Post-disaster reconstruction framework of Taiwanese indigenous people: A case study of 2009 Typhoon Morakot reconstruction process

台湾少数民族の災害復興フレームワーク：2009 年モラコット台風の復興過程を事例として

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EXECUTIVE SUMMARY

1. Background of the dissertation

Due to the global climate change, the extent and the frequency of natural disasters had been intensified. It is fair to say that most human habitats have been exposed to the threat of natural disasters with high disaster vulnerability. Therefore, the post-disaster reconstruction has been focused on by related governmental sectors and international organizations. For instance, the Sendai Framework for Disaster Risk Reduction, ratified in 2015 by the United National Assembly, has been considered the milestone and paradigm shift in disaster risk reduction and post-disaster reconstruction.

Without exception, Taiwan is also one of the disaster-prone islands. Located on the pacific rim seismic belt and overlapping several frequent typhoon paths, 99% of the island's land is vulnerable to two kinds of natural disasters (Dilley et al., 2005). Although the 1999 Ji-ji Earthquake had induced unprecedented disastrous casualties and damages, according to NCDR (2021), the Typhoon disaster accounted for more than half of the natural disaster events. Especially, Typhoon Morakot, which hit Taiwan on August 8, 2009, is regarded as the largest typhoon disaster in Taiwan historically. Noticeably, since the precipitation of Typhoon Morakot had caused the land slide of the southern mountainous tribal communities, 73% of the disaster victims were the indigenous population, rendering the disaster event unique.

After the disaster, the central government immediately launched a contingency relief plan, cooperating with NGOs and local government. The joint working groups had completed the investigation of the affected areas, determined the permanent housing beneficiaries, and found the construction site. During the government's budgetary constraint, the permanent housing construction, which served as the post-disaster housing of the disaster victims, was conducted by the major NGOs, including World Vision, Red Cross, and Tzu Chi.

Despite many undergoing discussion and abundant in-field post-disaster reconstruction implementation experience, countless concurrent mistakes and problems are still hard to be eliminated. As Arefian (2018) stated, *"how"* reconstruction activities are organized and implemented is intricately linked to multiple levels of policy, stakeholders, process, and other pivotal aspects. Moreover, Davis (2007) stated that the complexity of post-disaster reconstruction is because the project often includes physical, psychological, economic, social, and environmental issues. Therefore, due to the large scale, long-term (the conduct of research was ten year after the disaster), multiple stakeholders related (NGOs, central and local government, and residents), and disaster victims' ethnic diversity, the post-disaster reconstruction project after Typhoon Morakot had been selected as the case study of the dissertation.

2. Research questions

- What was the reconstruction policy of the Typhoon Morakot PDR project and the differences in planning and spatial characteristic among different reconstructed settlements?
- What were the most vulnerable ethnic group after Typhoon Morakot (Chinese or indigenous)? What

caused indigenous people to be vulnerable to the disaster?

- Since the Typhoon Morakot PDR project was an entire NGO-led program, how was the cooperative relationship of NGOs with other essential stakeholders in the indigenous context?
- Ten years after the disaster, what was the change, alternation, and modification of the post-disaster housing due to indigenous residents' social and economic requirements? What were the impediments that hamper the socioeconomic recovery progress of the indigenous community?
- How to suggest and provide a suitable PDR framework for the indigenous groups, which can comprehensively facilitate the groups' cultural, social, economic, and physical recovery?

3. Research objectives

- To investigate the detailed implementation framework and procedure of the Typhoon Morakot PDR project. To identify the difference in the planning of each reconstruction settlement.
- To compare the vulnerability, social capital, and awareness of disaster impact of different disaster-affected ethnic groups.
- To identify the cooperative strategies that different NGOs took during the PDR program. To analyze the relationship and interaction among different critical stakeholders.
- To explore how residents modify their post-disaster houses, patterns of modification, the physical, social, and economic factors of housing extensions, as well as the issues regarding long-term socioeconomic recovery in the indigenous community.
- Provide a comprehensive PDR project implementation framework to facilitate the future PDR project in the indigenous context.

4. Research scope

The data collection was conducted between August 2017 to March 2021, around ten years after Typhoon Morakot hit Taiwan. Therefore, the research can better capture the livelihood restoration process after the permanent housing reconstruction. Regarding the research case studies, since the dissertation applied both macro and micro perspectives, chapters three to four use the macro perspective to scrutinize the implementation framework and procedure of the Typhoon Morakot post-disaster reconstruction project. Moreover, the characteristic of different ethnic groups had been focused on (objectives one and two). On the other hand, from chapter five to six, the dissertation looked into two indigenous post-disaster reconstructed settlements—Rinari and Changzhi Baihe, given that the reconstruction work had been conducted by different NGOs and a relatively large number of relocated households.

5. Research findings

The findings of this dissertation are centered on the following issues that answer the research questions posed above:

- What was the reconstruction policy of the Typhoon Morakot PDR project and the differences in planning and spatial characteristic among different reconstructed settlements?

Regarding settlement planning, the research found that most disaster-affected communities had been divided or merged with different communities during the relocation decision. Moreover, due to the ad-hoc implementation, most of the settlements had been constructed on remote government-owned land, which deteriorated the post-disaster recovery of the residents. The research also showed that different NGOs acted differently during the settlement planning, while the resident highly evaluated the *"compound configuration,"* given that security, privacy, and community solidarity had been considered. Regarding the reconstruction policy, it was clear that the temporary housing policy had been ignored, and the presence of NGOs was tremendous.

- What were the most vulnerable ethnic group after Typhoon Morakot (Chinese or indigenous)? What caused indigenous people to be vulnerable to the disaster?

The research found that the pre-disaster social vulnerability can further widen the income and employment performance of both ethnic groups after the disaster. Although indigenous groups had higher social capital and social network than their Chinese counterparts and the pro-indigenous post-disaster reconstruction policy, the indigenous groups still showed difficulty recovering from the disaster compared to the Chinese groups, which attributed to their unique cultural context and self-identities.

- Since the Typhoon Morakot PDR project was an entire NGO-led program, how was the cooperative relationship of NGOs with other essential stakeholders in the indigenous context?

In the case of the NGO—government relationship, it was clear that NGOs can compensate for the role of the government and provide the necessary assistance to the community. However, NGOs can also dominate the decision-making. Regarding the NGO—community relationship, the flexibility of NGOs and mutual trust with the community can facilitate the post-disaster reconstruction projects. Nonetheless, the community might refuse the assistance of the NGOs if their culture and identities were not respected.

- Ten years after the disaster, what was the change, alternation, and modification of the post-disaster housing due to indigenous residents' social and economic requirements? What were the impediments that hamper the socioeconomic recovery progress of the indigenous community?

Five housing extension patterns were identified through the field survey of the Rinari settlement. The reason for extension including providing a satisfactory living space, catering to traditional livelihood, expressing one's identity and indigeneity, and catering to post-disaster livelihood. However, due to the violation of the building act, the housing extension also spurred the conflict between residents and governments. Through the interview survey, the research identified post-disaster long-term issues such as the reasonable and fair enforcement of the permanent housing extension demolition, legally extending the housing and obtaining land ownership, returning to their original community and road repair, and the livelihood support in the

future.

- How to suggest and provide a suitable PDR framework for the indigenous groups, which can comprehensively facilitate the groups' cultural, social, economic, and physical recovery?

According to the above findings, considering disaster risk reduction and participatory planning, a framework was proposed based on several holistic post-disaster reconstruction stages. The framework can be implemented by the NGO, government, and residents, especially useful in the indigenous context.

6. Implications for future research

The uniqueness of this research was two. First, this research looked at the short-term recovery process and analyzed the long-term (more than ten years) recovery process so that the scope of the research can cover various topics, including post-disaster livelihood development and housing extension. Second, since the targeting communities were indigenous groups, the research suggested that the cultural factors also profoundly impacted the post-disaster recovery.

The following research activities should broaden the focus to foreign indigenous post-disaster reconstruction projects in the future. In addition, some of the comparison studies can be done based on the findings of this research.

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ABREVIATIONS AND ACRONYMS

AIPA:	Administration of Indigenous People Affairs
CGPDRC:	Central Government Post-Disaster Reconstruction Committee
CIP:	Council of Indigenous People
DRR:	Disaster risk reduction
EPC:	Environmental Planning Collaborative
GDP:	global gross domestic product
GRNGO:	Grassroots Non-governmental oganization
HFA:	Hyogo Framework for Action
ICSU:	International Council for Science
IFRC:	International Federation of Red Cross and Red Crescent Societies
IICN:	Inter-indigenous communities network
INN:	Inter-NGOs network
IPCC:	Intergovernmental Panel on Climate Change
IRDR:	Integrated Research on Disaster Risk
LRC:	Life Reconstruction Center
LSNGOs:	Large-scale Non-governmental organizations
MPDRC:	Post-Disaster Reconstruction Regulation of Typhoon Morakot
NCA:	National counterpart aid model
NCDR:	National Science and Technology Center for Disaster Reduction
NGO:	Non-governmental organization
NTD:	New Taiwan Dollar
PCG:	Pintung County Government
PDI:	Personal disposable income
PDR:	Post-disaster reconstruction
PPP:	Public-private partnerships
SNS:	Social Network Service
TWS:	Temporary working scheme
UDN:	United Daily News
UNCHS:	United Nations Centre for Human Settlements
UNISDR:	United Nations Office for Disaster Risk Reduction (changed its acronym to UNDRR from 2019)

Chapter 1

1. Introduction

This chapter presented an overview of the entire Ph.D. dissertation. First, regarding the research background, the chapter differentiated and defined the concept of natural hazard and disaster. Second, given the increase of natural disasters, a big picture of the global natural disaster trend, geographical distribution, and categories was focused. Second, the concept of post-disaster reconstruction (PDR) was explained. Eventually, the case study used in this research, research questions, objectives, scope, and methodology, was presented as the background information for the following chapters.

1.1 Natural hazard and disaster

"Natural hazards only become a disaster when they affect people and society" (Sternberg, 2017). This quotation implies the distinct difference between natural hazards and disasters. To name something as a hazard entails potential danger and risk to humans, which cannot be avoided and concurrence on our planet. However, if natural hazards happen in human habitats which impact human society directly or indirectly, it should be recognized as a disaster. Looking back to history, countless case studies had shown the massive destruction of disaster aftermath (tsunamis, earthquakes, and typhoons).

1.1.1 Trend of natural disasters in the world

When it comes to the categories of natural disasters. The international disaster database (EM-DAT) sorted the natural disaster into geophysical (earthquake and volcanic activity), meteorological (extreme temperature, fog, typhoon), hydrological (flood, landslide, and wave action), climatological (drought and wildfire), biological (epidemic, insect infestation, pandemic), and extraterrestrial groups (impact and space weather; EM-DAT, 2022). According to the Centers for Disease Control and Prevention (CDC; 2021), the homepage listed earthquakes, landslides and mudslides, volcanoes, extreme heat, lightning, wildfires, floods, tornadoes, winter weather, hurricanes (typhoons), and tsunamis as the major natural disaster events. It is clear that natural disasters have high diversity and can happen in different scenarios.

If we look at the variety of natural disasters, approximately 60,000 people globally die from natural disasters each year (excluding the pandemic), which accounts for 0.1% of the global deaths. Nonetheless, the number of deaths from a natural disaster can fluctuate from year to year. According to Figure 1.1, from 2000 to 2020, in most of the yearly data, the annual number of casualties to natural disasters was around 100,000. However, the 2004 Indian Ocean earthquake, 2008 Cyclone Nargis in Myanmar, and the Haiti earthquake in 2010 raised the number of casualties to more than 200,000 (Our World in Data, 2021). Therefore, it is fair to say

that though the number of death due to disasters varies, the mega disastrous event did not absent in the latest two decades.

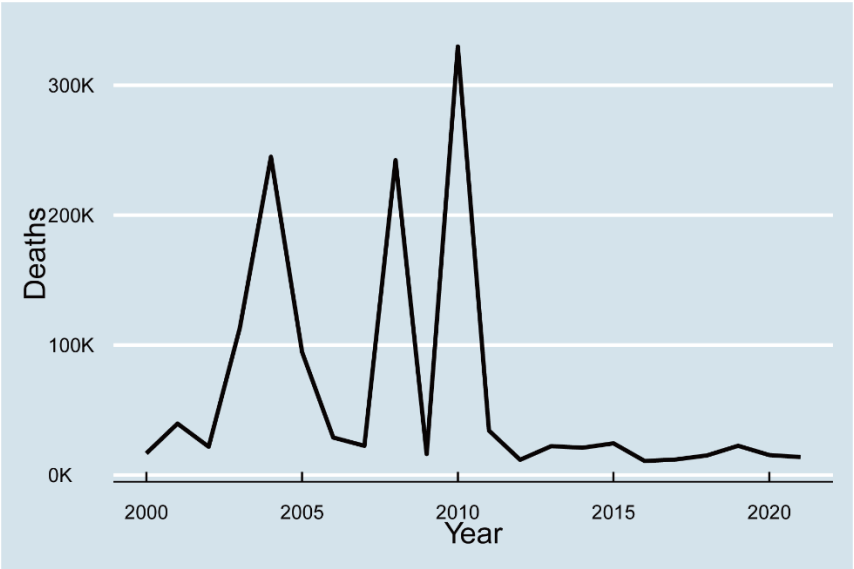

Figure 1.1 Global deaths from natural disaster, 2000-2021

Source: EM-DAT (2021); reproduced by the author

Regarding the natural disaster deaths based on the regional data, the result was plotted in Figure 1.2. The deaths had been categorized based on the continental pattern. The number of deaths in five continents from 2000-2020 was 872,473 (Asia), 145,053 (Africa), 312,396 (Americas), 5,814 (Oceania), and 158,525 (Europe), respectively. Among all, the Asia region accounted for disproportionately most deaths, given the vast area, diversity of disaster types, and huge population (EM-DAT, 2021).

Next, the economic loss due to the natural disaster was analyzed. According to the EM-DAT (2021), the total economic loss in Asia, Africa, the Americas, Oceania, and Europe from 2000-2021 was 1226 billion, 24 billion, 1310 billion, 78 billion, and 260 billion USD, respectively. The data was shown in Figure 1.3. The Americas and Asia bared most of the economic loss among all the continental regions. However, the economic loss in the Americas can attribute to its relatively high GDP per person and the availability of the financial data record. Therefore, it is evident that Asia is vulnerable to natural disasters.

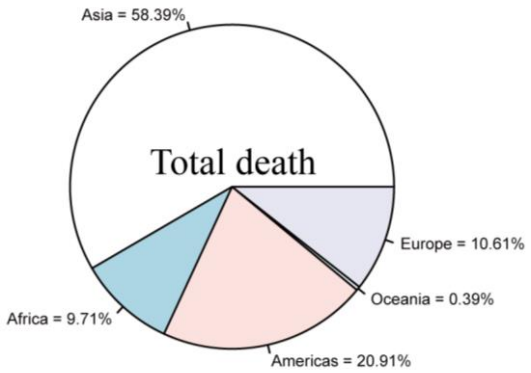

Figure 1.2 The continental distribution of the natural disaster driven deaths from 2000-2021
Source: EM-DAT (2021); reproduced by the author

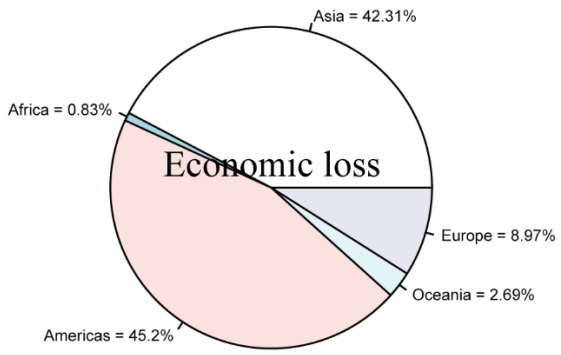

Figure 1.3 The continental distribution of the natural disaster economic loss from 2000-2021
Source: EM-DAT (2021); reproduced by the author

Moreover, it is crucial to look at the natural disaster frequency that occurred annually in the last two decades. According to the EM-DAT database, though a declining trend of the natural disaster was observed from the millennium, the number of the disaster hiked up again in the nearest decade (Figure 1.4). According to the United Nations, the recent natural disaster has several characteristics. First, the fatality rate of disasters has decreased, but the economic loss has increased. Second, compared to the more frequent and less intense *"generalized disaster risks,"* the majority of fatalities and economic losses are caused by the less frequent but more *"intensely concentrated disaster risks"* (United Nations, 2011).

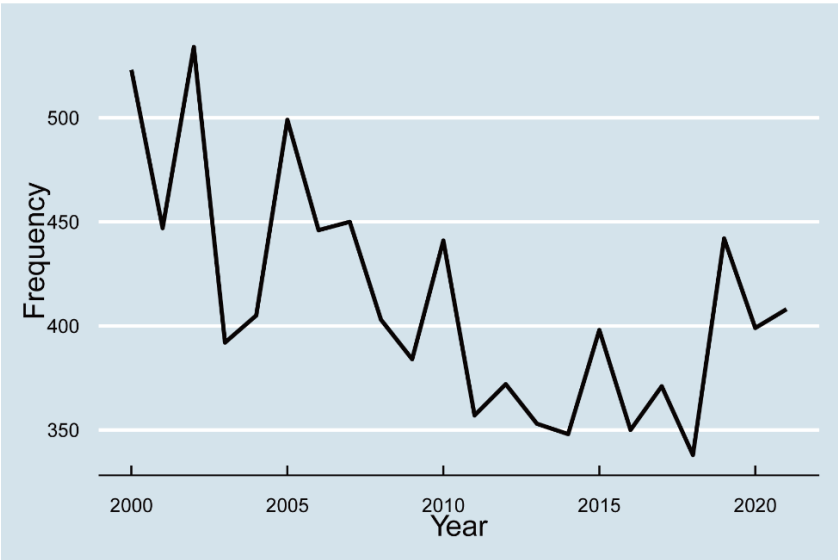

Figure 1.4 The disaster event frequency from 2000 to 2021
Source: EM-DAT (2021); reproduced by the author

The author plotted the disaster event frequency based on the regional distribution according to the given data (EM-DAT, 2021). In Figure 1.5, the five continental areas were marked in different colors. It is evident that Asia takes the lead regarding the number of natural disaster events.

