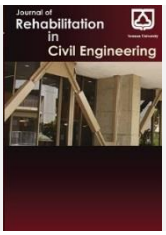

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An Outcome Overview of Housing Rehabilitation and Reconstruction in Mataram City Post Lombok Earthquake Disaster

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ABSTRACT

Several strong earthquakes hit Lombok Island in 2018. The earthquake that occurred in sequence caused damage to many buildings and even destroyed housing for residents. This residential sector suffered enormous damage and losses in Mataram City, the province's capital. The reconstruction and rehabilitation process was carried out in 2 phases, and the last Phase was completed in April 2021. A total of 14140 houses received assistance funds for repair and rebuilding in the first Phase, while the number of houses receiving repair funds in the second Phase was 1339. Compared to the initial data in the Reconstruction and Rehabilitation Action Plan, the number of major damaged houses decreased by 43.66% to 1350 houses. However, the number of medium and minor damaged houses increased to 30.75% and 10.83%, respectively, to 3631 and 9159 houses. Through the implementation of the housing reconstruction and rehabilitation in Mataram City, it can be concluded that either the funding or the process was under the central government's guidance. Meanwhile, the local government was an aid to ensure the effective implementation of reconstruction. The relationship between the central and local governments was conducive to running the process effectively and according to the timeline. The local government allows the community to choose the type of earthquake-resistance house for rebuilding. Of the various types of more earthquake-resistant houses, the people preferred the reinforced concrete panel type housing because the construction is faster, so they can live in it immediately.

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1. Introduction

The Flores Back Arc Thrust activity in the north part of Lombok Island triggered a series of earthquake events in Lombok in 2018. There were six earthquake events with a magnitude above 5.5 and more than 2000 earthquake events with lower strength. The series of earthquakes was initiated on July 29, 2018, with a magnitude of 6.4 at a hypocentre depth of 14 kilometers. The second earthquake occurred on August 5, 2018, again hitting northern Lombok with a greater magnitude of 6.9 and at a depth of 34 km. The impact of the damage caused by the second earthquake was widespread, including in Mataram City, the provincial capital located on the island of Lombok. Next, on August 9, 2018, the northern region of Lombok Island was again shaken by an earthquake of 5.9 magnitudes. The position of the earthquake source was about 20 km northwest of the August 5 earthquake. Furthermore, two earthquakes occurred on August 19, 2018, with a magnitude of 6.3 during the day and a magnitude of 7 at night with a relatively shallow depth of fewer than 25 km. The sixth earthquake occurred on August 25, 2018, with a magnitude of 5.5 [1–8]. The earthquake that occurred in sequence caused many buildings to be damaged and even destroyed, especially housing for residents. This residential sector suffered the most considerable damage and losses in the City of Mataram [9,10].

Following what was stated in the Rehabilitation and Reconstruction Plan after the Lombok Earthquake Disaster 2018 for Mataram City [9,11], the government has set a recovery time for the period of 2018 to 2019. Priority for recovery was the construction of permanent housing for disaster-affected communities.

The recovery process is one of the crucial steps that must be carried out after a disaster, not only because of the extensive damage but also because reconstruction is essential in community recovery. The most significant implementation is the rehabilitation of damaged housing and the recovery of settlements. Post-disaster reconstruction and rehabilitation is a complex process involving social, technological, and economic factors. Housing reconstruction and rehabilitation after a disaster means rebuilding routine activities limited and inhibited by the disaster—delayed housing reconstruction delays all post-disaster dimension recovery [12–15]. Reconstruction must be done appropriately because housing provides livelihood, health, education, security, and social for the family [16]–[18]. The other important thing is that people feel comfortable living in their homes after repairing or rebuilding [13]. In addition, the structural performances of the rebuilt house shall be more resistant to earthquakes and meet the requirement of the code [16–21].

Depending on the level of damage and the infrastructure to be repaired, the post-disaster recovery process might take several weeks to years. The post-disaster recovery phase of rebuilding from various aspects usually concentrates more on long-term development, including housing, economy, environmental, infrastructure, social-psychological, and public services sectors. Many lessons and knowledge shall be learned from implementing post-disaster reconstruction and rehabilitation. They should be coordinated, structured, and managed to increase resilience to disasters in the future. The valuable lessons and knowledge shall remain until the next major earthquake comes [22–24].

