

# Rehabilitation and reconstruction of community housing post-West Nusa Tenggara Earthquake 2018 (A case of Lauk Rurung Timuk and Lauk Rurung Barat Sub-villages, Sembalun Bumbung, Sembalun, East Lombok)

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**Abstract.** Three strong earthquakes occurred and damaged the infrastructures and human settlements at some regions of West Nusa Tenggara Province in July and August 2018. This paper describes the policy and action taken by Ministry of Public Works and Housing (MPWH), Republic of Indonesia, to assist in the rehabilitation and reconstruction, specifically for the housing. The process started from early September 2018 by Civil Servant Candidate from MPWH together with the society. The action was comprised of three phases: socialization, design, and construction. Those phases are discussed in this paper along with their particular obstacles. The most critical phase is deducted. All the resources were gathered from the law applied in Indonesia, the official instruction of implementation, the technical instructions, interviews and volunteers' point of views. This paper employed qualitative approach through observation, survey, group discussion, and interview to analyze factors that significantly affected the implementation of rehabilitation and reconstruction of houses by referring to the theory. The results of the study suggest that the socialization phase is found to be the most decisive.

## 1 Introduction

**Table 1.** Number of Heavily-Damaged Houses in the Regencies of West Nusa Tenggara Province

Regency/City	Number of Heavily-Damaged Houses
West Lombok	13,942
Central Lombok	2,884
East Lombok	7,447
North Lombok	44,014
Mataram City	2,396
Sumbawa	1,084
West Sumbawa	796

Indonesia, which is located at the confluence of the world's large plates and several small plates, has tectonic conditions that cause the country to experience frequent earthquakes. A study shows that some regions are positioned in Sunda plate and Burma plate boundaries, and surrounded by India, Australia and Yangtze plates [1]. Plenty of earthquakes have occurred in many places in Indonesia, such as in Aceh (9.2 M, 2004), in Nias (8.4 M, 2005), in Bengkulu (8.5 M, 2007), and in Mentawai (7.8 M, 2010) [2]. Recently, three strong earthquakes occurred

and damaged the infrastructures and human settlements at some regions in West Nusa Tenggara Province. The scales of the three earthquakes were 6.4 [3], 7.0 [4], and 6.9 Magnitude [5] respectively, devastating nearly 168,000 houses [6]. For heavily-damaged only, there were 74,092 houses in six regencies and one city.

In order to accelerate the processes of rehabilitation and reconstruction post-earthquake in the regions, President of Republic of Indonesia issued a presidential instruction to realize the plan [7]. The instruction called for several heads of agencies and ministers, including Minister of Public Works and Housing, coordinated by Head of National Board for Disaster Management (NBDM) to perform special tasks.

NBDM released a guideline for several ministries/agencies on how to use the stimulant fund allocated to rehabilitate and reconstruct public housing in West Nusa Tenggara Province [6].

The approach used in this disaster management program is self-help society, meaning that the society is expected to rebuild their own houses with facilitations. This independent scheme is mandated to educate society about earthquake hazards in their areas and how to build a seismic-resistant house for that geographical condition.

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Civil Servant Candidate facilitates the society by conducting socialization, public hearing, grouping, planning, design, construction, and reporting.

The NBDM guideline pattern is presented as follows:

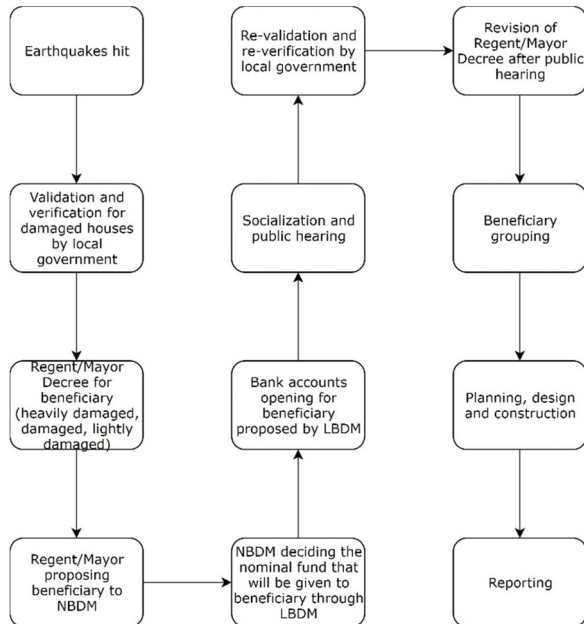


Fig. 1. NBDM Guideline

## 2 Study Literature

Disaster is an event or series of events that threaten and disrupt the lives and livelihoods of the people caused by natural, non-natural, or human factors resulting in human fatalities, environmental damage, property losses, and psychological impacts [8]. Asian Development Bank (ADB) in Disaster Management Handbook generalizes typical effects of disaster into the following categories:

1. Loss of life;
2. Injury;
3. Damage of property;
4. Damage subsistence and cash crops;
5. Disruption of production;
6. Disruption of lifestyle;
7. Loss of livelihood;
8. Disruption to essential services;
9. Damage to national infrastructure and disruption to governmental systems;
10. National economic loss; and
11. Sociological and psychological after effects.

Those effects of disaster can be minimized by disaster management. Disaster management is a sustainable and integrated process of plan preparation, organization, coordination, and implementation which are required to prevent hazards or threats of any disaster, and to mitigate or minimize any disaster risk through capacity building, preparedness to deal with any disaster, quick response to face any disaster condition, assessment

of the disaster effects, evacuation, rescue and relief, as well as rehabilitation and reconstruction [9]. The disaster management cycle can be, and often is, portrayed in various forms [10]. In general, it is divided into three phases: pre-disaster management, emergency response, and post-disaster management. ADB illustrates the cycle as follows:

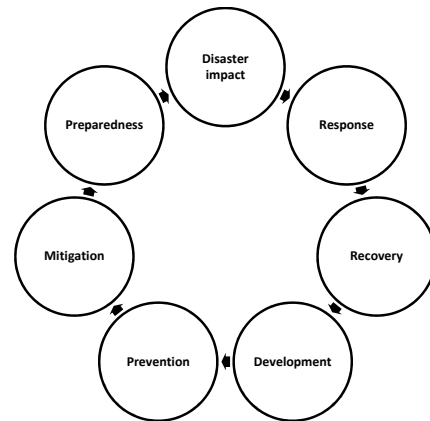


Fig. 2. Disaster Management Cycle

The cycle consists of three phases as shown above even though different terminology is used. Disaster management is a continuum of interlinked activities, but not a series of events which start and stop with each disaster occurrence [10]. This paper focuses on post-disaster management, especially about rehabilitation and reconstruction or “recovery”.

Rehabilitation means repair and recovery of all aspects of public or community services to an adequate level in post-disaster areas with the main goal of normalizing all aspects of government and community life in post-disaster areas [8]. In terms of earthquake, rehabilitation process should regard the regulation of building construction standard, cultural and socio-economic condition, as well as local knowledge [11]. On the other hand, reconstruction means rebuilding all infrastructures and facilities in post-disaster areas, both at the government and community levels with the main goal of encouraging and developing economic, social, and cultural activities, as well as law and community participation, in all aspect of community life in post-disaster areas [8].

Rehabilitation consists of some activities as follows:

1. Rehabilitation of the disaster area;
2. Improvement of the public infrastructure;
3. Provision of assistance to repair community houses;
4. Social psychological recovery;
5. Health services;
6. Conflict reconciliation and resolution;
7. Cultural socio-economic recovery;
8. Security recovery;
9. Government function recovery; and
10. Public service recovery.