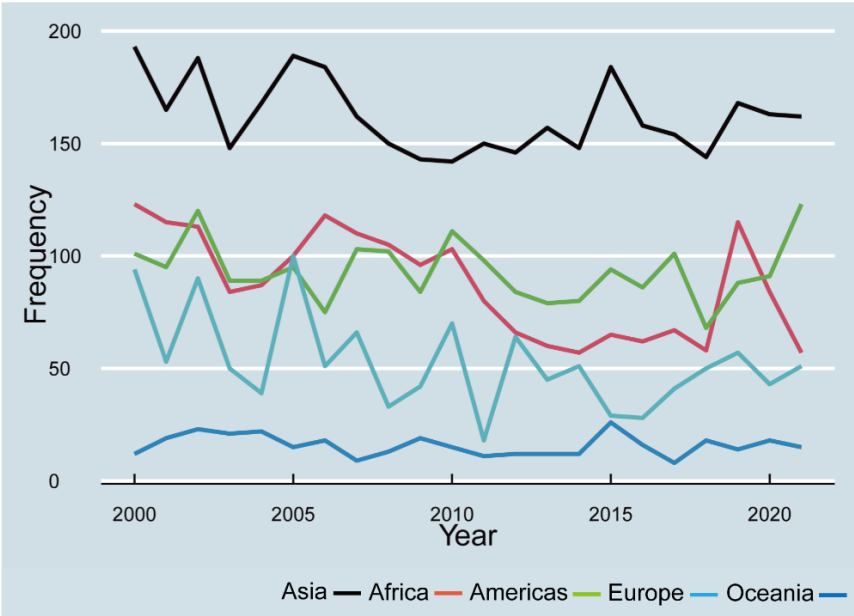

Figure 1.5 The continental distribution of the natural disaster frequency from 2000 to 2021

Source: EM-DAT (2021); reproduced by the author

From the above data, it is fair to conclude that the intensity and number of natural disasters varied from year to year. However, the mega-disaster event still frequently occurred in the past decades. From the regional perspective, it is evident that the Asia region accounted for most of the natural disaster events and casualties. It is due to Asia's vast population and complex climatic conditions. Moreover, its concentration of population also added up to its disaster vulnerability. According to Statista (2019), the urbanization progress had been churning out most dramatically in recent years. The urban population in the Asian cities in 2015 already accounted for more than half of the urban population on the earth. In the near future, the number is expected to grow (Figure 1.6).

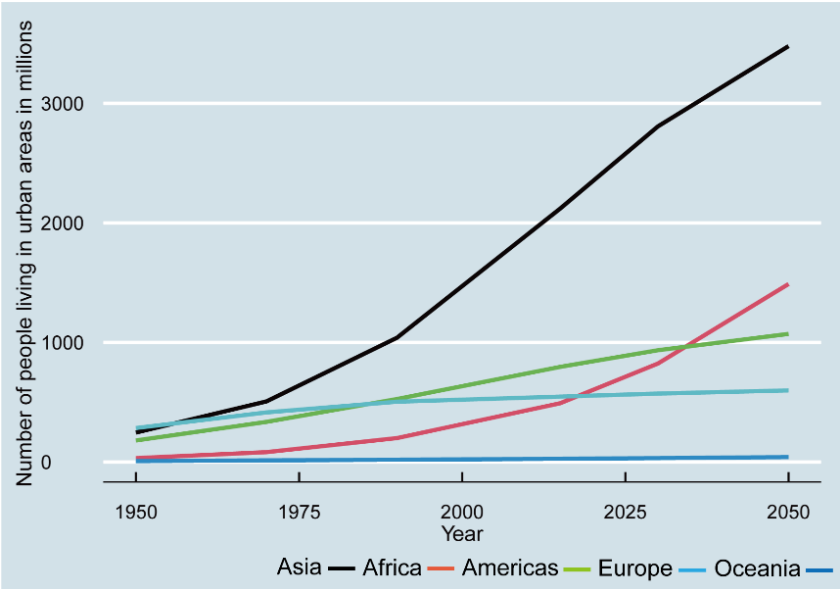

Figure 1.6 The population living in urban areas worldwide from 1950-2050

Source: Statista (2019)

1.1.2 The natural disaster in Asia and Taiwan

As discussed before, there is no argument that Asia is hit by a tremendous number of large-scale natural disasters after the millennium, which bared a significant amount of human and economic loss. It is widely believed that the vulnerability to the disaster attributes to the regions' geography, population size, and environmental and social instability (Daly and Feener, 2016). The recent mega natural disaster events such as the 2004 Indian Ocean earthquake and tsunami, Cyclone Nargis in Myanmar, 2008 Wenchuan Earthquake, 2011 East Japan Earthquake, and 2015 Nepal earthquake all inflicted catastrophic damage to the Asia region. Moreover, these disastrous events mainly took place in developing countries, where the vulnerability is considered high.

When we look at the breakdown of the disasters types, it is striking to see that the main categories of disasters in Asia are storms and floods, which account for 78% of the total disaster event and 79% of the accumulative death toll (EM-DAT, 2011). However, these highly occurred disaster types did not initiate large-scale PDR (Post-disaster reconstruction) projects (Daly and Feener, 2016). Most of the major PDR projects were planned to tackle the aftermath of the earthquakes and tsunamis, which only accounted for 11% of the recorded disaster event. This type of disaster casualties also remained at the 20% level. Therefore,it is clear that the government easily focuses on earthquakes and tsunamis because single disaster aftermath can bring about an above-average death toll and a tremendous amount of economic loss, with considerable damage to human habitation, communities, and facilities. The mass PDR project focused on earthquake disasters in Asia are many, for instance, 1976 in Tangshan, China, 1995 in Kobe, Japan, 2005 in Kashmir, India, and 2008 in Sichuan, China. There are also compound disasters like the 2004 Indian Ocean tsunami and earthquake; the 2011 East Japan tsunami and earthquake.

Similar to the overall situation of other parts of Asia. According to the World Bank report, located on the pacific rim seismic belt and frequent Typhoon path, 73% of Taiwan’s territory is exposed to three kinds of natural disasters. Moreover, 99% of the area is vulnerable to two kinds of natural disasters. Therefore, Taiwan has been labeled as a highly disaster-prone area (Dilley et al., 2005).

Taiwan usually has five to ten disaster events every year. However, the number of disasters was increasing year by year. From 1958 to 1987, there were 4.1 natural disasters on average, while in the next 30 years (from 1988 to 2017), the annual average disaster climbed up to 7.8 times. From 1958 to 2017, more than 66% of the disaster events were Typhoons (236 times). Flood accounted for 22% (78 times), while seismic disasters accounted for 8% (30 times) of the overall disaster events (NCDR, 2021; Figure 1.7). Among three kinds of disaster types (typhoons, flood, and seismic disasters), typhoons and flood disasters have increased significantly compared to the previous decades. At the same time, the number of earthquakes remained a limited number but steadily occurred. Regarding the number of casualties, from 1958 to 2001, 15,083 had died or were injured because of the earthquake, or 47.8% of the overall died or injured population. The typhoon disaster caused 13,873, or 44% of the overall dead or injured population. Flood also affected 2,432

people's lives, which account for 7.7% of the overall dead or injured population (Ministry of interior, 2002). The major earthquake disaster in Taiwan is widely considered to be the 1999 Nantou Ji-ji earthquake. According to statistics, more than 2,000 people were killed and missing, about 12,000 people were injured, more than 50,000 houses were completely destroyed, more than 50,000 houses were half-collapsed, and more than 100,000 people were left homeless (Lai, 2019). In viewing the catastrophic disaster damage, the central government swiftly established the special regulation and formed a contingency team to cope with the aftermath of the earthquake. This is also the first large-scale PDR project in the history of Taiwan. As for the major typhoon disaster, Typhoon Morakot had brought significant rainfall, which caused the large-scale landslide and floods and rendered many settlements in Taiwan unhabitable.

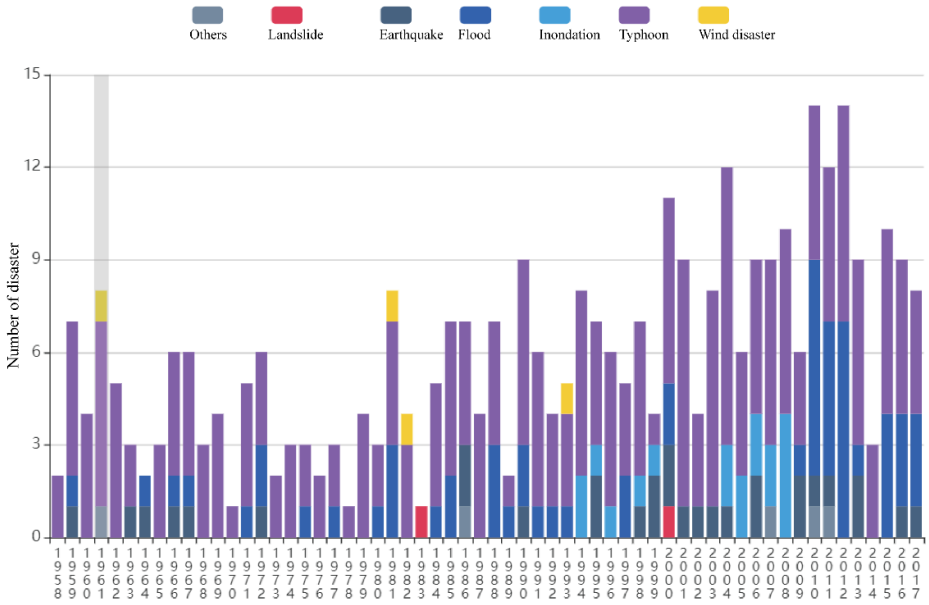

Figure 1.7 Number of the disaster and categories that happened in Taiwan from 1958 to 2017

Source: NCDR (2021)

1.2 The post-disaster reconstruction projects

The growth of natural disasters has prompted more international concern about reducing the destructive effects on the lives and livelihoods of individuals, communities, and society. Therefore, this section introduced the history of post-disaster reconstruction (PDR). Afterward, the Typhoon Morakot PDR project was discussed.

1.2.1 History of post-disaster reconstruction projects

Approximately fifty years ago, the government sectors initiated large PDR project in Peru and Turkey. The projects were to rescue people from the massive and destructive earthquakes in the cities. However, during the 1970s, although the government's engagement in the resource and budget in the PDR projects, few cases were similar to learning from (Lyons et al., 2010). Research like Blaikie et al. (1994) had criticized that most PDR projects during the 1970-80s had merely focused on the socioeconomic rehabilitation of the communities. The approaches only allow the reconstruction of the affected houses. Nonetheless, most of the

new-built houses remained unoccupied.

From the 1990s, aligned with the ever-increased disaster scale and economic loss, the various government sectors around the globe noticed the importance of PDR. Hence, the 1990s was known as the *"decade for reducing disaster risks"* (Arefian, 2018). After the millennium, the PDR projects' discussion was focused on the important international conferences. The most well-known discussion after the 2000s should be The World Conference on Disaster Reduction, held in Kobe, Hyogo Prefecture, Japan (UNISDR, 2005). The Hyogo Framework for Action (HFA), 2005-2015 was established during the conference. The framework can be regarded as a milestone for the international PDR project shifting from the reactive approach to a more proactive approach. Moreover, in the 2010s, The Third UN World Conference in Sendai, Japan, which was held in March 2015, gave birth to another well-recognized framework—the Sendai Framework for Disaster Risk Reduction 2015-2030, which had been regarded as the first significant agreement with the post-2015 development agenda (UNISDR, 2015). Nonetheless, despite the UN-driven PDR framework having been addressed and recognized widely, the approaches of the PDR in different localities can vary due to different environments, disaster types, disaster intensity, and engaged stakeholders.

To better understand the difference between different implemented PDR projects, the World Bank classified the reconstruction approaches into five types: 1. cash Approach, 2. owner-driven reconstruction, 3. community-driven reconstruction, 4. agency-driven reconstruction in-situ, and 5. agency-driven reconstruction in relocation site (Jha et al., 2010). Different kind of approach entails different stakeholders' engagement. Moreover, the owner-driven and community-driven projects need the housing beneficiaries' cooperation. Therefore, five PDR approaches have their pro and cons.

It is clear that during decades of development and discussion, aligning with the growth of disaster intensity, the PDR project had become paramount working agenda for the international society. However, there is still unsettled discussions and ongoing effort to improve the current PDR framework.

1.2.2 Typhoon Morakot and PDR project

As mentioned previously, Typhoon was the most catastrophic typhoon disaster in Taiwan, which hit Taiwan on August 8, 2009. Moreover, the precipitation brought by Typhoon Morakot approached the highest rainfall record in the world (Chen, 2009). The rainfall structure of Typhoon Morakot was clearly asymmetric due to the interaction between the typhoon circulation and the southwest airflow. Many convective heavy rainfall bands were concentrated in the southern Taiwan Strait and continued to move into the south-central part of Taiwan. Coupled with the blocking and lifting effects of Taiwan's topography, the Typhoon Morakot caused continuous rainfall in the south-central Taiwan mountains. The rainfall resulted in 699 deaths and missing, and 1,766 households suffered from housing damage, the second-highest among all disaster events in Taiwan. The total damage from Typhoon Morakot was estimated at USD 66.5 billion[1]. (Chen, 2011). Because the southern mountain area accumulated most of the rainfall, most of the disaster victims, or 73%, were

[1] According to the exchange rate of January 5, 2020

indigenous (Hsieh et al., 2012). Figure 1.8 showed the moving route of Typhoon Morakot from 2009.8.4-2009.8.11. Figure 1.9 showed the precipitation distribution in Taiwan during Typhoon Morakot. As shown in Figure 1.10, the center of the precipitation had overlapped with the indigenous habitations, especially the territories of Rukai and Paiwan indigenous groups.

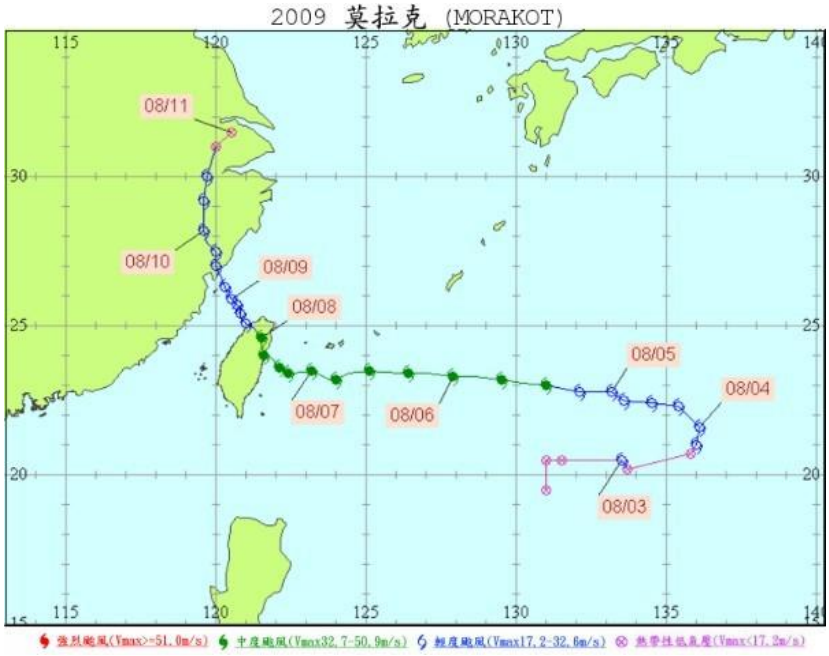

Figure 1.8 Movement of Typhoon Morakot
Source: Chen (2009)

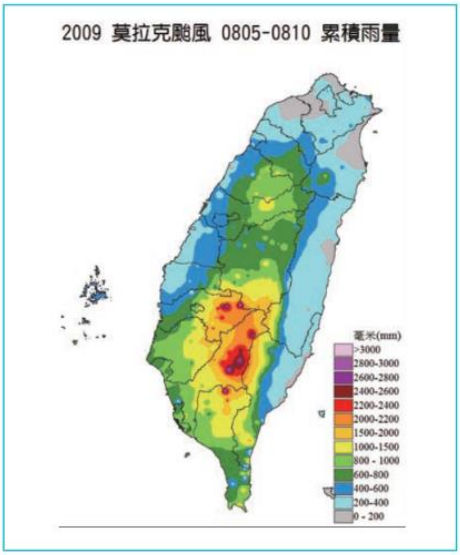

Figure 1.9 Rainfall analysis image of Typhoon Morakot
Source: Chen (2009)

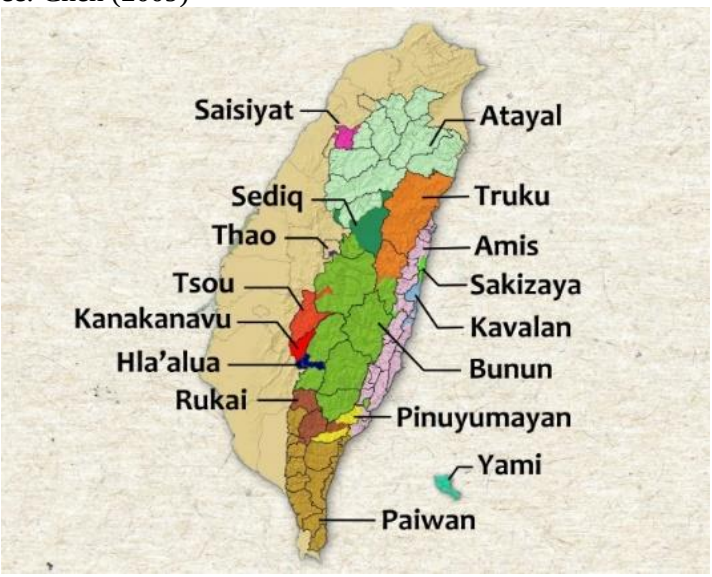

Figure 1.10 Indigenous people distribution of Taiwan

Source: Chang (2020)

After the disaster, the central government immediately launched a contingency relief countermeasure. On the other hand, the local government and NGOs provided emergency shelter for the affected people in disaster-affected areas. During the peak period, 158 emergency shelters were opened with a maximum number of 8,189 victims (Chen and Hong, 2012). Moreover, after the disaster, following the *"Post-Disaster*

Reconstruction Regulation of Typhoon Morakot," the government immediately investigated the affected villages and indigenous communities. The affected villages and indigenous communities were therefore divided into safe areas and unsafe areas according to the result of the investigation. For residents in unsafe areas, the government allocated them permanent housing at the relocation site—the permanent housing beneficiaries, and they were no longer allowed to live in their original settlement (Executive Yuan, 2009)[2]. After the government determined the number of permanent housing beneficiaries, the government began to look for construction land for permanent housing construction. At the same time, the government actively negotiated with major NGO groups to discuss possible PDR strategies. After the discussion, due to budgetary and time limitation, the reconstruction task of permanent houses was handed over to major NGOs. Therefore, the Typhoon Morakot PDR project was a total NGO-led reconstruction project. As shown in Figure 1.11, under the reconstruction regulation, the central government mainly conducted the investigation of the affected areas, while the local government determined the permanent housing beneficiaries, found suitable construction sites and established the emergency shelter with NGOs. Moreover, under the agreement (trilateral contract signed among government, NGOs, and disaster victims) with the government, NGOs independently finished the permanent housing construction.

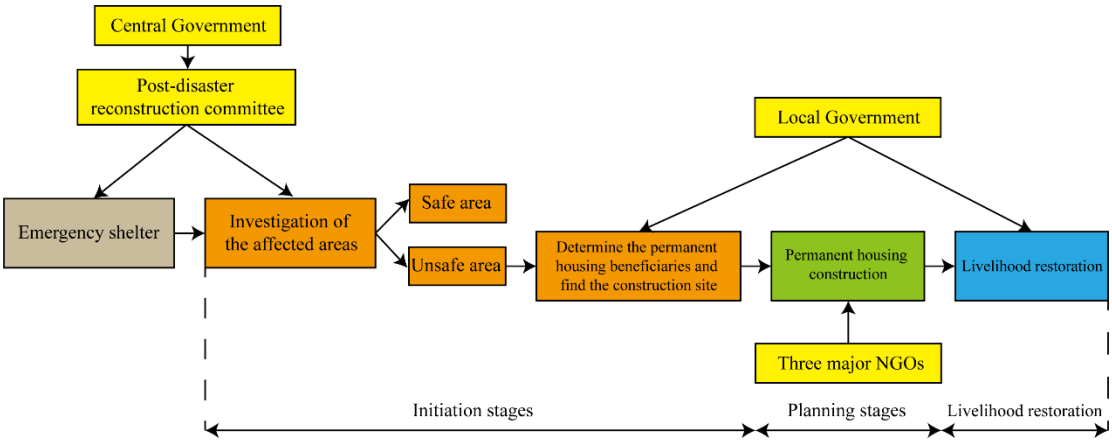

Figure 1.11 The organizational framework of the post-disaster reconstruction process

1.3 Research question, aims, scope, location, methodology, and framework

After the introduction of the research background. The research question, aims, scope, location, methodology, and framework need to be further explained in this section.