A stochastic queuing model was proposed for the housing recovery process after the 2018 Lombok earthquake. This queuing model emphasized the number of damaged houses, distribution of damaged houses, resources in the recovery process, and government strategy. This model enabled to reduce the RMSE value compared to other models. In practice, the record of the recovery process from each

condition of damaged houses is needed to avoid errors regarding the total number of untreated houses [25].

Good disaster recovery must improve future mitigation planning, preparedness, and disaster resilience [26,27]. Therefore, the government does not only provide services to the community in post-disaster recovery but also prepares for disaster risk reduction. In a region such as Mataram City, the procedures should be considered to be conducted during the post-earthquake disaster since it is located in earthquake-prone regions [28,29].

Mataram City suffered the most extensive damage in the residential area compared to other sectors. A total of 13437 housing units were damaged. The reconstruction process was planned to be completed in 2018-2019. However, due to an additional number of damaged houses being repaired, the second phase was continued in 2020-2021. When the reconstruction took place, it was alleged that there were obstacles that resulted in delays in the implementation of housing construction which could have occurred from various aspects. This paper examines several issues during the reconstruction in Mataram City after the Lombok earthquake in 2018, including verification of damaged housing numbers, the finances, type of housing, and technical issues during the process. Furthermore, the discussion involves surveying housing quality and public opinion regarding the reconstruction process and the rebuilt housing. In addition, further evaluation of the process and some conclusions are made to be considered as a lesson learned for implementing the reconstruction process and for better mitigation in the future.

2. Methodology

2.1. Study location overview

Mataram is located in the western part of Lombok Island and has an essential role as the local central government and economy at the provincial level. The area of Mataram City is 61.3 km^2, or approximately 1.3% of the area of Lombok Island. It is divided into six districts: Ampenan District, Cakranegara District, Mataram District, Selaparang District, Sandubaya District, and Sekarbela District. Mataram is about 47 km from the earthquake epicenter in northern Lombok. The earthquake's location, Mataram City's position, and six districts are shown in Fig. 1.

Lombok earthquake epicenters 2018 [30] | Mataram City location (in red) [31] | Districts of Mataram City [32]

Fig. 1. The Location of the Earthquakes, the Position of Mataram City, and the Districts.

2.2. Devastation scale

Before the earthquakes occurred, houses and high-rise buildings were in serviceable condition. They operated properly and firmly according to national standards for construction design and earthquake resistance construction [33,34]. The multi-story building system typically uses reinforced concrete and steel structure systems. The existing building

was designed and built by professional engineers and based on the national regulations so that when the earthquake occurred, the condition of the building was still in a condition of immediate occupancy or only non-structural damage occurred. Even though structural damage was recorded, the building remained firmly and did not collapse, so life safety was maintained. It differs from the condition of residential housing, which primarily used a masonry system and was made by local workers. When the earthquakes hit, the number of damaged housing was found to be significant. Therefore, the government prioritizes the recovery process in housing buildings first compared to the recovery of other sectors [9].

The first earthquake did not significantly affect residential buildings in Mataram City. The damage was felt since the second earthquake on August 5, and then the damage continued to spread during the following earthquakes. As stipulated in the 2018 Mataram Mayor Decree, Damage to the housing sector reached 13437 units covering 2396 major damaged houses, 2777 houses were medium damaged, and 8264 were minor damaged. The distribution of residential damage due to the Lombok Earthquake in each district is shown in Fig. 2. The Lombok earthquake caused damage to the residential sector in Mataram to reach 497 billion 115 million 300 thousand IDR in the form of damage to the components of the house and the contents inside [9].

According to Fig. 2, Selaparang District has the highest total number of house damage, consisting of many medium and minor damage. However, Sandubaya District experienced the highest number of major damaged houses. Therefore, this area was intended for field visits during the rebuilding of houses.