Meanwhile, reconstruction consists of some activities as follows:

1. Rebuilding public and social facilities;
2. Re-awakening of socio-cultural life community;
3. Implementing resilient building design;
4. Increasing participation of institutions, community organization, private sector and society;
5. Improving social, economic and cultural conditions;
6. Improving the function of public services; and
7. Improving of key services in the community.

Typical problems that arise in the recovery process are:

1. Delays occur in the formulation of recovery programs because the definition and management of recovery programs have not been adequately considered in overall counter-disaster planning and organization;
2. Damage and destruction may be so severe and extensive that it is difficult to handle and takes considerable time to assess and formulate recovery programs;
3. Information is inadequate for the formulation of recovery programs. In some cases, this can necessitate re-surveys in order to establish post-disaster effects more accurately;
4. The additional load imposed on the government system by recovery programs may slow down the functioning and output of government departments, so that the whole recovery process becomes unsatisfactory;
5. Occurrence of another major disaster (not necessarily of the same kind or in the same area) may divert funds and resources from recovery programs;
6. Problems relating to ministerial responsibilities may arise because recovery requirements overlap from one department to another;
7. Restrictions on availability of finance (and/or uncertainty concerning international assistance funding) may hinder the formulation of recovery programs;
8. Political problems can sometimes arise if certain areas/communities appear to not be receiving the same priority of attention as others in regard to recovery programs;
9. Inadequate attention may be given by governments to public information programs and public relations generally, so that false impressions or perceptions arise concerning recovery measures;
10. Some major and vital reconstruction programs may take a long time (e.g., reconstruction of bridges, roads, and rail systems). This may cause economic loss, further hardship, and other problems for disaster-affected communities;
11. Limitations may apply to the implementation of recovery programs; for instance, in materials, equipment, specialist and skilled personnel;
12. The time process of some recovery programs cannot be hastened; for instance, those which apply to the natural recovery of, say, coconut palms or oil palms. This usually has economic implications.

Regarding the amount of effect experienced, disaster shall be managed with proper coordination. Good coordination will produce effectiveness and cooperation from organizations involved in disaster management in the field. In this case, it is necessary to pay attention to the placement of the right organizational structure in accordance with the different levels of disaster management, as well as the clarity of tasks, responsibilities, and authorities of each component/organization which are continuously carried out across programs and across sectors from the time of preparation and post-disaster [12].

The coordination theory between bureaucratic organizations is well known as Whole of Government (WoG) scheme. This scheme has been recognized widely since it was listed in the curriculum of Civil Servant Candidate educational program. WoG aims to increase integration and capacity to achieve more. A desire for increased effectiveness and efficiency generally drives the adoption of the whole government approaches [13].

Scheme related to coordination from multi-stakeholders is also encouraged to achieve better result in disaster management. For instance, Japan has the Disaster Countermeasures Basic Act that mandates Prime Minister, several ministers and even local government to organize disaster management in an integrated manner.

## 2.1 Program Orientation

REKOMPAK is an acronym from Bahasa Indonesia for “Rehabilitasi dan Rekonstruksi Masyarakat dan Permukiman Berbasis Komunitas”, or Community-based Settlement Rehabilitation and Reconstruction Project (CSRRP). This is the name of a community-driven disaster-based resettlement project that is oriented towards disaster risk reduction. CSRRP is a project under Directorate General of Human Settlements, MPWH. During this program, CSRRP works with several stakeholders, such as Local Government, NBDM, Local Board of Disaster Management (LBDM), Bank, Indonesian National Police, and Indonesian Army.

This program applies a few approaches, such as:

1. Community-based development;  
This approach has some following characteristics:
  - a. The main actor is the targeted community;
  - b. It uses participatory planning, design and implementation;
  - c. Every stage of project cycle takes community involvement; and
  - d. It has a gender responsive system.
2. Accountability, which means the expenditure of grant follows financial norms and CSRRP financial guidance, as well as gives a wide opportunity for internal and external financial auditing; and
3. Transparency, which means every party or person has the opportunity to access information.