1.3.1 Statement of the problem

The extreme change of the climatic situation aligning with urbanization and the explosive increase of the global population had intensified the natural disaster—the human society becomes more prone to the disaster. It is no surprise that natural disaster has become the most threatening potential risk for human beings. The intensified disaster event urged the government and NGOs to focus on the PDR project. However, as Arefian (2018) stated, *"how"* reconstruction activities are organized and implemented is intricately linked to multiple levels of policy, stakeholders, process, and other pivotal aspects. Similarly, as Davis (2007) argued, a

[2] Base on the regulation of "Allocation, Reuse and Reconstruction of Houses after Typhoon Morakot"

multidimensional recovery framework should also be kept in mind during the planning and implementation of the PDR project. A multidimensional recovery framework including physical, psychological, economic, social, and environmental issues through a facilitative reconstruction approach should be focused. Therefore, given the multiplying complexities of planning and organizing reconstruction processes, practitioners and academics have reported several reoccurring issues in the PDR project at various levels.

Hence, by using the case study of 2009 Typhoon Morakot, some of the challenges and issues of PDR can be discussed. During the timing and interest of the dissertation, the author investigated the PDR process for up to a decade, ranging from relocation and housing reconstruction to livelihood restoration. Moreover, given that there is still a lack of PDR research conducted in the indigenous context, an indigenous-based PDR framework and suggestions were given at the end of the dissertation to facilitate the future potential PDR project in the indigenous context. Given several characteristics of the 2009 Typhoon Morakot PDR project, the case was qualified as the case study throughout the dissertation.

First, the PDR project after Typhoon Morakot was a relatively large scale in terms of the affected population and affected area. The 1,766 households that suffered from housing damage were not only tremendous but scattered in the southern counties and cities of Taiwan. Including Nantou, Yunlin, Chiayi, Tainan, Kaohsiung, Pingtung, and Taitung. Due to the massive number of households subjected to be evacuated, relocated, and reconstructed, the Typhoon Morakot reconstruction committee was established—a central government agency.

Second, multiple local governments and NGOs were involved in the PDR project because of the vast affected area and a considerable number of reconstructed and relocated needed households. Therefore, it is vital to understand any difference or discrepancy among various local governments and NGOs during various planning and implementation stages from project initiation, planning, spatial design, and resident participation. Moreover, identify the different roles of various stakeholders.

Third, ethnic diversity was also one of the distinct characteristics after Typhoon Morakot. Given that 73% of the disaster victims were indigenous, which had special human-nature, human-community relationships, and unique cultural identities (Hsieh et al., 2012; Lin and Lin, 2020). The PDR project inevitably needed to have a particular concern for these people's welfare and identities. Hence, the PDR process targeting indigenous disaster-affected communities was also one of the focuses of the research.

Forth, since the typhoon happened in 2009, the PDR and post-disaster recovery had proceeded for more than ten years. Hence, aligning with the PDR project, not only the spatial design and planning issues, various livelihood-related problems occurred recently. As David (2007) and Arefian (2018) argued, the PDR should entail the concern of socioeconomic reconstruction. Thus, in this research, the long-term recovery trajectory of indigenous groups, in terms of economic, and social, were focused.

1.3.2 Research question and aims

Based on the abovementioned four distinct characteristics of the 2009 Typhoon Morakot PDR project, there were five research questions were listed:

1. What was the reconstruction policy of the Typhoon Morakot PDR project and the differences in planning and spatial characteristic among different reconstructed settlements?
2. What were the most vulnerable ethnic groups after Typhoon Morakot (Chinese or indigenous)? What caused indigenous people to be vulnerable to the disaster?
3. Since the Typhoon Morakot PDR project was an entire NGO-led program, how was the cooperative relationship of NGOs with other essential stakeholders in the indigenous context?
4. Ten years after the disaster, what was the change, alternation, and modification of the post-disaster housing due to indigenous residents' social and economic requirements? What were the impediments that hamper the socioeconomic recovery progress of the indigenous community?
5. How to suggest and provide a suitable PDR framework for the indigenous groups which can comprehensively facilitate the groups' cultural, social, economic, and physical recovery?

Therefore, the research objectives, reflecting each of the research questions, were given:
1. To investigate the detailed implementation framework and procedure of the Typhoon Morakot PDR project. To identify the difference of planning of each reconstruction settlement.
2. To compare the vulnerability, social capital, and awareness of disaster impact of different disaster-affected ethnic groups.
3. To identify the cooperative strategies that different NGOs took during the PDR program. To analyze the relationship and interaction among different critical stakeholders.
4. To explore how residents modify their post-disaster house, patterns of modification, the physical, social, and economic factors of housing extensions, as well as the issues regarding long-term socioeconomic recovery in the indigenous community.
5. Provide a comprehensive PDR project implementation framework to facilitate the future PDR project in the indigenous context.

1.3.3 Research scope and location

The data collection was conducted between August 2017 to March 2021, around ten years after Typhoon Morakot hit Taiwan. By the time of the field survey and interview, all of the physical reconstruction projects had been finished. Nonetheless, the social and economic reconstruction is still ongoing.

Regarding the research targeted location, the dissertation looked from macro and micro perspectives. First, in the first half of the research findings, from chapter three to chapter four, the research applied the macro perspective to analyze the overall disaster-affected areas and the post-disaster reconstructed settlements on the national scale. Two chapters focused on the overall disaster-affected households, namely the relocated

households distributed in 35 settlements. These settlements are located in Nantou, Yunlin, Chiayi, Tainan, Kaohsiung, Pingtung, and Taitung regions, with more than 3,000 households (Figure 1.12; shown in red dots). Some are indigenous settlements, and some are Chinese settlements. Moreover, some of the settlements are comprised of both ethnicities. Second, from chapters five to six, as the second half of the research findings, the research shifted to the micro perspective, including two indigenous post-disaster reconstructed settlements—Rinari and Changzhi Baihe (Figure 1.12; shown in orange and black dots). There are relatively bigger settlements in the region in terms of the settlement area and the number of relocated households. Moreover, the PDR projects in two post-disaster reconstructed settlements were conducted by different NGOs. As a result, the PDR strategies, planning, and housing designs varied from each other.

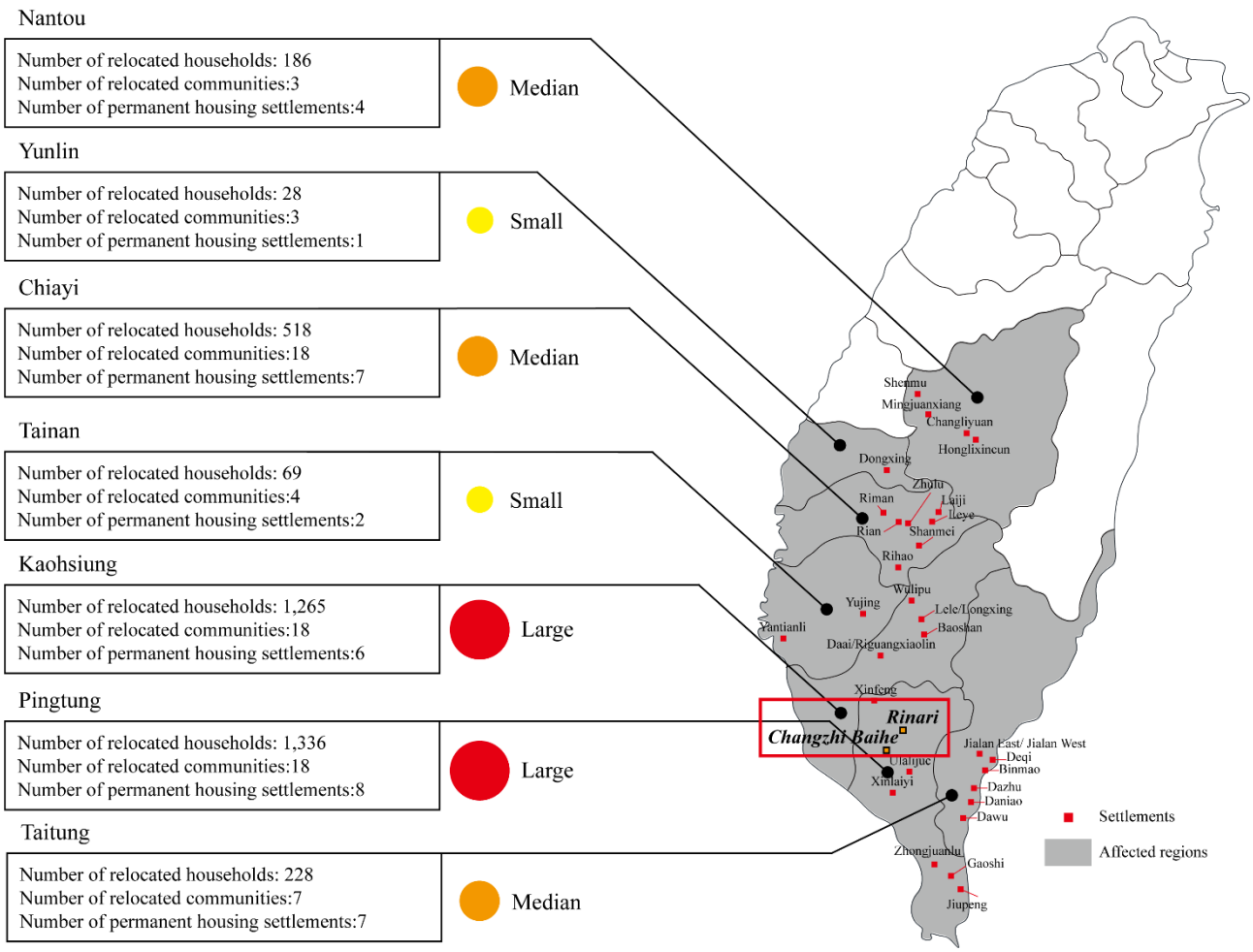

Figure 1.12 Distribution of the post-disaster reconstructed settlements

1.3.4 Research methodology

To meet the research objectives set out in the previous section, this research was conducted using the case study research method in social science. This approach has several advantages. First, the research objectives are easier to obtain and draw from a case study approach. Second, case studies enable the in-depth investigation, survey, and analysis of a case (Siggelkow, 2007). Also, in terms of the research approaches, a triangulation method—the use of both the qualitative and quantitative approaches to yield relatively

comprehensive findings- was applied. The method allows the findings gained from different methods to be cross-validated or compared (Mertens and Hesse-Biber, 2012). Specifically, the methodologies used, including 1. secondary document reviews, 2. semi-structured in-depth interviews, 3. questionnaire survey, and 4. field measurement and observation, were used. However, it is worth noticing that the same approaches might be applied in different chapters. Due to the different contents and objectives, the methodology was explained at the beginning of each chapter.

1) Secondary document reviews

An extensive literature review was undertaken to collect information such as the definition of natural hazard, disaster, PDR, and the related international case studies of PDR project to draw the critical topic and identify characteristics of the PDR project. The background information is deemed crucial as it provided some analytical perspectives, research questions, and implications for the research.

Moreover, as this case study targeted the Typhoon Morakot PDR project, related documents such as government reports, documents, newspapers, and websites were collected to use for the background information of the Typhoon Morakot PDR project.

Furthermore, given the tremendous number of newsletters from *"The 88 Morakot Disaster Network"*—an systemic new outlet that reported the Typhoon Morakot PDR project— were reviewed. Due to the number and time sequence of the text, the text analysis was adopted to count the frequency of occurrence of designated essential keywords related to the PDR project. By identifying the frequency of occurrence of a specific keyword, some of the important time-series patterns can be analyzed. Text analysis was defined as *"a research technique for the objective, systematic and quantitative description of the manifest content of the communication*" (Berelson, 1952). The secondary document reviews had been adopted in all chapters throughout the dissertation (Table 1.1).

2) Semi-structured in-depth interview

This dissertation was focused on the socioeconomic perspective of post-disaster reconstruction and recovery. Moreover, given the PDR project after Typhoon Morakot had involved multiple stakeholders, a semi-structured in-depth interview was conducted with the Typhoon Morakot PDR project-related stakeholders, including central and local government officials, community leaders, community organization leaders, NGO representatives, architects, and local households. The author believed it was crucial to gather the information from various stakeholders, given different stakeholders might have distinct and conflicting opinions toward a specific issue. The various stakeholders' interviews can also achieve a relatively unbiased consequence for the research. As for the sample selection, this research applied a purposive sampling method, which means that the selected samples align with the research objectives of each chapter (Tongco, 2007). The result thus cannot represent the overall situation in the local communities or other non-surveyed communities. Abide by the research ethic protocol, prior to the in-depth interview, the agreement from the interviewees had been obtained. The interview content was also recorded in the audio or paper format for the afterward

transcription and interpretation. Given that the local communities were indigenous households, some translators were hired if the elderly interviewees had only limited Chinese language proficiency. Given the contents and objectives are different from chapter to chapter, the interviewees and interview outlines varied in each chapter (Table 1.1).

3) Questionnaire survey

To better understand the Typhoon Morakot PDR project, the *"Social impacts and recovery survey of Typhoon Morakot"*—a nationwide, large-scale questionnaire survey which conducted by the National Science and Technology Center for Disaster Reduction (NCDR; a national level disaster research institution in Taiwan)—, was used. The aim of the *"Social impacts are recovery survey of Typhoon Morakot"* was to investigate various of socioeconomic well-being of the disaster-affected population, such as relationships, stress, needed assistance and help, trust, living environment and status, community participation, health status, human capital, recovery awareness, and community environment. The survey was conducted in 2010, 2011, 2012, 2015, and 2019 with the same groups of households, respectively, therefore able to cover the livelihood restoration phases of the post-disaster reconstruction settlements ten years after the disasters.

The NCDR was the author's internship institution during the study of master's courses in environmental management course, Graduate School of Global Environmental Studies, Kyoto University (from February to March 2018). Despite the massive data collection, the databased had rarely been used to analyze the long-term disaster recovery, recovery discrepancies between ethnic groups, and community participation in the PDR process. Thus, the survey was used to analyze the abovementioned issues after the consent and authority gained from the NCDR (Deng et al., 2011; 2012; 2013; 2017; 2020). The questionnaire survey was used in chapters three and five (Table 1.1).

4) Field measurement and observation

Given that the built environment issues were also one of the objectives of this research, the housing measurement, site observation, were conducted to understand the housing extension situation of the post-disaster housing. Specifically, the drone survey was applied in this dissertation. First, the authors had acquired all the settlement configuration plans and housing layouts of the post-disaster reconstruction settlements nationwide. Second, several drone survey was conducted to gain the photographic record. Third, through the cross-validation of the photographic data and the settlement plan, the area of extension of each household can be calculated.

Besides the nationwide scale survey, a detailed housing measurement and site observation was conducted in Rinari Settlement—a post-disaster reconstruction settlement in Pingtung County. 28 households in the settlement were selected. Several housing measurements and observations were conducted inside the housing to identify further the functions of the extended part of the housing. Furthermore, the extension's usage, motivation, and reason were asked. The method was adopted in chapter six (Table 1.1).

Table 1.1 Adopted methodology in the research finding chapters

Chapter	Research objectives	Methodology used
CH3	Investigate the detailed implementation framework and procedure of the Typhoon Morakot PDR project.	Secondary document reviews (including text analysis)/ Semi-structured in-depth interview.
	Identify the difference of planning of each reconstruction settlement.	Field measurement and observation.
CH4	Compare the vulnerability, social capital, and awareness of disaster impact of different disaster-affected ethnic groups.	Questionnaire survey/ Semi-structured in-depth interview.
CH5	Identify the cooperative strategies that different NGOs took during the PDR program.	Second document reviews/ Semi-structured in-depth interview/ Questionnaire survey.
	Analyze the relationship and interaction among different critical stakeholders.	
CH6	Explore how residents modify their post-disaster house, patterns of modification, the physical, social, and economic factors of housing extensions.	Secondary documents reviews/ Semi-structured in-depth interview/ Field measurement and observation.
	Explore the issues regarding long-term socioeconomic recovery in the indigenous community.	Secondary documents reviews

1.3.5 Thesis structure and framework

The dissertation was divided into three sections and seven chapters, as presented in Figure 1.13. Each section and chapter was described as follows:

Part I: Introduction and theory

Part I contained chapters one and two. The section provided an overview of the dissertation and the critical concept and theory regarding the PDR project.

Chapter 1

The chapter presented the definition of hazard and disaster, a brief introduction of the PDR project and thesituation after 2009 Typhoon Morakot, as well as the research question, objectives, scope, location, methodology, and the dissertation's framework.

Chapter 2

The chapter systematically reviewed some of the essential concepts and theories related to PDR, such as the introduction to hazard and disaster, the PDR project's development, the characteristic of the PDR project (physical and socioeconomic), and concurrence mistakes and challenge during the PDR implementation. Moreover, the essential PDR-related stakeholders had also been introduced.

Part II: Overview of the Typhoon Morakot PDR project (Macro perspective)

Part II contained chapters three and four. The section provided an overview of the Typhoon Morakot PDR project.

Chapter 3

The chapter provided an essential overview of the Typhoon Morakot PDR project from various perspectives. First, the chapter discussed and compared the planning and design of the PDR settlements nationwide, which can help understand the decision-making of different related stakeholders and residents' evaluation. Second, the chapter looked into the PDR policy, the government's behavior, and the residents' reaction based on the time-series text analyzing data.

Chapter 4

Since the disaster victims contained both the Chinese and indigenous households, using the questionnaire survey data provided by NCDR, the chapter compared the Chinese and indigenous groups' vulnerability, social capital, and recovery consciousness after the disaster. The chapter indicated that given the relatively low socioeconomic situation and the unique historical factors, the indigenous groups tend to have high vulnerability. However, they had better social capital bonding compared to Chinese groups. The overall disaster recovery trajectory presented a gloom prospect for the indigenous groups.

Part III: Typhoon Morakot PDR project to the indigenous groups (Micro perspective)

Chapter four identified the higher vulnerability and worse disaster recovery performance of indigenous victims than the Chinese population. Thus, the dissertation focused on the Typhoon Morakot PDR project in the indigenous context from chapters five and six to understand the mechanism of indigenous group's disaster vulnerability.

Chapter5

The chapter chose two major indigenous post-disaster reconstructed settlements—Rinari and Changzhi Baihe—as case studies to discuss the strategy, process, interrelationship of the NGOs, government, and local communities during the PDR project. The chapter mainly focused on the NGO—community and NGO—government relationship and identified the decisive elements for the PDR community participation in the indigenous context.