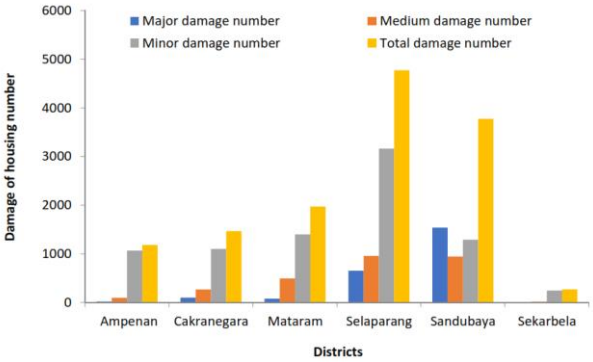

Fig. 2. Distribution of house damage in Mataram City in each district.

2.3. Review analysis

Study activities were conducted during the process of implementing the second phase of the reconstruction process in 2021 to evaluate the extent of the reconstruction implementation process and to examine the existing problems. The study reviewed secondary data on the housing reconstruction stated in the Rehabilitation And Reconstruction Action Plan for Mataram City issued by Mataram City Government in 2018 [9] and compared it to the field implementation.

Primary data included collecting data on housing reconstruction that had been, was being, and would be carried out based on confirmation to the chief executive of the Local Disaster Management Agency of Mataram City (BPBD). Descriptive analysis was conducted by comparing the data on the implementation of rehabilitation and reconstruction contained in the action plan document and implementation data in the field. In addition, it was confirmed whether there were obstacles or support during the reconstruction process. Furthermore, a field visit was conducted to find out the condition of the houses that had been built and to review whether the construction met the build-back better requirements, how the community felt about their new houses, and what the community still needed regarding earthquake disaster mitigation.

3. Result and discussion

3.1. Verification of types and damages number

The total number of buildings requiring repair and new construction assistance was 13437 units. This number consisted of 2396 minor damaged, 2777 medium damaged, and 8264 major damaged. The number is based on data from the Lombok Earthquake Rehabilitation and Reconstruction Action Plan 2018-2019 for Mataram City, which was composed according to the Mataram Mayor's Decree No.1123/X/2018 [9].

However, this number increased to 15545 due to more data proposed by the city residents. After being reviewed by the supervisory element in the National Disaster Management Agency (BNPB), the number of damaged houses requiring reconstruction assistance was approved to 14157 units. Furthermore, after re-cross-checking the existing data in the field, the number verified was 14140 units. Based on information from the Mataram City Disaster Management Agency (BPBD), the reduction in the number occurred due to some issues, namely that more than one household's application for assistance to one house was proposed. In addition, several houses have received assistance from the Department of Public Housing.

The comparison of the number of damaged houses from the Reconstruction and Rehabilitation Action Plan data and in-field implementation data can be seen in Fig. 3. Compared to the initial data in the Reconstruction and Rehabilitation Action Plan, from a total of 14140 damaged houses that received assistance, the number of major damages decreased by 43.66% to 1350 houses. However, the number of medium and minor damaged houses increased to 30.75% and 10.83%, respectively, to 3631 and 9159 houses. The increase in the number of medium and minor damaged houses was because, after the seismic assessment of housing, some aftershocks continued to occur even with a magnitude more powerful than the previous earthquake; therefore, the condition of damaged houses increased.

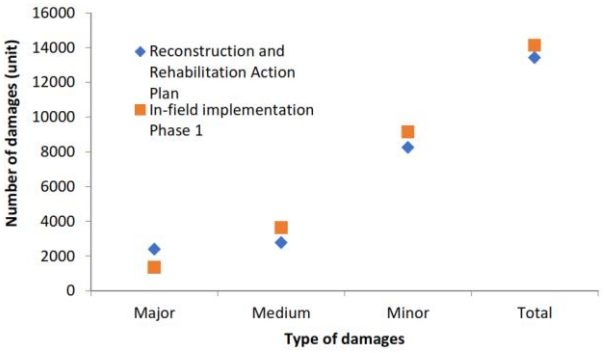

Fig. 3. Comparison number of damages between reconstruction and rehabilitation action plan and in-site data.

The reconstruction and rehabilitation of the 14140 houses could be completed according to the planned year because Mataram City Disaster Management Agency (BPBD) always accompanied the implementation process in collaboration with the facilitators and the community. In addition, it was required for material providers to have complete official documents, initial capital, and a warehouse to store construction materials to avoid delays in material procurement during the reconstruction and rehabilitation process.

