysis

IPA is carried out to determine the importance of each service quality attribute based on user perceptions of the importance of service quality. The analysis to determine the level of importance of service quality is carried out in 3 stages: pre-stage, during-stage, and post-stage.

Based on the questionnaire results regarding the importance level and performance attributes of the rehabilitation and reconstruction implementation, descriptive statistics are obtained on the data from all respondents in the study area, which can be seen in Table 3. The I is importance, P is performance, and G is the gap between importance and performance.

Based on the results of a survey of respondents in the rehabilitation and reconstruction after the Palu Disasters area, the average value of the rehabilitation and reconstruction series's satisfaction level was obtained. From these values, it is known that the indicator which has the highest level of importance according to the respondents is the quality road and bridge (4.34). Meanwhile, the indicator with the highest level of satisfaction is the current state of the road, and the bridge is compared to the past (3.99).

In the pre-reconstruction and rehabilitation stages, all performance indicators show an average number of 3.81. This shows that the community is quite satisfied with the pre reconstruction and rehabilitation performance. Likewise, the average performance during reconstruction and rehabilitation with an average performance of 3.81. Meanwhile, post-reconstruction and rehabilitation showed a higher number, namely 3.88. This shows that the community feels the overall performance satisfaction stages are above average.

The gap value is the ratio between importance value and performance value. When viewed from the value gap between importance and performance values, all attributes have a minus value, which means that no indicator can meet the community's expectations. The highest gap value is the current availability of street/environment lighting (−0.56). The performance indicators are considered to be still far below the value expected by the community. The indicator of the access road to residence current state is compared to the past, including attributes with a high enough importance and its performance is also relatively high. So, it can be concluded that respondents saw changes in access road to residence conditions better than before.

The IPA matrix of performance rehabilitation and reconstruction indicators is formed with an average value of importance as the X-axis and the average value of the performance level as the Y-axis, according to Table 3. Based on the matrix, indicators whose importance values are above the Y-axis are included in the high importance category (included in quadrants I and II). In Fig. 3, we can see the IPA matrix for each stage.

Based on the IPA matrix in Fig. 3, it can be seen that in the pre-reconstruction and rehabilitation stages. There are three indicators in quadrant I (keep up the good works) 1 indicator in quadrant II, three indicators in quadrant III, and one indicator in quadrant IV. From the questioners' results, the indicator in quadrant IV (concrete here) should get more attention, namely information and socialization about reconstruction and rehabilitation. While at the stage during rehabilitation and reconstruction, there are no indicators that require special attention. Furthermore, there is no indicator in quadrant IV at the post-reconstruction and rehabilitation stage, but the indicator of the current street/environment lighting availability is quite interesting. It can be seen that the community expects more on the availability of street lighting.

Table 3 The average level of community satisfaction

ID	Satisfaction indicator	I	P	G
A. Before the rehabilitation and reconstruction				
A1	Information and socialization	4.11	3.71	−0.40
A2	The time the reconstruction program began	4.06	3.85	−0.21
A3	Road and bridge damage identification process	4.22	3.85	−0.37
A4	Participation in the reconstruction and rehabilitation process	4.07	3.75	−0.32
A5	Collaboration between local communities in reconstruction and rehabilitation	4.07	3.78	−0.29
A6	The wishes of the people are fulfilled	4.10	3.90	−0.20
A7	Easy administration/disbursement process	3.84	3.62	−0.22
A8	The role of government in the reconstruction process	4.30	3.99	−0.31
Mean A		4.10	3.81	−0.29
B. During the rehabilitation and reconstruction				
B1	The Role of the Facilitator in the reconstruction and rehabilitation process	4.05	3.78	−0.27
B2	Labor availability	4.08	3.77	−0.31
B3	Work experience and skills	4.23	3.86	−0.37
B4	Availability of material for reconstruction and rehabilitation	4.28	3.85	−0.43
B5	Quality material available for reconstruction and rehabilitation	4.25	3.88	−0.37
B6	Quality of road and bridge	4.34	3.92	−0.42
B7	Community participation in the reconstruction and rehabilitation	3.93	3.62	−0.31
Mean B		4.17	3.81	−0.35
C. After the rehabilitation and reconstruction				
C1	With the results of existing assistance	3.98	3.69	−0.29
C2	The current state of the road and bridge is compared to the past	4.17	3.99	−0.18
C3	The road and bridge become more earthquake-resistant	4.25	3.94	−0.31
C4	The comfort of road and bridge compared to before	4.15	3.94	−0.21
C5	The quality of the road and bridge now compared to before	4.17	3.97	−0.20
C6	The road and bridge was had been as a community wish	4.22	3.96	−0.26