Chapter6

The chapter traced down the long-term spatial alternation of post-disaster housing. Moreover, identify how the spatial alternation is related to the households' physical and social needs. Moreover, the chapter introduced a spatial alteration induced government-community conflict and specified some long-term socioeconomic recovery issues.

Part IV: Conclusion and suggestions

Part IV contained chapter 7. Based on the above chapter, some conclusions and suggestions and a proposed framework for the indigenous-based PDR implementation framework were addressed in this chapter.

Chapter7

In the final chapter, the above six chapters had been summarized. In addition, an overall review and evaluation of the Typhoon Morakot PDR project were provided. To facilitate future PDR projects in the indigenous groups, this chapter proposed a comprehensive PDR implementation framework for the government, NGOs, and planners to practice in the future. Moreover, some research limitations and future prospoects, were discussed.

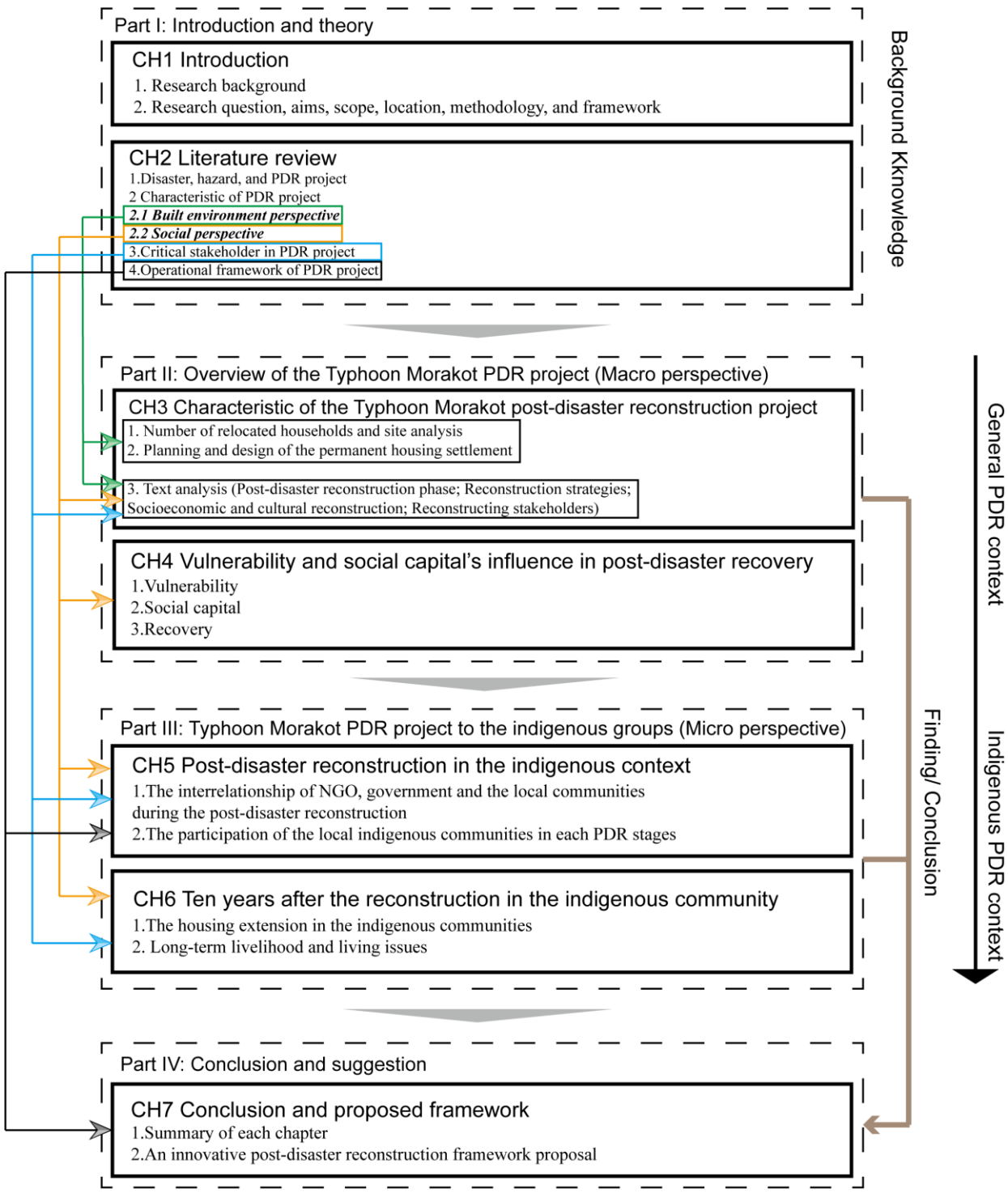

Figure 1.13 Dissertation structure

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Chapter 2

2. Literature review

This chapter provided the general concepts and the theories that had been used in this dissertation. However, given some concepts and theories were commonly used in the following chapter, instead of introducing the literature review in a chapter-wised manner, the literature review was organized based on the relationship between each concept and theory. The literature review was divided into five sections. In the first section, disaster-related terminology was introduced. The post-disaster reconstruction (PDR) project's development and history were discussed. In the second section, since PDR's interdisciplinary and complex characteristics, the chapter discussed the PDR's distinct features from physical and social perspectives. In section three, critical stakeholders, which usually have significant contribution and influence on the PDR's progress, were introduced. The section also discussed community participation in the PDR and the stakeholder analysis method. In section four, the operational framework of PDR, which had been adopted in the following chapters, was introduced.

2.1 Concept and definition of Hazard, disaster, and PDR project

In the first section, an extensive introduction to the definition of disaster-related terminology was provided. After that, the PDR project's development and history were discussed.

2.1.1 Concept and terminology

Climate hazards are the most destructive and universal natural disasters. For instance, floods, droughts, storms, and typhoons affect the swath of people. The impact can be lingering. Usually, the adverse impact of the natural disaster can disrupt the livelihoods, community, and households. Nonetheless, the term *"hazard"* and *"disaster"* are non-interchangeable terminology (Esnard and Sapat, 2014). Aligning with the decades-long development of disaster-related research, the two terminologies have their distinct difference.

1) Hazard

Regarding the definition of the hazard, according to the United Nations International Strategy for Disaster Reduction (UNISDR, 2009), *"a hazard is a natural process or phenomenon that may pose negative impacts on the economy, society, and ecology, including both natural factors and human factors that are associated with the natural ones."* It also stated that the hazards are the origins of the disaster. Natural hazards become a disaster in human habitation (Sternberg, 2011). Natural events are only termed hazards when they potentially harm human societies. The occurrence of the hazards primarily lies in natural phenomena and processes. Thus, the hazard can be classified into several patterns. For instance, the Integrated Research on Disaster Risk (IRDR) program of the International Council for Science (ICSU) classified hazards into six sub-groups:

geophysical hazard, hydrological hazard, meteorological hazard, climatological hazard, biological hazard, and extraterrestrial hazard (UN-ICSU, 2012).

Similarly, Gill and Malamud (2014) divided natural hazards into six groups. They are geophysical hazard (earthquake, tsunami, Volcanic eruption, landslide, and snow avalanche), hydrological hazards (flood and drought), shallow earth processes hazards (regional subsidence and uplift, local subsidence and heave, and ground collapse), atmospheric hazards (tropical cyclone, tornado, hail, snow, lightning and thunderstorm, long-term climatic change, and short-term climatic change), biophysical hazard, (wildfire), and space hazard (geomagnetic storm and extra impact events). Some similarities can be observed in these classification systems.

2) Disaster

On the other hand, compared to the potential threat of the natural hazard, the natural disaster has been regarded as *"a sudden, calamitous event that seriously disrupts the functioning of a community or society and causes human, material, and economic or environmental losses that exceed the community's or society's ability to cope using its own resources,"* (IFRC, 2021). According to the UNISDR, the disaster was defined as *"a function of the risk process. It results from the combination of hazards, conditions of vulnerability and insufficient capacity or measures to reduce the potential negative consequences of risk."* (UNISDR, 2003) Put it on the other way, the concept of the disaster can be interpreted in the following formula (Boudreau, 2009):

Disaster Risk = Hazard (H) x Vulnerability (V) / Capacity (C)

The formula indicated that the value of vulnerability, hazard, and communities' capacity plays a decisive role in the disaster's magnitude and risk. The concept of vulnerability was explained in section 2.3.

However, though the precise definition between hazard and disaster, it is vague to distinguish the difference among crises, disasters, and catastrophes (Esnard and Sapat, 2014). According to Faulkner (2001), crises refer to the internally generated or seen as being induced by action and inactions of the organizations, which might be the result of the disaster (Birkland, 2006). On the other hand, Alesch et al. (2008) prefer to use the term *"extreme events"* as an interchangeable term for crises. Hugo (2008) described that extreme events become a disaster if serious adverse consequences cascade through the community, whereas disaster refers to the result of a combination of exposure to hazards, the different vulnerability of communities and households, and inadequate capability to cope with the negative consequence.

Catastrophes had been rarely defined. However, it is widely considered more severe and profound than a disaster. Furthermore, the catastrophes can refer to broader areas, such as the entire community and

government being paralyzed and unable to function. Therefore, some international or interregional help is necessary during catastrophes (Birkland, 2006, Bissell, 2013). Overall speaking, disasters, crises, and catastrophes differ only in their magnitude or the extent ranging from an emergency event to an extinction-level event (Oliver, 2011). Nonetheless, they all cause calamities that the citizen and government need to pay more attention to and come up with the countermeasure to alleviate the adverse effects. Therefore, in this dissertation, the term disaster, referring to the 2009 Typhoon Morakot, was used interchangeably with crises and catastrophes.

3) Relocation and disaster

The mega-disaster always comes with displacement or relocation (IFRC, 2012). This kind of evacuation event is the withdrawal of people from an endangered area or adverse from the threat of the disaster (Sorenson and Vogt, 2006). The evacuation is variable in geographic scope. On the other hand, the term displacement is used more often to describe the moving activities of the long-term uprooting of the population because of natural disasters (Oliver-Smith and Sherbinin, 2014). Other than that, there are several other terms, such as dislocation, relocation, migration, and resettlement, to describe people's movements in a voluntary or forced manner. Nonetheless, in this dissertation, the terms relocation and resettlement had been widely used and deemed interchangeable, given that the two terms connotate the meaning of force and impelled migration of the people due to the long-last Typhoon Morakot disaster.

2.1.2 From post-disaster reconstruction (PDR) to disaster risk reduction (DRR)

Since the disaster had caused tremendous damage to the human habitat, the mitigation and countermeasure to the disaster are not new in human history. Nonetheless, as mentioned in the first chapter, it was not until the 1970s that the government sector had systemically carried on the PDR projects. For instance, the Peru and Turkey government conducted a large-scale PDR project due to the earthquake events (Schilderman, 2010). However, as Aysan and Oliver (1987) and Blaikie et al. (1994) criticized, by the time, the PDR only concentrated on the reconstruction of the damaged housing and infrastructure, whereas the socioeconomic reconstruction was never the concern of the government. On the other hand, the speed of construction had been over-emphasized. Tragically, some governments and agencies still get their reconstruction approaches wrong nowadays (Schilderman, 2010). Moreover, during the 1970s, the tide of neo-liberalism also refrained the government from putting out the mass housing provision scheme. As a result, the limitation of the public sector supply of housing became evident (Schilderman, 2010).

From early 1980, Kreimer (1980) stated that *"the disaster are not isolated factors in creating housing shortages and substandard conditions, some similarities exist between the normal and post-disaster housing development, which need to be considered in the future planning and implementation of PDR programs."* The main points of Kreimer were that the PDR project can learn from the normal settlement or housing development. Instead of treating disaster as entire *"disastrous"* event, the disaster also generates the opportunities given the influx of exterior resources. Those resources can help tackle low-income housing and facilitate the housing upgrade programs. This *"disaster as the window of opportunities"* had also been

resonated by researchers such as Amaratunga and Haigh (2011).

In 1990, the First IPCC Assessment Report (FAR) was released. The report underlined the importance of climate change as a challenge with global consequences and called for international cooperation. The report also stated that the number of increasing natural disasters might attribute to climate change (IPCC, 1990). From 1990 onward, the number of disaster events also exponentially increased (Our World in Data, 2021). International concern about the increased frequency and the large-scale of the catastrophic disaster had increased the incentive for the related stakeholder to put more effort into saving the lives and livelihood of the individuals and communities. Thus, the 1990s was known as the *"decade for reducing disaster risks"* (Arefian, 2018). World Bank had bolstered the statement as *"enabling market to work"* (World Bank, 1993). The statement included putting in policies and strategies that encourage the post-disaster housing provision by the private sector and the NGOs.

Moreover, there was also a paradigm shift in the government's role during the housing provision scheme, which transferred from the housing provision sector to the enabler and facilitator of the housing development (Schilderman, 2010). The concept was first proposed by Global Strategy for Shelter for the Year 2000. The proposal urged governments to integrate the environmental dimension fully in the formulation and implementation of national shelter strategies, which should involve governmental, private sector, and non-governmental actors in the shelter program (UNCHS, 1988). Meanwhile, the local participation and enablement were also at the core of the Habitat Agenda (UNCHS, 1997), agreed upon by the vast majority of countries. The idea was bolstered by Burkey (1993), who suggested the self-reliant participatory development and recognized the role of the communities in the housing development. Around the same time, the Yokohama Strategy for a safer world, known as the *"Yokohama strategy,"* was adopted in 1994 to provide landmark guidance on reducing the disaster risk and the impacts of disasters (UNISDR, 1994).

After the millennium, the development of the PDR project accelerated. For instance, The World Conference on Disaster Reduction, held in Kobe, Hyogo Prefecture, Japan, in 2005, had been regarded as the epic disaster risk reduction (DRR) international forum. During the event, the *"Hyogo Framework for Action"* (HFA), had been established (UNISDR, 2005). The conference's objectives were to conclude the Yokohama strategy and its plan of action, share the good practice of PDR, increase the awareness of disaster reduction policies and increase the reliability and availability of disaster-related information to the disaster management agencies in all regions. Additionally, three strategic goals had been mentioned:

- The more effective integration of disaster risk considerations into sustainable development policies, planning, and programming at all levels, with a particular emphasis on disaster prevention, mitigation, preparedness, and vulnerability reduction.
- The development and strengthening of institutions, mechanisms and capacities at all levels, in particular at the community level, that can systematically contribute to building resilience to hazards.
- The systematic incorporation of risk reduction approaches into the design and implementation of

emergency preparedness, response and recovery programs in the reconstruction of affected communities.

Also, some of the priorities of actions had been mentioned:

- Ensure that disaster risk reduction is a national and a local priority with a strong institutional basis for implementation.
- Identify, assess and monitor disaster risks and enhance early warning.
- Use knowledge, innovation, and education to build a culture of safety and resilience at all levels.
- Reduce the underlying risk factors.
- Strengthen disaster preparedness for effective response at all levels.

The Hyogo framework can be deemed the first comprehensive scheme that posed the guidelines to all PDR practitioners. It was also a remarkable milestone for the PDR development, given that disaster risk reduction (DRR) measures such as risk assessment and disaster preparedness had been proposed to be considered with the PDR project. The education, culture, socialeconomic well-being of the disaster-prone communities had been emphasized (Bosher, 2007).

From the 2010s onward, another remarkable event—The Third United Nations World Conference in Sendai, Japan, 2015—led to the establishment of the *"Sendai Framework for Disaster Risk Reduction 2015-2030"* (Sendai Framework). The Sendai framework was considered the successor instrument to the Hyogo framework for action (HFA). The Sendai framework agreed and passed seven global targets. Those seven targets will be measured at the global level and complemented by work to develop appropriate indicators (UNISDR, 2015):

- 2016 – Target (a): Substantially reduce global disaster mortality by 2030, aiming to lower the average per 100,000 global mortality rate in the decade 2020- 2030 compared to the period 2005-2015.
- 2017 – Target (b): Substantially reduce the number of people affected globally by 2030, aiming to lower the average global figure per 100,000 in the decade 2020- 2030 compared to the period 2005-2015.
- 2018 – Target (c): Reduce direct disaster economic loss in relation to global gross domestic product (GDP) by 2030.
- 2019 – Target (d): Substantially reduce disaster damage to critical infrastructure and disruption of basic services, among them health and educational facilities, including through developing their resilience by 2030.
- 2020 – Target (e): Substantially increase the number of countries with national and local disaster risk reduction strategies by 2020.
- 2021 – Target (f): Substantially enhance international cooperation to developing countries through adequate and sustainable support to complement their national actions for implementation of the present framework by 2030.

- 2022 – Target (g): Substantially increase the availability of and access to multi-hazard early warning systems and disaster risk information and assessments to people by 2030.

Moreover, four priorities for action had been introduced, based on the implementation experience of the Hyogo framework for action:

- Priority 1: Understanding disaster risk.
- Priority 2: Strengthening disaster risk governance to manage disaster risk.
- Priority 3: Investing in disaster risk reduction for resilience.
- Priority 4: Enhancing disaster preparedness for effective response and to "Build Back Better" in recovery, rehabilitation, and reconstruction.

Under each of the priority, the action guidelines were provided at local, national, regional, and global levels. Additionally, the innovation of the Sendai framework was the introduction of the role of stakeholders, which includes civil society, academia, business, and the media. The detail of the related stakeholder and their role in the PDR were explained in section 2.4.

It is without doubt that during several decades' evolvement, the PDR has become more comprehensive. The most important paradigm shift is the cooperation of PDR into the DRR framework. Align with the exponential increase of natural disasters, the PDR and DRR-related research increased sixfold from 2002 to 2012 (Yi and Yang, 2014).

2.2 Characteristic of PDR project

After the introduction of the definition of terminology, history, and the development of the PDR and DRR concept, in this section, some critical characteristics of the PDR project were discussed. The discussion ranged from the resilience, built-environment, and the physical and social perspective of the PDR project.

2.2.1 Resilience and PDR project

As mentioned earlier, though the disaster was deemed notorious at the initial phase of the PDR development, for the time being, the disaster was considered *"a window of opportunity"* (Amaratunga and Haigh, 2011). This paradigm shift was widely considered related to the resilience concept's incorporation in the PDR discussion.

The origin of the term resilience was introduced into the English language in the early 17th century from the Latin vocabulary *"resilire"*. The *"resilire"* connotates the meaning of rebound or recoil. The term had not been used in the academic field until the 1970s, when Holling (1973) presented resilience in his ecological academic paper. The usage of resilience at the time was to explain the non-linear dynamics in the ecosystems. The *"ecological resilience"* was defined to describe the amount of disruption that an ecosystem can resist without changing self-organized processes and structures.

In the following decades, the term resilience evolved from its limited use in the biology field to various academic world—for instance, materials science, politic, and environmental studies (Amaratunga and Haigh, 2011). Policymakers, practitioners, and academics had well recognized the term. Nonetheless, despite the evolution of the term resilience, different scholars used the terminology differently. For instance, Douglas and Wildavsky (1982) interpreted resilience from the perspective of risk: *"the capacity to use change to better cope with the unknown."* Sutcliffe and Vogus (2007) described resilience as a single stable state of constancy, efficiency, and predictability. It is the ability to absorb strain or change. Lettieri et al. (2009) suggested that resilience and resistance should be understood separately—resilience focuses on the after-crisis activities, while resistance forces on before-crisis activities. Longstaff (2005) suggested that resilience is more than mere survival. Resilience involves identifying potential risks and taking some proactive approaches.