In 2020-2021 there were still 1339 damaged houses proposing financial aid for reconstruction and rehabilitation; therefore, Phase 2 assistance was opened. The remaining budgets in Phase 1 were used to support the implementation of the later phase. There was a remaining fund in Phase 1 because, in the process, the number of damaged houses data on the initial verification approved by the supervisory element at the National Disaster Management Agency (BNPB) was 14157; however, based on the data collected in the field, it turned out that only 14140 houses needed repairs. The second phase of funding assistance was needed only for housing with medium damage, 369 units, and minor

damage, 970 units. There was no reconstruction assistance for houses with major damage because it had been fully completed in Phase 1. Phase 2 was completed in April 2021.

3.2. Institution and finance

The central government supported the reconstruction and rehabilitation fund, which was handled by the National Disaster Management Agency (BNPB) and then distributed to the Local Disaster Management Agency (BPBD) of Mataram City. Furthermore, the Mataram City BPBD regulated the use of these funds so that the funds were distributed according to the validated damaged house data. The assistance given to each house that suffered minor, medium, and major damage was 10 million IDR, 25 million IDR, and 50 million IDR, respectively. The amount of funds provided in Phase 1 was according to the number of damaged houses based on the review of the supervisory element in BNPB, which were as many as 14157 houses. However, in the implementation of Phase 1, the Local Disaster Management Agency (BPBD) distributed the funds to a total of 14140 houses. The number was based on the collected data in the field. The remaining 4 billion and 185 million IDR budgets were then used to implement the second Phase. Tables 1 and 2 show the amount of financing in Phase 1 and Phase 2.

Table 1. Amount of financial aid (IDR) of 1st Phase.

Damage type	Number of recipients		Aid for each house (million-IDR)	Amount of financial aid (billion-IDR)	
	Approved	Implemented		Approved	Implemented
Major	1345	1350	50	67.25	67.5
Medium	3672	3631	25	91.8	90.775
Minor	9500	9159	10	95	92
Total	**14517**	**14140**		**254.05**	**249.865**

Table 2. Amount of financial aid (IDR) of 2nd Phase.

Damage type	Number of recipients		Aid for each house (million-IDR)	Amount of financial aid (billion-IDR)	
	Approved	Implemented		Approved	Implemented
Medium	384	369	25	9.6	9.225
Minor	1024	970	10	10.24	9.7
Total	**1408**	**1339**		**19.84**	**18.925**

There was a remaining fund in Phase II of 915 million IDR. This fund is still held by the Local BPBD of Mataram City and is planned for disaster mitigation programs in Mataram City. This plan is still being proposed to the National Disaster Management Agency (BNPB) to make a mapping and location coordinates of the recipients with the remaining budgets of Phase II. This mapping is intended to monitor post-earthquake rehabilitation and rehabilitation assistance recipients.

3.3. Re-built housing type

The residents of Mataram City who suffered major damage to their houses after the earthquake received assistance to rebuild their houses. The central government offered several types of more earthquake-resistant housing, such as conventional type housing (in Indonesian: RIKO), wood type housing (in Indonesian: RIKA), steel wood type housing (in Indonesian: RISBA), and reinforced concrete panel type housing (in Indonesian: RISHA). Regarding the structurally primary

materials, the four types of more earthquake-resistant houses that the Ministry of Public Housing offered to reconstruct housing are briefly explained in Table 3.

People prefer the RISHA type, which means Simple Healthy Instant Home in Indonesian. There were some of the reasons people preferred RISHA. Firstly, it was faster to be built compared to a conventional house. The construction time was ten times faster than a conventional house. Secondly, there were few workers required to build the house, only around three people. Thus, it enabled the community to build their dwellings independently, which was assisted by a government-appointed facilitator.

RISHA is a knock-down construction technology that can be built quickly (hence called instant technology), using reinforced concrete as its main structure. This innovation is based on the need to accelerate the provision of affordable housing while maintaining quality housing

Tabel 3. Various types of more resistant earthquake housing [35].