In West Nusa Tenggara, CSRRP was focused on heavily-damaged houses only.

- Based on Fig.1, a facilitator in CSRRP has five tasks:
1. Conducting socialization and public hearing until beneficiary grouping;
  2. Conducting technical assistance in planning and design;
  3. Conducting technical assistance in construction;
  4. Creating weekly and monthly reports regarding the progress of the task; and
  5. Coordinating with all stakeholders in four tasks above.

### 3 Methods

The locus observed was in Lauk Rurung Timuk and Lauk Rurung Barat Sub-villages, Sembalun Bumbung, Sembalun, East Lombok Regency. As Table 1 shows, East Lombok Regency had 7,447 heavily damaged houses. The sample used in this paper was 109 beneficiaries from Lauk Rurung Timuk and Lauk Rurung Barat sub-villages mentioned in Regent Decree.

Qualitative approach was employed because this paper aims to identify the implementation of rehabilitation and reconstruction of community housing. This approach was adopted based on four-month experience. Study literature, participant observation, informal interview and group discussion were conducted to collect data. During four months of duty as CSRRP, the methods were applied in these three big phases:

1. Socialization and public hearing;
2. Planning and design; and
3. Construction.

#### 3.1. Socialization and Public Hearing

First of all, CSRRP was given a list containing names and addresses of the people that would be socialized. CSRRP and the society affected by the earthquakes had a meeting to discuss: 1) the description of the program that is community-based, so the society was expected to rehabilitate and reconstruct the houses damaged by the earthquakes independently, 2) the pattern of the program (Fig. 1), and 3) the concept of how a seismic-resistant house works and types of seismic-resistant house they could select.

Typically, the socialization is conducted in sub-district first and proceeds to smaller groups: village, sub-village, or individual when needed. At that time, only three types of house were offered: RISHA, reinforced-concrete house, and wood-based house. Reinforced-concrete type was not very popular because of the trauma.

**Table 2.** RISHA Dimensions

RISHA Type	Thickness	Width	Height
P1	2.5 cm	30 cm	120 cm
P2	2.5 cm	20 cm	120 cm
P3/Connector	2.5 cm	30 cm	30 cm

In contrast with reinforce-concrete and wood-based, RISHA is relatively less known. RISHA is an abbreviation from Bahasa Indonesia for *Rumah Instan Sederhana Sehat* or Simple and Healthy Instant House, which is introduced by MPWH. A construction

technology to build this type of house consists of three standardized different modular size blocks made of reinforced concrete.

RISHA is introduced concerning its construction speed, strength and durability. Because RISHA is made of reinforced-concrete, it was rejected by the society at the first time. After CSRRP explained that the wall could be constructed from other light materials, the society started to accept RISHA. It is important to note that RISHA only covers structural elements of the house; beam and column.

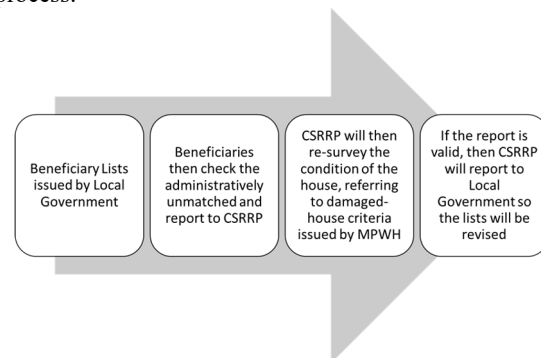


**Fig. 3.** P3 RISHA in Workshop



**Fig. 4.** P2 (left) and P1 (right) RISHA in Workshop

The output of this phase is to create groups and hold public hearing. Each group shall consist of 10 up to 20 individuals and be designed to have the same preference of seismic-resistant house, but it is acceptable to have less than 10. In parallel with grouping process, the society re-checks the status of their house; for instance, it is heavily damaged or lightly damaged. It is understandable that some people try to convince that their house belongs to heavily-damaged category. They have a right to complain. The following is the flowchart of the public hearing process:



**Fig. 5.** Flowchart of Public Hearing.

This flowchart helps people to differ what is the task of Local Government and what is not. From the flowchart above, it is clear that CSRRP does not have the authority to revise the Beneficiary List, but CSRRP can report it to Local Government. This hearing is effective to re-check the grant right on target. CSRRP is open for aspiration, while the society performs social control to make sure the one who receives the grant is the one who deserves it.

In order to create a fine group, every administration document in individual possession must be carefully checked to prevent problems in near future. Normally, here are the documents that should be checked:

1. Identity Card
2. Family Card
3. Account Book

In the end, eight groups were formed in which three of them selected RISHA and the rest preferred wood-based house. This selection was primarily based on the flexibility of structure as RISHA has more rigid configuration (it has definitive length, width, and thickness). These groups were then legalized by Local Government (village). If a member decided to leave the group, Local Government (village) had to re-legalize the group.

### 3.2 Planning and Design

This process started with land checking, including the lands' certificate, length, width, number of windows and doors desired, type of roof, height of foundation, type of walls, and labor cost. The last three items were closely related with local wisdom and environment surrounding the area. Sembalun Bumbung village is characterized as a village with less drainage, strong mountain wind, and very heavy rain. These characteristics affected the house designed.

CSRRP performed surveys to collect data about certificate and dimension of the area. After that, one group, which was well-educated after the socialization phase, gathered to discuss the number of windows and doors desired, type of roof, height of foundation, type of walls, and labor cost. Although the labor cost was calculated daily, the maximum amount was important as it defined the maximum cost of materials. One group shall have typical design mentioned above. This was encouraged because it simplified the design and shortened the time needed since each individual had plenty of construction drawings and one cost estimation.

Once the data were collected, the planning process was finished. The design phase started with sketching the house and estimating the cost of it. This was suggested rather than drawing the CAD directly since the cost given was limited and the process should be approached iteratively. Drawings and cost estimation were made concerning the budget and the house desired.

In this phase, the supplier of materials was selected. In order to choose the best supplier, the group surveyed in total three different suppliers to provide materials needed. Those materials covered foundation, wall, floor, window,

door, and roof. The structure itself was divided into two types; RISHA and wood-based. Normally, the groups selecting RISHA made a contract document with RISHA applicator, while the groups selecting wood-based house did not make any contract like RISHA. The purchasing of the wood for structure was the same as other materials, but RISHA was a special case because RISHA applicator needs to be certified by MPWH.

**Table 3.** Requirements of Fund-Liquefying

Requirements	Percentage	Amount per individual
1. Listed in the Beneficiary List 2. No unsynchronized data between Identity Card, Family Card, Book Account, and Beneficiary List 3. Gathering in a group with the same house preference 4. Signing a declaration letter mentioning the readiness to follow the program	50% liquefied	IDR 25,000,000.00
1. 80% of IDR 25,000,000.00 used 2. Minimum 40% physical progress of construction	30% liquefied	IDR 15,000,000.00
1. 70% of IDR 15,000,000.00 used 2. Minimum 70% physical progress of construction	20% liquefied	IDR 10,000,000.00
Total	100% liquefied	IDR 50,000,000.00

After the cost estimation was fixed, the group would be expected to fill a form called "fund usage plan". The guideline at the time instructed beneficiary to liquefy 50% only of total IDR 50,000,000.00 per individual. the scheme to liquefy the fund is summarized in table 3.

One group had only one bank account to simplify the fund's transfer. It was also intended that in purchasing and payment, the group acted collectively.