It might be curious how the resilience concept link to the PDR project. As Amaratunga and Haigh (2011) stated, *"the resilient related to the PDR project when we design, develop and manage context-sensitive buildings, spaces and places that have the capacity to resist or change in order to reduce hazard vulnerability, and enable society to continue functioning, economically and socially, when subjected to a disastrous event."* The above quotation showed that resilience is the ability to accommodate disastrous and disruptive events. Therefore, identifying and assessing the potential risk before the threats happen is critical. That is to say, if communities, individuals, and countries are well-prepared for an abnormal event, then they can be considered in a more resilient status.

The second aspect is the ability to absorb and withstand the disruptive impact, which keeps the mechanism retaining the same function. This means the mechanism can maintain the same situation regardless of the disaster's impact or even improve to a better situation. This absorption might be realized through the use of disaster-resistant methods, materials, and technologies. Therefore, nowadays, the resilience concept has totally adhered to the PDR project. The ultimate goal of the PDR project is to establish an environment to withstand the threat of the disaster by using various disaster-counter measurements. The research such as Ismail and Halog (2017) tried to find how different approaches used in the design, building material, and construction technologies contribute to the resiliency of the PDR projects. On the social side, a questionnaire survey showed that recovery income support, physical, mental health, ability to transfer to other occupations are the most critical factors achieving livelihood resilience in the aftermath of the disaster (Sina et al., 2019).

2.2.2 Built-environment perspective of the PDR project

According to the discussion of the PDR's development and history, it is fair to say that one of the core PDR issues is to deal with housing development and reconstruction. As literature had emphasized the importance of spatial planning in the PDR project, it is inevitable to discuss the built-environment characteristic of the PDR project.

The built environment study had evolved from the 1980s onward. The term is to describe the products and processes of human creation collectively. The built environment is traditionally associated with building engineering, construction technology, landscape architecture, and urban architecture (Amaratunga and Haigh, 2011). As Griffiths (2004) stated, *"built-environment is a range of practice-oriented subjects concerned with the design, development and management of building, spaces, and places."* Additionally, Bartuska (2007) stressed that the built environment is everything created by the human being; the creation of human minds and human purposes; is to help us deal with, and to protect us from the overall environment, to change the environment for our comfort of living and livelihood; Every component of the built environment's elements can contribute positively or negatively to the overall quality of environments.

In that sense, it is without doubt that the context of the PDR project can fit into the discussion of the built environment, given that the activities of PDR are intricately related to the four distinct characteristics mentioned in Bartuska (2007). Under the built-environment perspective, it is essential to look at settlement planning and housing development issues.

1) Settlement planning

Relocation

According to Jha et al. (2010), relocation is defined as *"a process whereby a community's housing, assets, and public infrastructure are rebuilt in another location."* To relocate or not to relocate is always a bothering question for the PDR practitioners. Jha et al. (2010) suggested that relocation might be inevitable if the disaster-affected household's habitat had been judged uninhabitable. Also, if there is no alternative and the relocation can enhance the resilience and reduce the community's vulnerability, the household should be relocated. On the contrary, if the household rebuilds their house on the pre-disaster site, it should be regarded as *"in-situ reconstruction."*

However, relocation is often not the right solution. Research had suggested that inadequacy of the decision-making process might lead to the refusal of relocation (Dikmen, 2007). The importing of outside labor and the lack of community participation can hinder the development of the personal sense of ownership and the household's responsibility for the reconstruction. After the Great East Japan Earthquake, the Japanese Government, in formulating its post-disaster reconstruction policy, took into account the community's solidarity. It encouraged households with five or more families to move as a *"disaster relocated group,"* meaning that the affected communities expressed their intention to move to the new settlement after the disaster as a group. Moreover, the distance from the livelihoods and social networks had been identified to be crucial. Affordable land in areas close to livelihood resources is crucial for relocation. Maeda (2016) found that most of the households who had been living by fishing for generations were reluctant to migrate inland because the distance from the seashore was not conducive to maintaining their livelihoods. Another issue that had been raised during the relocation is the poor coexistence or maladjustment due to the socio-culturally unsuitability. For example, in the case of the reconstruction of Sri Lanka, researchers had pointed out that the post-disaster relocated community and the original community had difficulties integrating due to religious

and lifestyle factors (Siriwardhana et al., 2021).

However, among the relocation projects, there are various relocation patterns. According to the relocation ratio of the households in a disaster-affected community, the relocation pattern can be sorted into entire relocation and partial relocation. Moreover, considering the relocation distance, it can be categorized into within community relocation or outside community relocation (Ishikawa et al., 2008). Based on the study by Ishikawa et al. (2008), Ishimaru et al. (2015) defined four types of relocation types between the original settlement and the new permanent housing community: 1. same type, 2. unified type, 3. divided type, and 4. compound type, which provided a typology of the relationship between the original settlement and the new community after the disaster.

Settlement planning and design

The definition of design is ambiguous. Ralph and Wand (2009) suggested that the definition of design should incorporate seven elements: agent, object, environment, goals, primitives, requirements, and constraints. The design activities are "*based on the view that projects are temporal trajectories of work systems that include human agents who work to design systems for stakeholders and use resources and tools to accomplish this task.*" In the PDR context, the design activities can relate to the housing design and settlement design. The settlement design is defined as *"the design exercise that uses the land use plan as a framework to propose the optimal physical infrastructure for a settlement or area"* (Jha et al., 2010). Tucker et al. (2014) suggested that the design criteria for sustainable post-disaster settlement and housing should be responsive to the topography and emphasize public space's importance in the community.

Chiba (2015) mentioned the planning project of the high-rise permanent housing in Kamaishi City, Iwate Prefecture, where the 2011 East Japan Earthquake struck. To avoid the problem of isolation and death, in the configuration of the building, the *"O"* shape design was adopted to allow the elderly in the community to keep their privacy and achieve the effect of looking out for each other. The design concept fully embodied the possibility of co-housing, making the permanent house a home after the disaster and the embodiment of a resilient social network. The community highly appreciated the design. Also, in the permanent housing community in the suburb of Sendai city, the residents and the designer decided to use a *"geese"* configuration to zigzag the housing units through 28 workshops, allowing residents to *"look at each other"* while maintaining privacy (Sonoda et al., 2013). Charlesworth and Ahmed (2015) collected a large number of post-disaster reconstruction communities designed in Australia, Bangladesh, Haiti, the United States, Sri Lanka, and Vietnam. They analyzed the relationship between public spaces (parking lots, play spaces, trails, libraries, activity centers, etc.) and private spaces (permanent housing units). The study revealed that communities with large and open public facilities, such as subdivisions or permanent housing units, tend to have higher residential satisfaction.

In terms of post-disaster settlement design planning typology, Ishimaru et al. (2015) collected configurations of permanent housing communities in the Kesennuma area after the East Japan earthquake. They classified

them into four configurations: 1. inner circle type, 2. opposite circle type, 3. opposite linear type, and 4. unilateral linear type. Then, they used these four configurations to analyze the community's external traffic functionality and the designers' planning ideas.

Another important consideration in the design and planning process of a settlement is the size of the construction site. The inadequate new sites can lead to the failure of the PDR project. Jha et al. (2010) stated that inappropriate land could be chosen for the new settlement because it can be acquired quickly, which is owned by the government sector. Sometimes, the accessibility can also be the reason for the tiny land to be selected. Regarding this issue, Ishimaru et al. (2015) investigated the residential area, road area, and community facility area of 37 permanent housing communities in the Kesennuma area after the Great East Japan Earthquake in 2011 to understand the area ratio of each permanent housing settlement in each function. According to Yoshika and Nameda (2011), a proper ratio of public space to residential space is helpful for the recovery of disaster victims.

Project management

Among the various planning-related elements, project management is one of the most decisive factors. General management is defined as" the *planning, coordination and control of a project from conception to completion."* The objective can range from the utility, function, quality, cost, and time (Walker, 2015). In the PDR project, time management profoundly influenced the residents' decision-making, given that the early completion of the post-disaster housing and settlement is beneficial for disaster recovery. However, due to the complexity and various conditions, the time that PDR project spent might vary given different governmental organizations and decision-making processes.

In Japan, before the housing construction, the government spent substantial time consulting the future housing options with the disaster victims. However, according to Kondo and Karatani (2018), the result showed that because the government-initiated housing project did not finish within four years after the disaster, some disaster-affected households might decide to reconstruct the housing by themselves. Moreover, the nuclear power plant-induced radioactive disaster after the tsunami can substantially delay the reconstruction schedule, which resulted in a low return rate to the pre-disaster habitation (Sawano et al., 2019).

On the other hand, after the Wenchuan Earthquake in 2008, the top-down Chinese government facilitated the long-term recovery of the local communities. The research stated that the top-down administration, though limited participation of the residents, can effectively facilitate the process of the PDR (Xu and Shao, 2020). Similarly, according to Xu and Lu (2013), the innovative governance and implementation system can also accelerate the PDR execution. The public had recognized the efficiency of government. Xu and Lu (2013) stated that the *"national counterpart aid model"* (NCA) successfully showed more efficiency and effectiveness than the central government-oriented aid, national non-governmental organization aid, and international humanitarian aid. The NCA model cost the Chinese Government only three years to finalize the

physical construction of the 2008 Wenchuan Earthquake affected area after three years.

2) Housing

Quarantelli (1982) first proposed that PDR should include 1. emergency sheltering; 2. temporary sheltering; 3. temporary housing; 4. permanent housing. The four phases of housing stages indicated that the primary goal of PDR is to provide livable housing after the disaster. Shao et al. (2018) stated that four different stages serve a different role in the PDR recovery. First, the disaster victims might escape from the disaster-affected areas to the emergency shelter or the temporary sheltering. The victims can stay in their places from a few days to several weeks. Second, due to the permanent housing usually taking several months to years to finish, the disaster-affected household might thus transfer to the temporary housing before completing the permanent housing.

Peacock et al. (2007) argued that the four stages of resettlement are not linear but dynamic and complex. The boundaries between the different stages are ambiguous. However, it is still possible to see a housing-based development context for the PDR project. Given that the temporary and permanent housing had been discussed in detail in this dissertation, the temporary and permanent housing stages deserved further explanation.

Temporary housing

Quarantelli (1982) defined temporary housing as *"the reestablishment of household routines but with the understanding that more permanent quarter will be eventually obtained."* Esnard and Sapat (2014) described temporary housing as *"differs from sheltering in that it is more long term and may also become permanent if disaster victims decided to occupy the unit for the long term."* Compared to the permanent housing stages, the temporary housing policies are believed to be more ad hoc, given that the decisions are made quickly within a few days after the disaster. The actions are initiated to house people in the interim before completing the permanent housing. The disaster-affected population is usually hard to estimate before the disaster (Johnson, 2007). Some researchers stated that the PDR practitioner always should consider some recurrent issues in the temporary housing, such as cultural, climatic inappropriateness, poor location, and social problems inside the camps (Davis, 1977; Bolin and Stanford, 1991). Comerio (1998) suggested that it is necessary to have adequate and various contingency temporary housing strategies that can be activated in stages, depending on the types of the disaster. Moreover, the use of the private market sometimes proves helpful. After the 1999 Ji-ji earthquake in Taiwan, Peng (2019) believed that the planning of the relay housing communities did not properly consider the victims' public space and activity space. The different unit designs resulted in different household units, which also caused concerns about fairness.

In terms of the comparative empirical study, Johnson (2007) compared the temporary housing programs in various earthquake catastrophes in Turkey, Colombia, Japan, Greece, Mexico, and Italy. The research found that pre-disaster temporary housing planning was generally lacking in these countries. The issue such as the duration of construction (have temporary housing available quickly), cost, the overall reconstruction strategy,

unit design, location, services (community amenities), social network, institutional support, and long-term use or outcomes for the temporary unit can deviate the effectiveness and incentive for the government sector to address the temporary housing issues.

Permanent housing

According to Quarantelli (1982), permanent housing can be considered as the termination of the PDR housing development process. Compared to the previous housing stage, permanent housing is one of the ultimate goals of the PDR project. Esnard and Sapat (2014) stated that the permanent housing stage is *"the return to the former home after its reconstruction, or resettlement in a new home where the family can plan to live on a permanent basis."* Therefore, the design, material, structure, layout, and construction process normally had more discussion among the stakeholders compared to the previous housing stages. However, Quarantelli (1982) argued that permanent housing is usually a matter almost totally ignored at the local community level—the community and local government find themselves unprepared compared to the experienced central government and NGOs. Esnard and Sapat (2014) stated that the lack of permanent housing planning could delay and hamper housing development. Moreover, the permanent housing development project might neglect the renter and lack an affordable and adequate number of housing for the vulnerable population. The housing design and planning might conflict with the communities' norms and expectations (Sapat et al., 2011).

Due to the complexity of permanent housing policy and design issues, Tucker et al. (2014) developed a design guideline for sustainable permanent housing. The research extensively analyzed the permanent housing after the 2004 Indian Ocean tsunami in Sri Lanka. The research found that five design factors—site and settlement pattern, climate and thermal strategy, traditional technique, materials, and community participation need to be emphasized during the design of the permanent housing. First, the neighborhood and housing should respond to the topography, with adequate open common spaces and potential private spaces. Second, the local climatic context should be responded. The ventilation and thermal comfort are critical. Third, since the disaster-affected population might have their own cultural identities, the traditional vernacular design, the adjustment of the window, wall, and the layout should be built according to the residents' requirements. Forth, energy-intensive materials should be avoided. Instead, the local material should be encouraged. The idea had been endorsed by Escamilla and Habert (2015), which stated that the low material should have a low environmental impact. Lastly, the construction should use the local labor force and be built in the local context. For instance, the residents in Sri Lanka were allowed to decide the layout of their permanent homes, while in the case of Australia, trees were interspersed throughout the redeveloped community to ensure green space and privacy for the residents. These examples showed that an excellent permanent housing plan could increase the residents' satisfaction and lead to a more resilient redevelopment (Charlesworth and Ahmed, 2015).

Similarly, according to Jha et al. (2010), during the housing design, the criteria such as building codes, infrastructure, beneficiaries' needs, climatic conditions, need for flexibility, environmental impact, cost,

exposure to risk, and available construction technologies should be taken into account. Besides, Jha et al. (2010) also suggested that the construction technology application needs to consider in the permanent housing design process.

Permanent housing extension

By looking at the conclusion provided by Tucker et al. (2014), some of the suggestions for the permanent housing design and construction were not entirely related to the physical factors. Instead, the suggestions implied a mix of social and cultural elements when considering a suitable permanent housing design. However, this is not the first time that housing has been discussed with the social factors. For example, Rapoport (1999) suggested that the housing environment, like all environments, should respond to human wants and needs. This indicated that the concept of housing is interrelated with the family, household, and society. Moreover, housing can embody the culture, reflecting its size, material, location, and type.

Additionally, housing keeps evolving with the family's lifestyle and requirements. As pointed out by Ghaffarian Hoseini et al. (2014), the mismatch of housing layout and size can cause dissatisfaction among residents and urge the alteration activities. This phenomenon was observed in some developing countries (Arimah and Adeagbo, 2000). In Cairo, Egypt, the consideration of safety and income generation can also lead to housing extension by defying the laws and regulations. Moreover, the concept had been developed into the extensible core housing (Kardash, 2018).

Recently, research on housing extensions has been widely conducted in the PDR project. For instance, the study in Hambantota New Town, Siri Lanka, a disaster-affected area after the 2004 Indian Ocean Tsunami, found that residents spent their deposits extending and improving the layout of permanent housing based on rudimentary planning guidelines, thereby deteriorating the quality of living (Ahmed and McEvoy, 2014). Furthermore, the housing extension behavior is not limited to the single household. A spillover effect might drive the household to change its housing layout. Nonetheless, spiked the confrontation with the government because of this unlawful deed. Carrasco et al. (2016) noted that after 2011 Typhoon Washi, a bottom-up housing alteration intensified a dispute between the government and relocated households. The relationship between the PDR projects and housing extension was also underscored by Dikmen et al. (2016) by taking the case study after the 2000 earthquake in Cankiri, Turkey. The Turkish government rolled out a typical design—a government-provided housing with standardized layout and custom designs—an innovative housing provision scheme that empowered under an owner-driven pattern. The study revealed that the residents disliked the typical design because of the mismatch to the local context and climate, which drove more housing extension in typical design housing than in custom design housing.

2.2.3 Vulnerability and social capital to PDR project and recovery

In the above paragraphs, the built environment perspective on the PDR project had been introduced. Nonetheless, even from the built environment perspective, the cultural and social connection of the household and housing is unable to be ignored. Therefore, in this section, some important factor, such as

vulnerability and social capital, was introduced.

Marin et al. (2015) suggested that disaster vulnerability reflects the likelihood of being damaged, which can be considered an external factor. On the other hand, social capital is the ability of a group or individual to recover from a disaster, which is considered an internal factor. Hence, the overall vulnerability and social capital evaluation can provide a good understanding of post-disaster recovery. Similarly, based on the framework of Aldrich (2011), Roque et al. (2020) suggested that recovery depends on the pre-and post-disaster context (vulnerability) and the ability to support community resilience (social capital).

1) Vulnerability

Vulnerability has an inclusive meaning, incorporating demographic, economic, and political factors as subcomponents. Masterson et al. (2014) stated that vulnerability *"implies a measure of risk associated with the physical, social and economic aspects."* Physical vulnerability is related to the location of a population and its built environment. Among all factors related to physical vulnerability, housing elements have been particularly focused on by an array of research, and housing recovery has been deemed essential to achieving a fast and fair recovery (Hamideh et al., 2021). Costs incurred due to housing damage, restoration, and recovery account for the majority of disaster losses for individuals or families (Peacock et al., 2007). A lag in housing recovery might lead some households to experience a decline in their living quality (Hamideh et al., 2021). In addition, individuals' homeownership status before the disaster is also considered a critical factor influencing post-disaster housing recovery. Specifically, renters are particularly vulnerable to eviction and face skyrocketing rent prices after a disaster (Pardee, 2012).

A social vulnerability perspective focuses on the characteristics and diversity of communities or individuals in terms of gender, household composition, education, poverty, income, and employment status (Masterson et al., 2014). Specifically, income and employment issues had been particularly emphasized in the literature. The poor are relatively more exposed to natural disasters over time because of the increased occurrence of disasters and their concentration in disaster-prone areas (Kim, 2012). Income loss might not be the highest among the poor compared to the average number of disaster-affected households in a community. However, economic losses can be disproportionately high among disaster victims (Kim, 2012). Moreover, because of a disaster's heavy impact, economically vulnerable groups might become injured and disabled to be reemployed, further widening the discrepancy with other groups (Luchi and Esnard, 2008). Guo et al. (2014) found that the agriculture and aquaculture sectors face more significant livelihood challenges in disasters because they heavily rely on natural resources. The above-mentioned literature all pointed out the importance of income and employment recovery to disaster victims.