Type	Description	Advantages	Limitations
RISHA (reinforced concrete panel type housing)	RISHA is a small precast structural system consisting of panels and joints. The quality of the concrete used is 24 MPa with a reinforcing steel frame with a diameter of 8 mm and 6 mm, using a nut and bolt connection system and a 3 mm plate.	The community can do the house. Each panel weighs less than 47 kg, so one worker can lift it When assembling only requires simple equipment Fast house construction time (5-7 days)	Precast panels are made by fabrication, so it takes more time to order and bring them to the work site.
RIKA (wood type housing)	More earthquake-resistant housing that uses wood as the basic material for construction. Using fast-growing engineering wood such as Albizia Falcata Backer.	Wood is a light and strong material; therefore, it is suitable for earthquake-prone areas The cost is cheaper It can be moveable because of the knock-down system More environmentally friendly	The construction time is longer than RISHA, which is around 30 days.
RISBA (steel type housing)	Risba is a simple steel house structural system that can be done by the community. The steel required for the Risba technology is anti-corrosion-coated channel steel with a tensile strength of 250 MPa	RISBA is more robust, durable, and faster construction (5 days)	Steel material has a higher price. Steel material must be ordered in advance. Advanced equipment required, especially for the connection.
RIKO (conventional type housing)	The reinforced concrete structural house consists of beams, columns, and beam foundations with masonry bricks as walls.	This type of house is well known by the community.	a. The construction must be carefully constructed to ensure that this house is more earthquake resistant, especially in materials and the joint between house structural elements; therefore, tight supervision is on demand. b. It takes a longer implementation time (1-2 months)

according to Indonesian National Standards [35,36].

RISHA refers to a modular size consisting of two-panel structural types and the connector; therefore, the size of each component is constantly repeated. Each component has been analyzed as being able to be used on any structural elements such as foundations,

foundation beams, columns, beams, roof trusses, and walls. Each panel weighs less than 47 kg, so one worker can lift it. Assembly also does not require complicated equipment. The quality of the concrete used is 24 MPa, with 8 mm and 6 mm diameter reinforcing steel and a bolt nut connection system with 3 mm plates. Fig. 4 dan Fig. 5, respectively, show the assembly process of the RISHA [37] and the ongoing RISHA construction.

Structural panels are used as functional, structural elements such as columns, beams, or foundation beams. The connector panel functions as a join or connecting between structural panels. All of these components are assembled directly on-site to make RISHA.

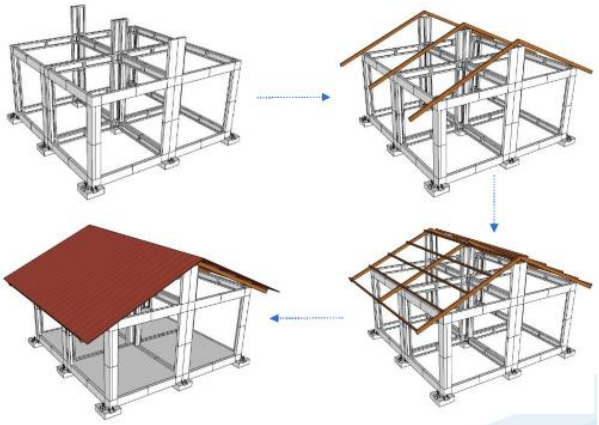

Fig. 4. RISHA Construction Process [37].

Fig. 5. Examples of RISHA Construction in the Field.

3.4. The reconstruction process and in field- issues

Housing reconstruction was conducted on a community basis. It means that the community was responsible for the reconstruction process under the supervision of the local government (BPBD). Community groups were arranged consisting of 10 to 15 families. These community groups were assisted by a team of facilitators in planning and implementing the reconstruction. Each team of facilitators consists of a legal expert, an economist, and an engineer. In addition, this team is responsible for assisting community groups in preparing legal and technical documents and managing financials obtained from the government for the construction of their houses. Community groups then work with third parties (such as contractors) to supply building materials and build houses. BPBD, as the local government, required that the contractors and material providers have complete official documents, initial capital, and a warehouse to store construction materials to avoid delays in material supply during the reconstruction and rehabilitation process.