However, some individuals from the groups in the socialization phase could not proceed. Thus, only 76 houses involved in the design process and CSRRP performed regrouping in parallel. This happened because CSRRP was filtering from Beneficiary List issued by Local Government. It was sorted by considering:

1. The number of targeted people and the number of CSRRP team members;
2. Public facilities that were still included in Beneficiary List;

### 3.3 Construction

The process started with fund settlement from the bank to the group's bank account. After that, the groups went to

the supplier and listed the materials they desired to purchase. Once all the materials were delivered, the payment would then be issued.

In the areas devastated by the earthquakes, construction began after the land was cleared. Normally, the construction site is full of damaged reinforced concrete, damaged wall, damaged roof, and some portion of foundations.

The construction phase was the point of self-help scheme. At this phase, labors from society were registered and started constructing theirs and their neighboring houses. Facilities were provided and technical advice was offered. They started considering the ties for shear force, minimum bar diameter for column and the importance of structural integrity.

The construction phase was relatively normal although supervision was still needed. There were few technical concerns regarding the construction, but since the society saw CSRRP's commitment, trust was successfully built and they followed the supervision from CSRRP.

## 4 Analysis

CSRRP performed rehabilitation and reconstruction in Lauk Rurung Timuk and Lauk Rurung Barat Sub-villages. These performances included:

1. Providing assistance to repair community houses (rehabilitation);
2. Conducting conflict reconciliation and resolution (rehabilitation);
3. Implementing resilient building design (reconstruction); and
4. Increasing participation of institutions, community organization, private sector, and society (reconstruction).

Several problems were observed and matched with those mentioned by ADB as follows:

### 4.1 Formulation of Recovery Program

Community-based recovery policy chosen by the government was intended to give society understandings about the earthquake hazards in Indonesia and the seismic-resistant house. Consequently, longer time was required. Time became more critical due to rainy season, threatening diseases, and some necessities that needed to be resolved privately. Another policy that could be taken was contractual based. Although the society experienced no educational process, the advantages of contractual scheme were the same quality of the building and faster processing time.

### 4.2 Standard

Since Indonesia is a country with high seismic hazards, the concept of recovery and disaster management in general must be standardized although every disaster has its unique treatment. This standard can include the

treatment method (community based or contractual based) and categories of damaged houses.

This standardized category will avoid turmoil in society because it will be extremely difficult to encounter an individual whose status is downgraded (for instance: from heavily-damaged to lightly-damaged) since it is directly related to the fund received.

### 4.3 Necessity to Re-survey

Multiple earthquakes cause verification and validation process to repeat. A house was once verified and validated as lightly-damaged, but then changed when the next earthquake hit. The Local Government found it difficult to deal with because they could not forecast what time the very last earthquake occurred. When the next earthquake hit, they needed to start the process all over again. However, verification and validation are very important because CSRRP will use the results.

Another issue appeared as the process of re-survey was taking place. A time between the last earthquake and the start of verification and validation was very concerning since society could exploit this period to destruct their own houses in order to receive the fund they desired. This concern rose because the three categories of damaged houses were introduced along with their nominal fund.

### 4.4 Administrative Document and Land Certificate

During the socialization phase, CSRRP also verified the administrative documents of each individual before proceeding to the second phase (planning and design). As mentioned above, CSRRP checked the Identity Card, Family Card, and Account Book and synchronized these documents with the Beneficiary List given by the Local Government. The delivery of fund was performed by bank transfer. The bank, selected by the government, had strict rules regarding the identity. In order to describe this case, take a look at Table 4.

Once CSRRP found one of those four documents unsynchronized, CSRRP guided the person to Local Government (village) to make a declaration letter mentioning that this person had two different identities in two of his/her administrative documents. Without declaration letter signed by Local Government (village), incorrect spelling would not be tolerated by the bank. This scheme is also applicable when the beneficiary is outside Indonesia or if the beneficiary has inheritance matters.