Additionally, several researchers had found that different ethnic groups have different recovery paths and vulnerabilities following a disaster (Airriess et al., 2008; Monteil et al., 2020). A misconducted PDR process might hamper some groups considered vulnerable pre-disaster and perpetuate marginalization, and in particular, such a situation had been largely observed in indigenous groups. Indigenous groups can be

defined as those groups with the right to define their indigeneity—who retain a distinct culture and identity apart from the globalized culture (United Nations General Assembly, 2007). The worldview of indigenous peoples is rooted in human–land, human–nature, and human relationships (Lin and Lin, 2020). Nonetheless, these distinct characteristics also contribute to their pre-and post-disaster vulnerability. For instance, after the 2011 Canterbury Earthquake in New Zealand, the lack of vertical coordination and engagement, compounded with the lack of social sensitivity, led to the government-initiated PDR further marginalizing the Māori communities in particular (Finucane et al., 2020). Two years later, in the aftermath of the 2013 Lushan earthquake in China, the government ignored the multi-ethnic context in Sichuan Province, and cultural conflicts emerged during the PDR project (Xu et al., 2016). In Taiwan, Hsu et al. (2015) argued that top-down institutional PDR enhanced the *"procedural vulnerability"* of Taiwanese indigenous groups following Typhoon Morakot. Meanwhile, Lin and Lin (2016) suggested that confusion regarding regulations combined with low communication skills prevented indigenous communities from participating in resettlement discussions with the government. Taiban et al. (2020) also pointed out that the assertive government limited the options of the livelihood restoration plan, which contradicted and undermined the indigenous groups' cultures. However, despite these findings, no research has focused on an intercomparison of disaster-affected groups. The discrepancy in recovery between groups after the disaster remains largely unexplored.

2) Social capital

The concept of social capital has become increasingly important in explaining economic, social, and political development (Putnam, 2000). Putnam (1993) described social capital as *"the features of social organization, such as networks, norms, and trust, that facilitate action and cooperation for mutual benefit."* Although social capital measurement varies depending on the context, a distinction can be drawn between bridging, bonding, and linking social capital. First, bonding social capital refers to social ties within a community. Second, bridging social capital refers to a social tie that combines people across different social groups, but still in the same hierarchy—the social tie between different communities. Third, linking social capital refers to the social ties of two groups in a different hierarchical structure, typically the link between the community and formal or administrative units (Aldrich, 2012). In the PDR context, disasters are closely connected to daily life and development processes. Meyer (2018) suggested that social capital positively impacts mitigation and adaptation in the aftermath of a disaster. Study had found that social capital can facilitate access to diverse forms of support and resources, such as subsidies apply information, financial support, and capacity-building programs (Aldrich and Meyer, 2014). By exerting a different kind of social capital, households can maximize resource access from internal and external stakeholders (Amaratunga and Haigh, 2011).

However, the three kinds of social capital (bridging, bonding, and linking) tend not to be evenly utilized by the community. The local community may tend to prioritize bonding networks. For example, Aldrich and Crook (2008) found that a robust local network only benefited certain sections of society and excluded the *"outsiders"* from those social networks. In the indigenous context, a relatively homogenous indigenous

community might resist merging into diverse communities to build a resilient society after relocation following a disaster (Monteil et al., 2020). In the NGO-driven PDR context, trust between the assisted community and NGOs is essential. Higher trust between stakeholders manifests high linkage social capital, which can facilitate the work of PDR. In this dissertation, the network of internal stakeholders (friends, community, neighbor, bonding network) and the network between internal and external stakeholders (NGO, government, linking network) were focused on specifically.

2.3 Critical stakeholders in the PDR project

The PDR project can never be completed only by the government or community itself. A successful PDR implementation entails the engagement of various kinds of stakeholders. Hence, in this section, the critical stakeholders in the PDR project were discussed.

The definition of the stakeholders can refer to "*any identifiable group or individual who can affect the achievement of an organization's objectives, or who is affected by the achievement of an organization's objectives"* (Freeman and Reed 1983). Furthermore, in terms of the construction project, the stakeholder is considered *"groups or individuals who have a stake in, or expectation of, the project's performance and include clients, project managers, designers, subcontractors, suppliers, founding bodies, users and the community altogether."* The definition indicates that the construction project requires a variety of cooperatives stakeholders to complete (Newcombe, 2003).

Based on the different attributes and characteristics, the engaging stakeholders can be identified into different categories. For instance, based on the lesson learned from the Gujarat earthquake, the EPC (2004) defined the stakeholders as 1. community and citizen stakeholders; 2. government; 3. civil society organization; 4. private or corporate sector; 5. professional group; and 6; media. Moreover, Jha et al. (2010) pointed out that the key actors in a PDR planning process are 1. central or national government; 2. state provincial government; 3. local government; 4. community; 5. project facilitators; and 6. the technical experts.

Furthermore, Siriwardena and Haigh (2011) suggested that stakeholders can be either primary or secondary, internal or external due to the importance and the standpoint of the PDR project. Nevertheless, overall speaking, the government, NGOs, and community can be deemed the most crucial stakeholder during the PDR project according to the array of the literature. (Lu and Xu, 2014; Xu et al., 2018).

2.3.1 NGO

NGO is defined as *"any nonprofit, voluntary citizens' group organized on a local, national, or international level. Generally, outcome-oriented and driven by people with a common interest"* (Jha et al., 2010). Looking back from history, the NGO-led PDR programs had been widely executed in the aftermath of disasters (Eikenberry et al., 2007; Telford and Cosgrave, 2007; Williams and Shepherd, 2016; Lu et al., 2020; Lu and Li, 2020; Szczepanska, 2020). Bolin and Stanford (1998) showed that the NGOs approach could successfully be implemented in the relief programs that connected the victims with their needs to diverse resources by

fully utilizing their local knowledge and expertise. Moreover, Kilby's case study of the Indian Ocean Tsunami in 2004 pointed out that the NGOs tend to meet the needs of affected people through relief and the resettlement project to restore their livelihoods (Kilby, 2008). Aldrich (2011) also showed that in the 1995 Kobe earthquake PDR process, NGOs were able to help at the neighborhood level to manage the activities and the planning in the long run. It is widely agreed that NGOs can provide complementary and flexible services compared to the government sector.

However, although the NGO-led approach has many advantages during the PDR mentioned above, some of the research pointed out that this approach might have an adverse outcome. The underpinning philosophy of NGO funders and other decision-makers might choose the approach and plan for the disaster relief program which favors the organization (Siriwardena and Haigh, 2011). Regarding the budget usage, some researchers argued that the post-disaster aid dispensed through NGOs might be used to satisfy the interests of the donor side (Schuller, 2012; Wroe, 2012; Esnard and Sapat, 2014). Moreover, a lack of cooperation of NGOs can consequence in a waste of resources. For example, according to the official record of the Bam earthquake in Iran, the representatives from more than 100 international NGOs individually requested a meeting with the Iranian government sector, which resulted in a chaotic situation (Wood, 2004). Others pointed out that NGOs highly rely on their donors and need to complete the project quickly. Therefore, NGOs have limitations in being aware of the social, cultural, and economic aspects of the communities they work for (Easterly, 2002). Moreover, the Agency-driven recovery work might be accompanied by the non-local worker. (Fletcher et al., 2006).

2.3.2. Government

It is widely agreed that the government plays essential political, economic, cultural, and social roles in the collaboration and coordination of the PDR project. Usually, the government sector had multiple layers and institutions to deal with the disaster and PDR. First, the local government had been described *"…as the first responder in any disaster or emergency, local governments play a critical role in dealing with all phases of housing, but particularly in emergency and temporary housing"* (Esnard and Sapat, 2014). The local government often needs to develop partnerships and agreements with the schools, convention centers, and arenas as the sheltering for the disaster victims. Moreover, the local government can act as the policy maker. For instance, the PDR project and strategies can cooperate with the local comprehensive emergency management plan or the local land development regulations (Esnard and Sapat, 2014). The land use plan, regulations, and building codes are important to manage the recovery and reconstruction. The local government must make sure the local capacity and institution are adequate to undertake the PDR projects (Jha et al., 2010). On the other hand, the central government ought to play an essential role in the non-emergency post-disaster housing planning—primarily permanent housing. Normally, the central government should 1. coordinate the resources required to assist the community and local government in recovering and responding to the disaster; 2. support the development of local, regional, and nationwide disaster management plans; 3. provide technical assistance and training to support the PDR project; 4. help identify, mobilize, deploy, and maintain PDR-related resources (FEMA, 2009). Compared to local government, the

central government also had the overall leadership to rule and design contingency systems.

Moreover, another role of the government is to coordinate and communicate with other stakeholders during the PDR implementation. Jha et al. (2010) stated that all levels of government should designate the focal points for communications activities. Similarly, Shi (2012) suggested that the government should have an international cooperation capability to strengthen the PDR ability. A PDR-collaboration framework was shown by Lu and Xu (2014) by studying the 2008 Wenchuan earthquake. A subsequent study conducted by Xu et al. (2018) also showed that the government-NGOs relationship was indispensable during the PDR project of the 2013 Lushan earthquake.

2.3.3. Community

The definition of *"community"* and what it refers to is very vague and broad. Kumar (2005) mentioned 94 different definitions of community that can be found in scientific journal papers, all of which used spatial, human, and social relations to define community. Among them, Willmott (1986) and Lee and Newby (1983) standardized the discussion of community into three directions 1. Place: a geographic or spatial community can be considered as having some spatial element in common, also known as locality; 2. Interests: members of a community are united by a common interest or goal, such as sexual orientation, religion, work, or moral values, and are not limited to locality; 3. Communion: it can be understood as an attachment to and identification with space and values (the spirit of the community). McMillan and Chavis (1986) identified membership, bidirectional influence, fulfillment of needs, and shared emotional connection as the four major components of community organization. It can be seen that the definition of community is not limited to traditional geographical location and culture. The psychological factors and the pursuit of a common goal can be used to define community.

However, such a definition can easily be misunderstood as community as homogeneous. In fact, communities are constantly evolving and highly diverse among their members (Phillips, 2009). Subgroups have different characteristics, concerns, goals, and values. They can be similar to some extent, but they do not always agree on all issues. Therefore, it is necessary to engage in PDR research from a community perspective while understanding the heterogeneity among community members and subgroups.

Given that the PDR process needs to address housing and underlying socioeconomic vulnerabilities, community participation is essential during the entire PDR process. Align with the development of the PDR project, housing is considered a process, not merely a product or a technical project. From the 1980s onward, a participatory PDR process encourages communities to lead the project (Archer and Boonyabancha, 2011). Afterward, in the HFA and Sendai framework, the participation paradigm was again endorsed and ratified into the important PDR project element.

Several scholars listed some advantages of the participatory approach in the PDR project. For instance, local communities' engagement can enhance disaster-affected people's psychological healing and overcome the

trauma after the disaster (Jha et al., 2010). In addition, the communities can develop a sense of ownership during the PDR project and address the meaning of home for individuals and families (Zetter and Boano, 2010; Cronin and Guthrie, 2011). The participatory method can also reduce the potential cost reduction, maximizing the variety of solutions and minimizing the dangers of top-down decision-making (Lizarralde et al., 2009). By empowering the community, they can become the agents of change within the local system (Archer and Boonyabancha, 2011)

However, in a large-scale project, the housing quality of different participatory schemes varies from place to place. Therefore, the participatory approach is deemed to be challenging to scale up, which might be ineffective to reach the vulnerable groups and thus, marginalize their chances of improving their livelihood after the disaster (Hidellage and Usoof, 2010). Furthermore, the mutual trust and constant community between government and residents proved vital to streamlining the participatory PDR project (Méheux et al., 2010). Therefore, various problems need to be solved when applying the participatory approach in the PDR project (Arefian, 2018).

In this section, it is clear to see the variety of the stakeholder that can have their role in the PDR projects—primarily the NGOs, community, and government. Therefore, inter-sectoral collaboration issues during the implementation of PDR programs had been highlighted (Chen et al., 2013; Ayala-Orozco et al., 2018). For instance, Lu et al. (2017) and Xu et al. (2018) applied the social network collaboration approach to understand the inter-stakeholder cooperation degree. A timeline-based semi-structured interview was applied to analyze the PDR implementation innovation of NGOs from the 2008 Wenchuan earthquake to the 2013 Lushan earthquake (Lu and Li, 2020). The public-private partnerships (PPP) approach in the PDR project had been focused gradually (Chen et al., 2013). Jha et al. (2010) further stated that the principles of partnership entails equality (mutual respect between members of the partnership), transparency (active dialogue within the partners), result-oriented approach (reality and action-based thinking), responsibility (integrity and ethical obligation working attitude), and complementarity (diversity of the partnership which complements each other's contributions).

2.3.4. Stakeholder analysis method—Field theory

As aforementioned, it is necessary to engage in PDR research from a community perspective while understanding the heterogeneity among community members and subgroups. In this sense, Bourdieu's conceptual tools of capital and field can provide an analytical approach—not only to explain the behavior and interaction patterns of different stakeholders in the field but also to analyze the differences in expertise and competitive capabilities held by subgroups within the community (Bourdieu, 1987).

Capital is the driving logic of Bourdieu's construction—a subject of confrontation and a source of power. Bourdieu (1987) distinguished between three primary forms of capital: economic, cultural, and social capital. Economic capital is composed of different factors of production and economic goods in general, such as the residents' income from their jobs and their property rights to buildings and land. Cultural and social capital

refers to the networks established and constructed by individuals or groups, such as community leaders and contacts with outside groups and local governments. In the case of indigenous communities, cultural and social capital refers to the degree to which individuals or groups are familiar with the history of the community and retain traditional skills, cultural awareness, and traditional knowledge. Bourdieu (1987) uses the concept of *"field,"* which is different from the concept of *"domain"* to refer to a field of forces—a system of the power dynamic. In other words, a field is a network, a structural configuration of objective relationships between locations. Various stakeholders bet on and participate in the field and compete with each other based on their capital.

2.4 PDR project operational framework

Aligned with the evolution of PDR, it is essential to have certain guidelines and protocols to follow to avoid concurrent mistakes. Recently, Bilau et al. (2018), Vahanvati (2018), and Jamshed et al. (2018) had developed several resilience PDR frameworks for practitioners to follow. These proposed frameworks had followed the principle of resilience and the Sendai framework. Based on the literature, three critical stages of the PDR project, including the initiation stage, planning and implementation, and livelihood restoration and monitoring stage, were presented.

2.4.1. Initiation stage

First, delineation of the dangerous areas and site selection is considered a critical process within the PDR process, which can help determine the number of housing beneficiaries. By relocating the disaster-affected household, the disaster exposure has also been reduced (Dias et al., 2016). However, a challenge might emerge if the disaster-affected households have properties within the disaster-affected areas (Correa et al., 2011).

Site selection can be in situ or resettlement (Jha et al., 2013). Because residents—especially the indigenous households—are emotionally attached to their land due to their human-land, human-nature conception (Lin and Lin, 2020). There is higher satisfaction with in situ reconstructions versus resettlement (Andrew et al., 2013). A shorter distance between the original settlement and the working place can facilitate the subsequent process of livelihood restoration (Shaw and Ahmed, 2010; Arnall et al., 2013).

Third, the determination of the post-disaster housing provision strategy is also considered vital. Johnson (2007) pointed out that the government, without the pre-disaster temporary housing plan, might easily abandon the temporary housing provision scheme due to budgetary and time constraints. As for the permanent housing strategy, the period of construction and implementation can be different due to the government organization, work distribution of the stakeholders, and envision of the PDR project (Onoda et al., 2021).

Forth, some research focused on the permanent housing beneficiaries selection. Since the definition of the *"disaster victims"* varies tremendously according to different disaster aftermath and context, the housing

beneficiaries might be hard to define. The decision might be deviated by the community leader (Leemann, 2013) and different from the city and rural areas (Haberli, 2013).

2.4.2. planning and implementation stage

Compared to the initiation stage, the planning and implementation stage involves more participation and coordination of various stakeholders. First, a stakeholder assessment is necessary. Bilau et al. (2018) stated that the stakeholder assessment can *"provide the coordinating agency an understanding of the different stakeholders, their functions, and how to effectively engage them."* In this process, the government should identify and categorize stakeholders. Moreover, allocate roles and responsibilities to stakeholders. The sharing database, communication strategy, plan, and objective of PDR should be developed.

Second, multi-hazard vulnerability and risk assessment-oriented planning should be conducted. The assessment and planning need to consider the building codes and construction guidelines. The local building codes with guidelines provided can help streamline the building development process. Moreover, a model housing prototype can be provided to enable good workmanship and quality. Furthermore, if the detailed construction documents and implementation plan is available, it can enable the housing program and enhance the collaboration with the beneficiaries, which is considered crucial for the housing qualities control.

Third, the housing and settlement design and planning process requires well-prepared design guidelines (Tuker, 2014). It is reported that the practitioners merely having comprehensive blueprints will likely lead to a vulnerable community (Chang et al., 2010). Frequent supervision and inspection can ensure the building quality (Bilau et al., 2018). If the PDR project is implemented in the indigenous context, reflecting their particular concerns on the architectural design is deemed crucial (Lin and Lin, 2016). Moreover, the local workforce and material used, as well as the beneficiary and community engagement during the implementation should not be ignored (Bilau et al., 2018).

2.4.3. Livelihood restoration and monitoring stage

As mentioned in 2.2.3, the social vulnerability issues cannot be underestimated in the PDR project. Wilford (2008) argued that physical assets are not merely physical assets but include the meaning and identification to the place. The psychological, socioeconomic, and cultural dimensions are essential during the PDR process. Moreover, Carrasco et al. (2016) also stated that the social vulnerability might induce a living environment change by the community members. Therefore, Bilau et al. (2018) suggested that needs assessment, livelihood mapping, and planning should be implemented in this stage. A comprehensive livelihood restoration scheme is critical, given that the impact on livelihood after a disaster usually inflicts a long-last influence on the disaster-affected households (Ismail et al., 2018). According to Mannakkara and Wilkinson (2015), community support and community involvement were considered crucial in livelihood restoration strategies. Regarding community support issues, case managers and specialized assistance should be provided to the disaster-affected family. Psychological support and counseling should be available for the community. Group activities can be helpful to build community cohesion with adequate rebuilt public

facilities. All the above countermeasures should let the community informed. Regarding the community involvement issues, the PDR project should incentivize the community to create the groups and involve them in designing livelihood recovery plans and implementing the plan by themselves. The government and NGOs should maintain complete transparency with the affected communities regarding the funding, timelines, and potential issues of the livelihood recovery plan.

Another important task is monitoring. Jha et al. (2010) stated that monitoring is *"the assessment whether a program is being implemented as was planned, which enables continuous feedback on the status of program implementation, identifying specific problems as they arise."* According to Bilau et al. (2018) the importance of monitoring and evaluation had also been stated. Consistent reporting and monitoring should be practiced by obtaining management information and database. Some auditing events can assure community engagement and trace down the construction quality, financial transparency, and accountability. Eventually, these databases and audits should be transferred into improvement and lessons learned for the PDR project.

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Chapter 3

3. Characteristic of the Typhoon Morakot post-disaster reconstruction project

To understand the reconstruction policy of the Typhoon Morakot PDR project and the differences in planning and spatial characteristic among different reconstructed settlement, this chapter provided an overview of the 2009 Typhoon Morakot PDR project. First, the chapter looked at the settlement and permanent housing geographical distribution, as well as the relocation pattern. Afterward, the chapter discussed the settlement planning and design strategies applied in different regions. It is fair to say that different local governments and NGOs had very distinct PDR strategies. Second, from the text analysis method, this chapter calculated the keyword that appeared in "The 88 Morakot Disaster Network" in four major aspects, which were the post-disaster reconstruction phase, reconstruction strategies, socioeconomic and cultural reconstruction, and reconstructing stakeholders to understand the propensity of PDR activities based on the timeline.