The delay time in the reconstruction process in Mataram has been studied using a time-based stochastic model and is shown in Fig. 6 [25]. The delay time is the time of a building to obtain a reconstruction crew and the materials needed to reconstruct. The data used in the calculations was up to March 2020. The delay time for the reconstruction of buildings with major damage was recorded for almost one year, and the largest number of major damaged buildings experienced a delay time of around 8-9 months.

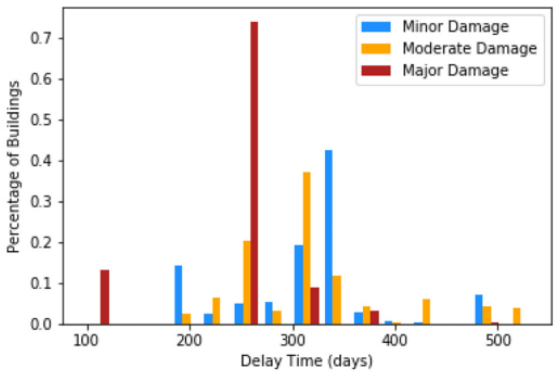

Fig. 6. Histogram of the delay construction time calculation in Mataram City [25].

Based on the results of field visits and interviews with BPBD Mataram City, problems can be identified while implementing the reconstruction and rehabilitation of Mataram City. There were differences in the data on the number of damaged houses submitted by the community and approved by the government. The Local Disaster Management Agency (BPBD) conducted a direct check in the field to finalize the number of houses being assisted. This amount of data in the field was used as a guideline by BPBD in repairing and rebuilding houses. Thus, a number of reconstruction and rehabilitation assistance funds were not disbursed, a total of 446 houses consisting of 377 houses in Phase I and 69 houses in Phase II.

The Mataram City Disaster Management Agency, BPBD, has collaborated with the Local Citizenship and Civil Registration Agency to synchronize the number of damaged houses in the field. It was found that one house applied for more than one aid. It can occur because more than one family head often occupies one house. When applying for house reconstruction funds, there was no coordination between the heads of families living there. Therefore, cases in the one damaged house applied for funds more than once, causing the increasing data on the number of damaged houses. The data validation process in the field was completed immediately by the Mataram City BPBD in cooperation with the Local Citizenship and Civil Registration Agency.

In addition, the difference in the amount of data is also because several damaged houses have received assistance from the Mataram City Housing and Settlement Services Agency. Through the process, Mataram City was able to complete housing assistance for earthquake victims in Mataram City on time, namely before the deadline for the extension of the emergency response condition on August 31st, 2021.

For this reason, it can be concluded that the implementation of the reconstruction and rehabilitation in Mataram City ran well because of several strategies according to Mataram City BPBD, namely: 1) there was no tolerance for doubled proposing data for aid, always based on the number according to the decree during the implementation; 2) there was a cooperation with other agencies such as the Local Citizenship and Civil Registration Agency in verification resident households; and 3) the material provider of housing construction must have complete documents, capital, and material storage warehouse to avoid delays in the implementation of house construction.

Furthermore, residential houses have been built in the previous area in accordance with the legal certificate they have. The housing was not relocated, and the city did not move after the reconstruction process. The only thing that has changed is the type of houses built to be more earthquake resistant and the distance between houses extended to provide the evacuation route.

3.5. Re-built housing condition

The RISHA housing was adjusted to the residents' land area. The most expansive building area was 36 m^2, and the smallest

house area was 17.5 m^2. Visually, the houses are fixed vertically and firmly, and the materials used follow RISHA specifications. The houses are fully structurally constructed, starting from the foundation, foundation beams, columns, beams, and roof. In receiving housing construction assistance worth 50 million IDR, the costs for constructing ceramic floors and ceilings could not be covered for the house with an area of 36 m^2. However, some residents independently provided ceramic floors and ceilings for their houses. However, for the house with a smaller area, the construction assistance funds can be included ceramics floors and ceilings.

During the construction of the houses, electricity facilities, wells for the water source, drainage, and communal toilets for 3-4 houses were also provided. Fig. 7 illustrates a house built using the aid.

Fig. 7. Front View of Built House.