(continued)

Table 3 (continued)

ID	Satisfaction indicator	I	P	G
C7	Satisfaction with the current design	4.15	3.95	−0.20
C8	The access road to residence compared to before the reconstruction and rehabilitation	4.11	3.95	−0.16
C9	Current availability of street/environment lighting	4.11	3.55	−0.56
Mean C		4.15	3.88	−0.26
Grand mean		4.14	3.84	−0.30

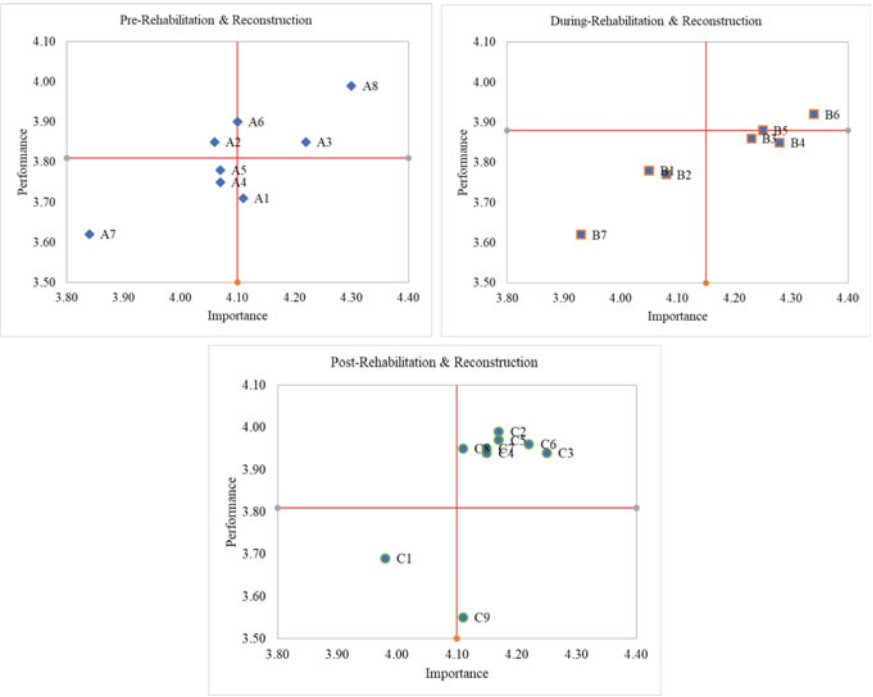

Fig. 3 IPA matrixes for each stage

5 Conclusion

From the data analysis that has been carried out, it can be concluded that the community gets satisfaction above the average for all stages. Consecutively starting from the pre-during-post reconstruction and rehabilitation, the average performance satisfaction level obtained was 3.81; 3.81; and 3.88, with an overall average of 3.84. The satisfaction performance almost met the satisfied category (almost 4.00). An interesting indicator is that the community is satisfied with the access road to residence

current state compared to the past. This is indicated by the minimal gap between importance and performance. This study also found several important things that must be improved: information and socialization and street/environment lighting. This is consistent with several references that state that socialization is an important stage in rehabilitation and reconstruction.

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