3.1 Overall PDR project after Typhoon Morakot

At the beginning of the chapter, it is essential to provide some background information regarding the overall strategies and process of PDR after Typhoon Morakot. The background information can help comprehend the discussions and research findings in the following sections.

After Typhoon Morakot, due to unprecedented disaster extend and tremendous among of disaster victims, the central government set up the *"Morakot Post-Disaster Reconstruction Committee"* to coordinate post-disaster reconstruction and enacted the *"Post-Disaster Reconstruction Regulation of Typhoon Morakot (MPDRC)."* Under the regulation, 6,316 households and 19,191 people were resettled in 160 areas within five months after the disaster. In addition, the government opened 158 emergency shelters and sheltered 8,189 victims. Moreover, aligned with the *"Mountain conservation[3]"* policy, the government prioritized relocation—if affected communities were identified as *"dangerous areas,"* residents had to be relocated. On the other hand, if the affected communities were recognized as *"safe or risk concerned areas,"* the resident can decide whether their communities need to be relocated or not based on the consensus. The safety of the disaster-affected communities was evaluated by a scientific expert group with a civil engineer, which was organized by the MPDRC.

Regarding the following housing reconstruction policy, the central government decided to skip the construction of temporary housing and build permanent housing directly after discussing with NGOs, given that the reconstruction schedule and budget were limited. The construction of permanent housing was mainly carried out by various NGOs with PDR experience, including Buddhist Compassion Relief Tzu Chi

[3] The government believed the typhoon disaster could partially related to the over-developing of the mountain areas.

Foundation (hereafter Tzu Chi), World Vision Taiwan (hereafter World Vision), and the Red Cross Society of the Republic of China (hereafter Red Cross). In total, as many as seven medium and large-size NGOs undertook the tasks from the government for constructing the permanent houses. Most of these NGOs received significant donations from the public, and some of them had overseas experience in PDR and relief work prior to the Morakot disaster.

After the NGOs were selected, the local government negotiated with the NGOs to coordinate the construction workload and reconstruction site selection. To ensure that the residents adapt to the post-disaster life, the government proposed a *"leaving the disaster but not the village"* policy (Chen, 2014). The policy was to allow residents to live as close as possible to their original communities and prevent them from a drastic change of livelihood. In terms of construction plans, the local government had the legitimacy to determine the eligibility of the permanent housing beneficiaries from the disaster victims based on the household register data, disaster-affected extent, and so on. Moreover, the MPDRC also regulated and determined certain types of permanent housing with different floor areas according to the number of housing members in the household. Therefore, the NGOs needed to construct the permanent housing according to the size and number provided by the government (Chen, 2014).

After the completion of the physical reconstruction, the central government also imposed the livelihood restoration policy (mental reconstruction project). However, most of the policies and schemes were implemented by either local governments or NGOs in different permanent housing settlements.

3.2 Methodology of the chapter

By applying the macro point of view, the objective of this chapter was to explore some of the critical characteristics of the Typhoon Morakot PDR project, including the viewpoint of the built environment and policy. Given the chapter's variety of concerns, several methodologies were used to cover the chapter's aims, including 1. secondary documents review; 2. semi-structured in-depth interview; 3. spatial measurement and drone survey; 4. text analysis.

3.2.1 Secondary document reviews

Information of each reconstructed settlement and relocated community was collected mainly from central government publications, websites, and local government announcements, including credible citizen journalist platforms such as *"The 88 Morakot Disaster Network"* (88 Morakot Typhoon Disaster Network, 2010). Additionally, the information was also collected from local government e-newspapers, major Taiwanese newspapers (referred to Apple Daily, the Liberty Tines, United Daily News, and China Times), and some relative conferences. Specifically, the collected information included the start and end date of the construction work, the number of households residing in the relocated community, the number of households moved to the permanent housing settlements, and so on.

3.2.2 Semi-structured in-depth interview

This chapter used semi-structured in-depth interviews to understand the disaster-affected residents' evaluation of the effectiveness and performance of the PDR project conducted in different permanent housing settlements. Semi-structured in-depth interviews were conducted with residents belonging to five major permanent housing settlements in southern Taiwan (Rinari, Ulaljuc, Xinlaiyi, Changzhi Baihe, Jialian). These five permanent housing settlements are the major post-disaster settlement, given the size of the permanent housing settlements and the number of households. As mentioned in chapter one, the interviewees were selected based on purposive selection to diversify the demography and socioeconomic background of interviewees. The interviewees were aged from 30 to 80 years and included community leaders, teachers, public servants, housekeepers, farmers, and self-owned businesspeople. Also, some related PDR stakeholders (e.g., government, NGOs, and architects) were included to provide the information regarding the PDR policies and implementation. The interviews were conducted from August 2017 to March 2021 (including pilot fieldwork in August 2017). The interviewed areas included Rinari, Ulaljuc, Xinlaiyi, Changzhi Baihe, Jialian permanent housing settlements, and the major cities in Taiwan (Table 3.1).

Table 3.1 Interviewees and the quantities

Code of interviewees	Interviewees	Location	Time	Number of interviewees	Abstract
CG1	Central government	Taipei City	March 2021	1	1. PDR strategy 2. Important implementation items
LG1-LG3	Local government	Pingtung City	November 2019; March 2021	3	
N1-N3	NGOs (the representative of Chi Zhi, Red cross, and World vision)	Taipei City; Pingtung City; Taichung City,	August 2018; November 2019; March 2021	3	
A1-A2	Architects	Chiayi City; Rinari	August 2018; August 2019	2	Planning and design issues
R1-R16	Rinari residents	Rinari	August 2017; February and August 2018; April, August, and November 2019; March 2021	16	1. Evaluation of PDR project 2. Relocation process 3. Evaluation of planning and design 4. Living satisfactory
W1-W14	Ulalijuc residents	Ulalijuc	August 2019	14	
X1-X19	Xinlaiyi residents	Xinlaiyi	August 2019	19	
C1-C16	Changzhi Baihe residents	Changzhi Baihe	August 2018; November 2019; March 2021	16	
J1-J16	Jialan residents	Jialan	August 2018; March 2021	16	

3.2.3 Spatial measurement and drone survey

To analyze the configuration of the post-disaster resettlement and the spatial characteristics, first, the settlement configurations and post-disaster housing layouts were identified though the site plan given by the architecture design office and NGOs, which in charge of the housing and settlement design. Afterward, a drone survey of the 29 permanent housing settlements was implemented (6 settlements was unable to

conduct the drone survey due to the policy restrictions). Aligned with the provided site plan from the architecture offices and NGOs, the configurations were plotted on the architecture drawing software *"AutoCAD"* for inter-settlement comparison.

3.2.4 Text Analysis

As mentioned in Chapter one, text analysis was defined as *"a research technique for the objective, systematic and quantitative description of the manifest content of communication"* (Berelson, 1952). In recent years, text analysis has been applied in PDR research, which reached some desirable achievements (Xu et al., 2019). In this study, the *"keyword cumulative frequency method"* approach for the text analysis was applied through manual identification and computational assistance. The purpose of using the text analysis method was to understand the popularity and the frequency of discussion of a specific topic in a certain period, given that the PDR process can evolve for the time being. Regarding the procedure of text analysis, first, a data set (series of texts based on a specific time sequence) needs to be identified as the source of the text analysis. Second, the analyzing target, some PDR project keywords, needs to be designated. Third, a monthly cumulative frequency of a specific keyword can be calculated and compared with other essential keywords. In this dissertation, the *"The 88 Morakot Disaster Network"* website was used as the analysis text (88 Morakot Disaster Network, 2010). In terms of timeline, this study extracted the first report published by the website in September 2009 (one month after the disaster) to the last report published in August 2013 (four years after the disaster). Four crucial aspects covered by the website—post-disaster reconstruction phase, reconstruction strategies, socioeconomics and cultural reconstruction, and PDR stakeholders—were used as the target of the text analysis. The aspects of text analysis were based on the previous related research (Xu et al., 2019). In accordance with the interview samples, the relevant reports of the five permanent housing settlements were extracted. Finally, 553 reports were extracted as the basic information for text analysis. The basic information of *"The 88 Morakot Disaster Network"* was provided in Table 3.2.

Table 3.2 About the 88 Morakot disaster network

Operation period	September 29th, 2009-August 27th, 2013
Number of the staff	12 independent journalists, four recorders
Number of the news	1263 (553 be extracted as the text analysis object)
Topic	Reconstruction policies, safety assessments, reconstruction, socioeconomic reconstruction

There were two reasons why *"The 88 Morakot Disaster Network"* was selected as the text analysis object of this study. The first was particularity. Distinct from other media and outlets in Taiwan, *"The 88 Morakot Disaster Network"* served as the only open online platform to share the Morakot PDR project-related news and reports. In addition, the journalists in the platform were well-trained with some disaster-related knowledge. Therefore, compared with ordinary news media, the platform was considered to have local perspectives, and the journalists had more chances to interact with residents. The second was extensiveness. Since *"The 88 Morakot Disaster Network"* had been in operation for nearly four years, the coverage of the topic varies—from the physical reconstruction to the socioeconomic rehabilitation—was considered comprehensive. The analysis process took several steps, as indicated below.

Step 1: Keyword selection

Firstly, the authors extracted the content of the news of *"The 88 Morakot Disaster Network"* from September 2009 to August 2013, according to the explanation in Table 3.2. After extracting the text from the website, the vocabularies were divided by software *"python"* using *"Chinese vocabulary recognition system."* The extracted vocabularies were further merged if the meaning were similar (e.g., "*temporary housing"* and *"transitional housing"*). The author manually browsed more than 2,000 vocabularies that appear most frequently in the overall text. After the merging and the selection process, a total of 118 vocabularies related to PDR were selected for analysis.

Step 2: Classification

The selected 118 keywords were further classified according to the above-mentioned four major aspects of post-disaster reconstruction. Some sub-categories were made to fit these 118 keywords into the four major aspects (Table 3.3).

Table 3.3 Major aspects and the sub-categories

Major aspect	**I: Post-disaster reconstruction phase**	**II: Reconstruction strategies**	**III: Socioeconomic and cultural reconstruction**	**IV: Reconstructing stakeholders**
Sub-categories	1-1 Dangerous area delineation 1-2 Emergency shelter 1-3 Temporary housing 1-4 Permanent housing	2-1 Housing reconstruction policy 2-2 Resettlement policy	3-1 Livelihood 3-2 Culture 3-3 Education 3-4 Agriculture	4-1 NGO 4-2 Residents organization 4-3 Local Government 4-4 Central Government 4-5 Design agency

Step 3: Cumulative analysis of keyword frequency

The classified keywords were used to perform a cumulative pattern in monthly units using the TF-IDF (term frequency-inverse document frequency) analysis model (Xu et al., 2019). The cumulative graph within each sub-group was plotted for comparison.

Step 4: Interpretation of analysis results

Based on the cumulative graphs generated from the four major classifications. Align with the interview result, the main issues of the Typhoon Morakot PDR project were interpreted. If the slope of the graph was steeper, it meant that the topic was discussed more often during a given period and vice versa. The crucial particular time periods were marked from sections one to six in the following research finding.

3.3 Number of relocated households and site analysis

The analysis of the number of relocated households and site selection included four items: 1. relocated households and settlements analysis, 2. relocation type analysis, 3. relocated communities analysis, and 4. distance analysis.

3.3.1 Relocated households and settlements analysis

In terms of the relocated households number and the number of permanent houses been built, 1,265 households were relocated and 1,269 households were built in Kaohsiung City; 1,336 households were relocated and 1,339 households were built in Pingtung County; 518 households were relocated and 518 households were built in Chiayi County; 228 households were relocated and 228 households were built in Taitung County; 186 households were relocated and 186 households were built in Nantou County; 28 households were relocated and 28 households were built in Yunlin County; in Tainan City, 69 households were relocated and 70 households were built. Kaohsiung City and Pingtung County both built more than 1,000 households, which were the regions for large scale construction; Chiayi County, Taitung County, and Nantou County all built more than 100 households, which were the medium-sized construction field; Yunlin County and Tainan City had only a few households, which were small-sized construction region (Table 3.4). In addition, this study found that the number of housing built in Kaohsiung, Pingtung County, and Tainan City slightly exceeded the number of relocated households. The difference was because of the change of the final recognized eligible relocated households.

In terms of the number of permanent housing settlements, Kaohsiung City had six permanent housing settlements (Daai settlement had two phases of construction); Pingtung County had eight settlements (Zhongjuanlu, Changzhi Baihe, Rinari, Gaoshi, Ulalijuc, and Xinlaiyi had two phases of construction); Chiayi County had seven settlements (Rian had two phases of construction); Taitung County had seven settlements (Jialan west had two phases of construction). Nantou County had four settlements; Yunlin County had one settlement; Tainan City had two settlements. In total, there were 35 permanent housing bases in Taiwan[4] (Table 3.4), and the locations of the permanent housing bases were shown in Figure 3.1.

Although Kaohsiung City and Pingtung County accounted for the majority of the relocated households which also had a tremendous number of permanent housing units built, Pingtung County had the most of the permanent housing settlements (eight), Chiayi County and Taitung County came second (seven), and Kaohsiung City had only six permanent housing settlements. The analysis indicated that the permanent housing settlements in Kaohsiung City had multiple affected communities merged into one permanent housing settlement. This issue was discussed in detail in the following section.

[4]Although the government information showed that there are 44 permanent housing settlements, which were calculated based on the number of construction contracts, from the spatial perspective, there should be 35 permanent housing settlements. Therefore, as for the purpose of this study, 35 permanent housing sites were used as the basis for the subsequent analysis.

Table 3.4 Quantity of the relocated households and the built households

	Kaohsiung	Pingtung	Chiayi	Taitung
Relocated households	1,265	1,336	518	228
Constructed housing units	1,269	1,339	518	228
Size of the construction project	Large	Large	Medium	Medium
Number of affected communities	18	18	18	7
Number of reconstructed settlements	6	8	7	7
Name of the settlements	1.Baoshan	1.Zhongjuanlu*	1.Laiji	1.Dawu
	2.Daai	2.Ulalijuc*	2.Rihao	2.Daniao
	3.Lele	3.Jiupeng	3.Shanmei	3.Binmao
	4.Longxing	4.Xinlaiyi*	4.Riman	4.Dazhu
	5.Wulipu	5.Changzhi Baihe*	5.Leye	5.Jialan East
	6.Riguangxiaolin	6.Rinari*	6.Rian*	6.Jialan West*
		7.Gaoshi* 8.Xinfeng	7.Zhulu	7.Deqi
	Nantou	**Yunlin**	**Tainan**	**Total**
Relocated households	186	28	69	3,630
Constructed housing units	186	28	70	3,638
Size of the construction project	Medium	Small	Small	N/A
Number of affected communities	3	3	4	71
Number of reconstructed settlements	4	1	2	35
Name of the settlements	1.Honglixincun	1.Dongxing	1.Yantianli	
	2.Mingjianxiang		2.Yujing	
	3.Changliyuan			
	4.Shenmu			

"*" Indicated that settlement had several phases of construction

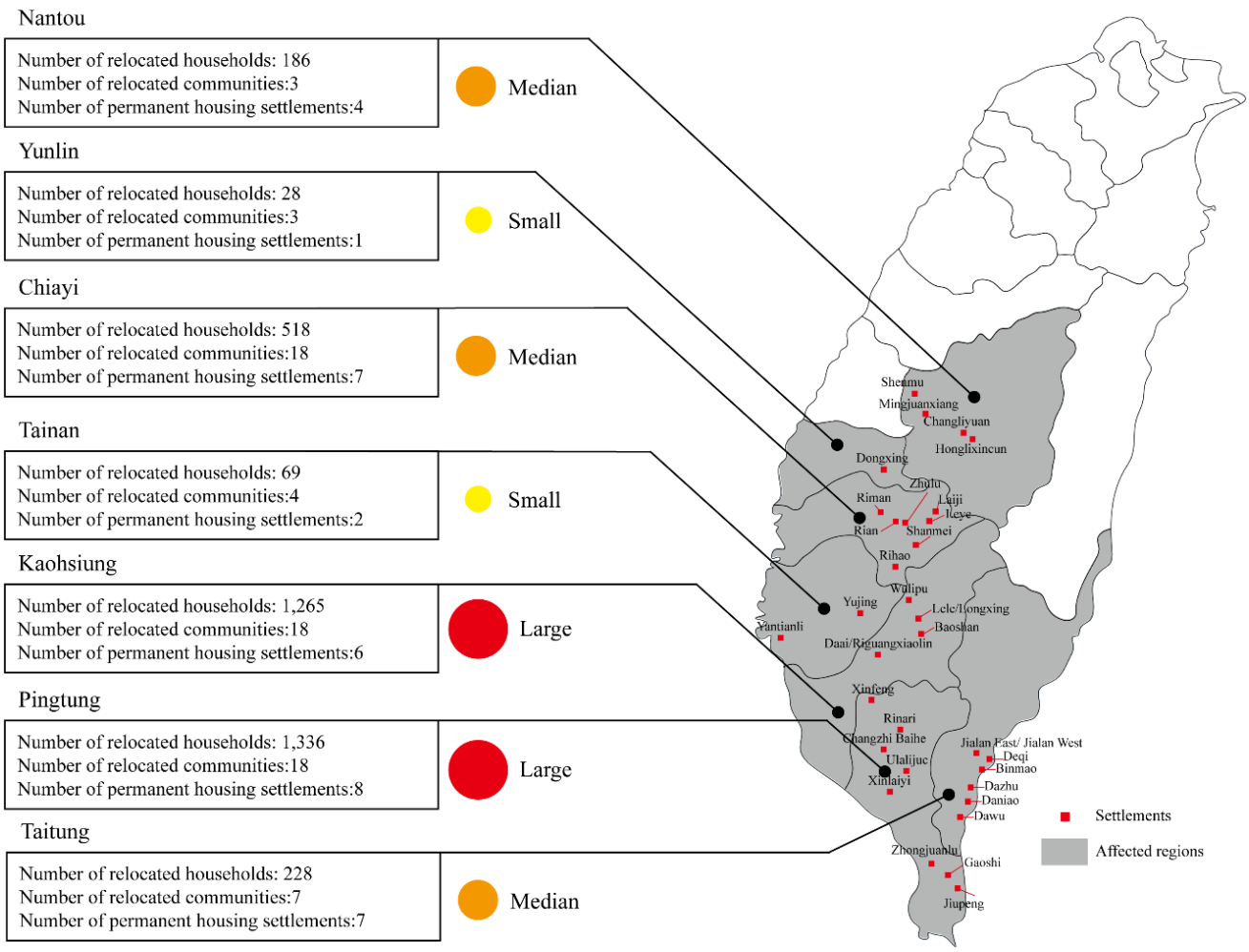


Figure 3.1 Allocation of the permanent housing settlements in Taiwan

3.3.2 Relocation type analysis

According to Ishimaru et al. (2015), the relationship between the original community and the new settlement can be 1. homogeneous: a single community moved to a single permanent housing settlement and did not share the settlement with other relocated communities (one-to-one); 2. unified: plural communities moved together to a single permanent housing settlement and shared settlement with various communities (multiple-to-one); 3. divided: a single settlement which was divided and moved to multiple permanent housing settlement (one-to-multiple); 4. Compound: multiple communities were relocated to plural permanent housing settlements, where the phenomenon of division occurs (multiple -to- multiple). These four types of relocation patterns can completely cover the relationship between the affected communities and the new permanent housing settlements after the Typhoon Morakot disaster. The classification patterns were shown in Figure 3.2.