In addition, compared to conditions before the reconstruction, wider side alleys are currently available. During the housing construction, each housing area was reduced by 20 cm from each side to enlarge the side alleys to make disaster evacuation easier in the future. Fig. 8 shows the expanded distance between the houses.

Fig. 8. Expanded Distance between Two Houses.

3.6. Community opinions

Based on the survey results, people feel more comfortable living in a new house than before the earthquake. They believe that their current home is safer from earthquakes in the future. This field survey agrees with the reconstruction results after West Sumatra Earthquake 2009 [38]. In addition, the Local Disaster Management Agency is continuously monitoring to inspect the condition of the community during reconstruction so the people feel more peaceful.

However, the community expects the BPBD's attention not to stop until the house construction stage is completed. There is expected to be regular visiting and education to the community for disaster preparedness. According to the BPBD, disaster mitigation rules for each village are being prepared.

3.7. Lesson learned

The lessons and knowledge from the Lombok Earthquake 2018 are expected to be managed and used effectively to accelerate the reconstruction and rehabilitation process in the future [36][36][39]. That Mataram can complete this process according to the timeline so it can be considered by other districts in Lombok Island, as several districts have been

struggling to meet the reconstruction and rehabilitation process on time [36,39].

Strong coordination among all relevant parties is the primary key to the reconstruction and rehabilitation process in Mataram City. Starting from the central government as a policy maker and funder, the local government act as a person in charge of all operations in the field, commencing from managing finances, construction, monitoring, and evaluation, as well as the affected communities who continually support the government programs.

Several strategies can be considered from the reconstruction and rehabilitation process in Mataram City as follows.

a) Through National Disaster Management Agency (BNPB), the central government led the reconstruction and rehabilitation process by providing regulations and finances for the implementation.

b) The central government verified the number of damaged houses so that the implementation was on the right target.

c) Through the Mataram City Disaster Management Agency (BPBD), the local government realized reconstruction and rehabilitation by distributing the funds to the affected community according to the level of damage and providing facilitators. BPBD appointed certified facilitators who consisted of a legal expert, an economist, and an engineer to one community group of 15 households. Community groups then cooperate with developers to supply building materials and build houses. Likewise, developers were appointed with official permissions and material storage warehouses.

d) The local government cross-checked the number of damaged houses proposed by the community to prevent each house from being submitted for aid by more than one household head. For this purpose, BPBD cooperated with the Local Citizenship and Civil Registration Agency.

e) The local government monitored, evaluated, and assisted the community during the reconstruction and rehabilitation process so that the process ran smoothly, on time, and following the community's needs.

f) For rebuilding houses, the local government allows the community to choose the more earthquake-resistant house type. Of the various types of houses that are more earthquake-resistant, the people of Mataram prefer RISHA because the construction is faster, so they can live in it immediately.

g) The community was thoroughly assisted by the facilitator teams during the reconstruction and rehabilitation to accelerate the process so that they would immediately occupy permanent houses. They showed cooperation and supported the reconstruction and rehabilitation process. In addition, during the housing reconstruction, the community was assisted in trauma healing and social assistance post-earthquakes.

4. Conclusion

The reconstruction and rehabilitation process was carried out in 2 phases. A total of 14140 houses received assistance funds for repair and rebuilding in the first Phase, while the number of houses receiving repair funds in the second Phase was 1339. Compared to the initial data in the Reconstruction and Rehabilitation Action Plan, the damaged houses that received assistance decreased by 43.66% to 1350 for major damaged houses. However, the number of medium and minor damaged houses increased to 30.75% and 10.83%, respectively, to 3631 and 9159 houses.

Either the funding or the regulation process was under the central government's guidance. Meanwhile, the local government was an aid to ensure the effective implementation of reconstruction. The relationship between the central and local governments was conducive to running the process effectively.

Regarding the process, although the central government has approved the number of damaged houses that need assistance funds, the local government continued to review it according to conditions in the field. It was found that several heads of family occupied a house, and all heads of families who occupied the house applied for aid funds, so there were cases of one house receiving more than one grant.

In terms of re-building houses, the local government allowed the community to choose the more earthquake-resistant house type. Of the more earthquake-resistant house types, the people preferred reinforced concrete panel type housing because the construction was faster, so they could live in it immediately.

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