**Table 4.** Example of Synchronization of Administrative Documents.

No	Identity Card	Family Card	Account Book	Beneficiary List	Result
1	H. ABD. KUDUS	H. ABD. KUDUS	H. ABD. KUDUS	H. ABD. KUDUS	OK
2	ANAHA	ANAHA	ANAHA	ANNAHA	NOT OK

CSRRP also encountered land problem. Plenty of individuals did not possess land certificates to their names, so the chance of conflict caused by land problem was high. Fortunately, the damaged area did not get cleared by heavy-equipment. This is principal as the society could still consolidate and have mutual understanding of their land boundaries.

The synchronized data between those four documents, including the land certificate, must be solved to provide faster action during disaster. This may involve Ministry of Internal Affairs, Ministry of Agrarian Affair and Land Planning and National Land Agency.

These administrative issues caused delay of time, hence 6 individuals decided not to join the program. It means that those people would build their houses by themselves. There were only 70 houses proceeded to construction phase. According to the Regent of East Lombok in formal discussion conducted in Sembalun, 40% of beneficiaries in East Lombok decided not to join the program and have been constructing their houses independently since then.

#### 4.5 False Impression

When CSRRP arrived, society had three wrong perceptions. First of all, they thought that CSRRP was a verification and validation team. This was fundamental and must be cleared because the central government did not have the authority to determine who is selected as a beneficiary, but the Local Government did.

Secondly, they thought that the grant was a compensation for the damage caused by the disaster. Apparently, it is simply a stimulus to help society to accelerate their settlements recovery. Compensation means the government grants society as much as the house price. The policy states that regardless of the house cost, the grant is 50,000,000.00 IDR for heavily-damaged.

Thirdly, some people in the society thought that the fund could be used not only for building houses, but also for fulfilling other necessities such as food and seed. Although this is prohibited by the guideline, this is understandable because of two reasons: (1) people in Sembalun Bumbung spent only half of total 50,000,000.00 IDR to build their houses. No wonder the houses can be easily damaged by earthquakes; and (2) this program required careful attention, hence people could not go to work and earn for living. CSRRP did multi-level socializations to clear those perceptions in parallel with public hearing.

Correcting these perceptions took longer time and some of the beneficiaries decided not to join and built their own houses without assistance. Their constructions were performed with less supervision from CSRRP because at the same time, CSRRP focused on clearing the administrative obstacles and repeatedly regrouping other beneficiaries while keeping performance stay within the law.

#### 4.6 Price of Materials

The price of materials was one of the major concerns during the planning phase. Since the cost was limited, usually the water closet, electrical system, and plafond were not provided in the house, although it depended on the cost unallocated. The guideline allowed the group to collect their assets that could be used in order to reduce the cost and maximize the components of the house.

In particular, the cost estimation must also consider transportation. Sembalun Bumbung is located 1,200 meters above sea level, hence the supply materials are expensive and the suppliers are very limited. Normally, it takes 45-minute trip to find suppliers, not to mention that the road is very steep. The groups needed to compromise their design in order to meet the cost limit because the price was getting higher in line with the obstacle.

The price was also affected by the number of beneficiaries. The demand was rising, but the supply remained constant, so the price rose unexpectedly. Both RISHA and wood material were rare. Thus, it was difficult for the facilitators in CSRRP to find the materials, especially when it came to wood-based house. Different from RISHA of which quality is more guaranteed, it was extremely hard to determine which wood was accepted. To cope with this limitation, the purchasing of the wood must be thoroughly checked as well, especially its density and water content.

#### 5 Conclusion

CSRRP performed rehabilitation and reconstruction in Lauk Rurung Timuk and Lauk Rurung Barat Sub-villages. On December 21, 2018, there were 61 houses under construction; on March 25, 2019, 61 houses were finished, while 9 houses were under construction.

In these studied locations, 6 out of 12 recovery problems occurred and most of them were in socialization phase. Those problems delayed processes. Thus, people and the local government are encouraged to have more accurate administrative documents before the approach.

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