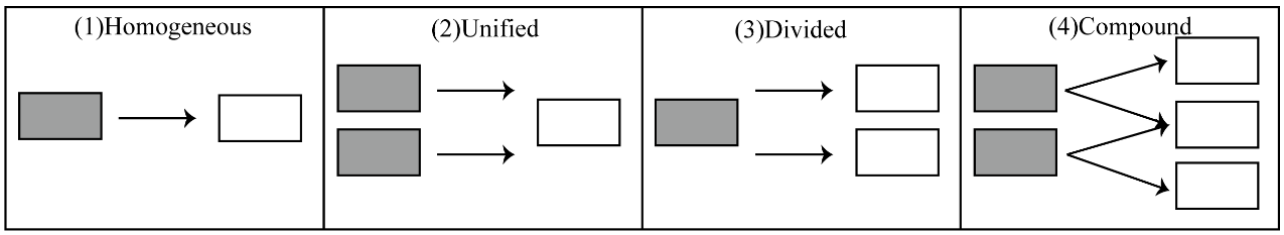


Figure 3.2 Four types of relocation patterns

As shown in Table 3.5, among the four types of relocation patterns, in the Typhoon Morakot PDR project, the homogeneous type was the most common type, with 11 permanent housing settlements. The homogeneous type was a typical post-disaster relocation type, in which a single affected community was rebuilt off-site in a specific settlement to ensure the solidarity of the community and the social structure that sustains it.

The reason for the unified type of relocation was that the local government tended to merge multiple affected communities into the same permanent housing site to save time and budget due to the tight construction schedule and practical issues such as land area constraints. Among them, the Pingtung County government adopted a unified resettlement strategy. For instance, the Changzhi Baihe settlements received residents from the Wutai Village, Jilu Village, Jiamu Village, and Ila Village in Wutai Township and Darai Village and Dewen Village in Sandimen Township, which was the most complicated case of this type. The inhabitants of Wutai Township basically belong to the Rukai ethnic group[5], while those from Sendimen Township are of the Paiwan ethnic group. Both groups grew up in different areas in the past, resulting in conflicts in the Changzhi Baihe settlement (C1, C5, C8)[6]. Also, the Rinari settlement is home to the residents of Haocha Village in Wutai Township, Majia Village in Majia Township, and Dashe Village in Sandimen Township, which also had ethnic conflict problems. Although the residents of Haocha were the first to express their desire to move

[5] The Rukai and Paiwan groups are two of the Taiwan indigenous groups in the south. The background of indigenous people of Taiwan was introduced in chapter four.
[6] The parenthesis indicated the sentence was quoted from certain interviewees, the code of interviewees in the parentheses were correspond with the one in Table 3.1.

to the Rinari settlement, Rinari is the traditional territory of Paiwan's Majia village. Thus, the residents of Haocha had to accept living with the Paiwan tribes.

There were three groups of permanent housing settlements, seven in total, belonging to the divided type. For instance, the Wulipu, Riguangxiaolin, and Daai settlements had divided the residents from the Xiaolin Village. By the time, because the government urged the residents to choose relocation as soon as possible, some residents were worried that they would have no place to live, so some of them moved into the Daai settlement first. Later, the Red Cross assisted in the construction of the Riguangxiaolin and Wulipu settlements. The Xiaolin village was therefore divided (88 Morakot Typhoon Disaster Network, 2010). The other two groups of divided settlements were Changliyuan and Honglixincun in Nantou County, which divided the residents of Xinshan Village in Shuili Township, Nantou County. Although, according to the actual survey, both Changliyuan and Honglixincun settlements are located in the downtown area of Shuili Township, due to the land size, it was difficult to accommodate all the relocated households from Xinshan Village to a single settlement. The last group was the Mingjuanxiang and the Shenmu settlements in Nantou County, which divided the residents of Shenmu Village in Xinyi Township.

There were two groups of the compound type. The first group also belonged to the divided type, which was the Daai, Longxing, and Lele settlements. Three settlements divided the residents of Qinhe Village in Taoyuan District and Xinfa Village in Liugui District. The residents mentioned that the settlement consisted of indigenous and Chinese, with differences in religion and culture. The Kaohsiung City Government's compound resettlement approach had made it difficult for community residents to develop a sense of identity and even caused low occupancy rates in the permanent housing settlements. Another group included Shanmei, Leyu, and Laiji settlements in Chiayi County.

This section found that although the number of permanent housing settlements belonging to the divided type and the compound type was not as large as that of the homogeneous type and the unified type, they still have a certain number and overall proportion. In the case of the divided type and the compound type, the residents were separated from their friends and relatives in the original community, which may have fragile the original community's organization and structure and hampered cultural inheritance for the indigenous people (Table 3.5).

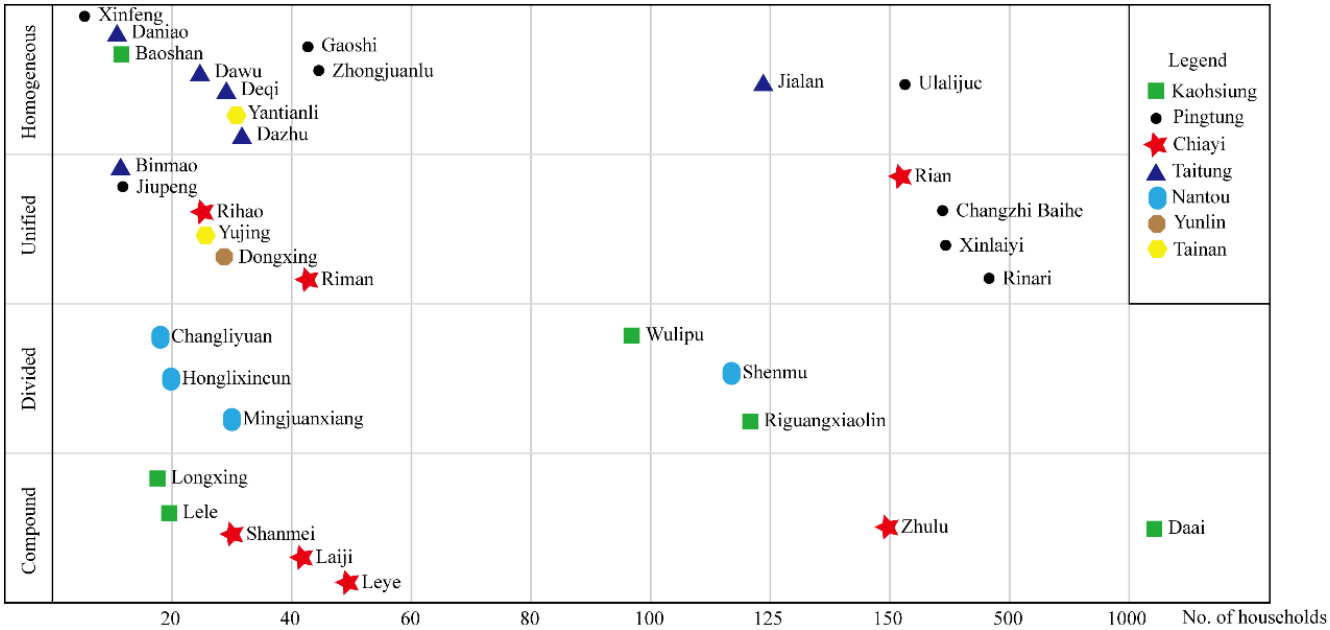
Table 3.5 Relocation patterns allocation of the permanent housing settlements

	Homogeneous	**Unified**	**Divided**	**Compound**
Permanent housing settlement	**Pingtung:** Gaoshi, Zhongjuanlu, Ulalijuc, Xinfeng **Taitung:** Deqi, Dawu, Jialan, Dazhu, Daniao **Kaohsiung:** Baoshan Tainan:Yantianli	**Pingtung:** Changzhi Baihe, Rinari, Xinlaiyi, Jiupeng **Chiayi:** Rian, Riman, Rihao **Taitung:** Binmao **Yunlin:** Dongxing **Tainan:** Yujing	**Kaohsiung:** Wulipu & Riguangxiaolin & Daai **Nantou:** Changliyuan & Honglixincun, Mingjianxiang &Shenmu	**Kaohsiung:** Daai & Lele & Longxing **Chiayi:** Shanmei & Leye & Laiji &Zhulu
Total	11 settlements	10 settlements	3 groups /7 settlements	2 groups/7settlements

From the above discussion, it can be seen that the unified type was the relocation type used by most of the counties and cities, with Pingtung County (four), Chiayi County (three), Taitung County (one), Yunlin County (one) and Tainan City (one), a total of five counties and cities using this migration type; the homogenous type was also the relocation type used by most of the cities, with Pingtung County (four), Taitung County (five), Kaohsiung City (one) and Tainan City (one), a total of four counties and cities using this relocation type; The divided type was only found in Kaohsiung City (one) and Nantou County (two); Also, the compound type was only found in Kaohsiung City (one) and Nantou County (two).

Although the Taitung County government had planned a relatively large number of permanent housing settlements, because one-third of the county's population were indigenous peoples, the policy formulation had considered the solidarity of the indigenous communities (LG3). Therefore, the homogeneous type was the dominant relocation type in Taitung County. On the other hand, some local governments neglected the rights of the disaster victims and indigenous groups due to the lack of time, resulting in more complicated relocation patterns (divided, compound types). For example, Pingtung County government officials mentioned that the central government pressured the county government to recognize the number of permanent housing units and complete the site selection process as soon as possible for the sake of political performance, which did not carefully consider the subjectivity of the indigenous tribes (LG1, LG2).

In terms of the number of households, the homogenous type usually had a smaller number of households because only one community relocated to the permanent housing settlements; the unified type had more households than the homogenous type, and the number of low-households and high-households permanent housing settlements in this type was about half each; while the divided type had a high diversity of the number of the households in a settlement; The compound type, except for the Daai settlement in Kaohsiung, mostly contained the low-households settlements. This showed not only the unified type, divided, and compound type of relocation pattern generated complicated relationships between the original community and permanent housing settlement. The number of households also varied a lot in these three types (Figure 3.3).



Note: X-axis is shown in nominal form

Figure 3.3 Relationship of the relocation patterns of the permanent housing, counties, and number of households.

3.3.3 Relocated communities analysis

As mentioned earlier, the relocation type of the Typhoon Morakot PDR project was not merely planed accoring to a homogeneous type but a combination of four different relocation types. To understand the complexity of the relocated communities composition of permanent housing settlements in each jurisdictions, this section counted the number of relocated communities in each permanent housing settlement by the unit of the village. Afterward, the relocated communities' mean and standard deviation were calculated and compared using the county and city as the base for comparison to understand the intergroup differences.

In terms of the number of relocated communities, there were 18 relocated communities in Kaohsiung City, 18 in Pingtung County, 18 in Chiayi County, seven in Taitung County, three in Nantou County, three in Yunlin County, and four in Tainan City. Therefore, in terms of the number of relocated communities, Kaohsiung City, Pingtung County, and Chiayi County were the largest, and there were 71 relocated communities nationwide, as shown in Table 3.6.

This section found that Kaohsiung City had the highest average number of relocated communities and the highest standard deviation, indicating a considerable variation among its permanent housing settlements. Especially, Kaohsiung City's Daai settlement accommodated up to 17 different affected communities, which was much higher than the second place Zhulu settlement in Chiayi County (eight) and the third-place Changzhi Baihe settlement in Pingtung County and Rian settlement in Chiayi County (six).

In terms of the total number of households, Kaohsiung City’s Daai settlement had 1,004 households, the only

mega settlement among all the permanent housing settlements in Taiwan that exceeded 1,000 households. This situation showed that the Kaohsiung City government tried to use Daai settlement as the main base for relocation was clear. The city government tried to concentrate most of the affected households in Daai to reduce land acquisition, construction time, and administrative procedures, which had been criticized as *"fast food reconstruction"* (88 Morakot Disaster Network, 2010). Residents had also criticized Daai settlement for their dissatisfaction with the design, quality of living, and lifestyle of permanent housing (88 Morakot Disaster Network, 2010). In addition to the high average and high standard deviation of the number of permanent housing settlements in Kaohsiung City, Chiayi County's Zhilu and Rian and Pingtung County's Changzhi Baihe settlements also had a serious *"melting pot"* phenomenon, making Chiayi County the second and Pingtung County the third in terms of the average number of relocated communities. As mentioned earlier, these mixed living conditions had led to subsequent community consensus building and cultural conflicts (R1, R4, C2, C8).

Table 3.6 Each permanent settlement's relocated communities number and the relocated communities numbers' average/ standard deviation calculated by counties

Jurisdictions	Name of the settlements	Number of the communities (Village)	Jurisdictions	Name of the settlements	Number of the communities (Village)
Kaohsiung Average:3.67 Standard deviation:6.53	Daai	17	**Chiayi Average:3.57 Standard deviation:2.64**	Rihao	3
	Wulipu	1		Shanmei	1
	Riguangxiaolin	1		Leye	4
	Lele	1		Laiji	1
	Longxing	1	**Taitung Average:1.17 Standard deviation:0.41**	Deqi	1
	Baoshan	1		Dawu	1
Pingtung Average:2.43 Standard deviation:1.81	Changzhi Baihe	6		Jialan	1
	Rinari	3		Binmao	2
	Gaoshi	1		Dazhu	1
	Zhongjuanlu	1		Daniao	1
	Ulalijuc	1	**Nantou Average:1.5 Standard deviation:1**	Changliyuan	1
	Xinlaiyi	3		Honglixincun	1
	Xinfeng	1		Mingjianxiang	3
	Jiupeng	2		Shenmu	1
Chiayi Average:3.57 Standard deviation:2.64	Rian	6	**Yunlin Average:3 Standard deviation:NA**	Dongxing	3
	Zhulu	8	**Tainan Average:2 Standard deviation:1.41**	Yujing	3
	Riman	2		Yantianli	1

3.3.4 Relocated distance analysis

Because some of the relocated communities were severely affected by the disaster, such as Xiaolin Village in Jiaxian District, Kaohsiung City, and Haocha Village in Wutai Township, Pingtung County, where the original communities was basically eradicated after the typhoon disaster. According to the central government's post-disaster relocation strategy: *"leaving the disaster but not the village,"* residents were expected to live in the same administrative area as their original residence to reduce post-disaster adaptation and avoid the disconnection of the human-land relationship. In this section, the distance of the relocated

settlement was defined as 1. relocated to same county (city) but different township = 3, 2. relocated to same county, township but different village = 2, and 3. relocated to same county, township, and village = 1. Simply speaking, if the administrative area before and after the disaster was at a lower level, the distance was shorter, and vice versa.

From the aforementioned relocation type analysis, it was clear that the permanent housing settlements usually comprise various relocated communities. In this study, the *"distance-weighted average"* of the households in the relocated communities was used to calculate the *"distance-weighted coefficient* $\boldsymbol{D_{(settlement)}}$*"* of a single permanent housing settlement by considering the weight of households in each relocated community. $D_{(settlement)}$ was defined as:

$$D_{(settlement)} = \frac{\sum_{k=1}^{K} P_k * D_k}{\sum_{k=1}^{K} P_k}$$

D_k=Distance between the kth relocation community and the permanent housing settlement
P_k=Total number of households in the kth relocation community
K=Number of relocated communities in a permanent housing settlement

Using the same concept, the *"distance-weighted coefficient of county or city* $\boldsymbol{D_{(county)}}$*"* was calculated, which considered the number of households in the permanent housing settlements located in a county or city. $D_{(county)}$ was defined as:

$$D_{(county)} = \frac{\sum_{h=1}^{H} P_h * D_{(settlement)h}}{\sum_{h=1}^{H} P_h}$$

$D_{(settlement)h}$=Distance-weighted coefficient of the hth permanent housing settlement
P_h=Number of households in the hth permanent housing settlement
H=Number of permanent housing settlements in a county or city

Table 3.7 showed that the distance coefficient of Kaohsiung City was 2.85, which was the highest among the seven counties and cities, representing that the average distance between the original community and permanent housing settlement was long. Nantou County, with a distance coefficient of 2.79, and Pingtung County, with a distance coefficient of 2.72, were the second and third. It can be seen that most of the counties and cities with longer relocation distances had multiple permanent housing sites being built and planned at the same time, making it impossible for the county governments to communicate with the victims to a

satisfactory extent. The reason was that given the limited budget, the government used government-owned land or government-own company land as the settlements for permanent housing. Usually, the government-owned land and government-owned company's land (e.g. Taiwan Sugar Company) can be required at a lower price with a simple procedure, which was deemed beneficial from the government side. However, the decision-making also limited the choices of relocation as well.

In Kaohsiung City, even the small and medium-sized homogenous relocation type communities were relocated to permanent housing settlements remoted from their original communities under limited conditions. For example, the Lele, Longxing, and Baoshan settlements. The indigenous permanent housing residents in Pingtung County believe that indigenous people have a deep emotional connection to the land, and many of them had farming livelihoods before the disaster (R1, R5). Therefore, despite most of the permanent housing settlements being closer to the cities, the distance from the pre-disaster community to the permanent housing settlement was difficult to sustain the traditional agricultural livelihood.

On the other hand, though many permanent housing settlements were built in Taitung County at the same time, the county government's own reconstruction policy gave the government more time and resources to respond to the needs of the indigenous households. Because most of the permanent housing settlements in Taitung County applied a homogenous type of relocation, the government did not have to deal with multi-community integration issues (LG3). Residents in the Jialan East and West settlements believed that *"leaving disaster but not the village"* was very important to the indigenous people. The tribal members should live together (J1, J3). It was clear that both the local government's commitment and the community's voice were essential for the post-disaster relocation policy.

Table 3.7 Distance-weighted coefficient in each permanent housing settlement and county or city

Jurisdictions	**Name of the settlements**	**$D_{(settlement)}$**	**Jurisdictions**	**Name of the settlements**	**$D_{(settlement)}$**
Kaohsiung $D_{(county)}$**:2.85** **Standard deviation:0.84**	Daai	3	**Chiayi** $D_{(county)}$**:2.24** **Standard deviation:0.64**	Rihao	2
	Wulipu	1		Shanmei	1
	Riguangxiaolin	3		Leye	1.53
	Lele	3		Laiji	2
	Longxing	2	**Taitung** $D_{(county)}$**:1.03** **Standard deviation:0.2**	Deqi	1
	Baoshan	3		Dawu	1
Pingtung $D_{(county)}$**:2.72** **Standard deviation:0.95**	Changzhi Baihe	3		Jialan	1
	Rinari	2.73		Binmao	1.5
	Gaoshi	1		Dazhu	1
	Zhongjuanlu	1		Daniao	1
	Ulalijuc	3	**Nantou** $D_{(county)}$**:2.79** **Standard deviation:0.58**	Changliyuan	2
	Xinlaiyi	3		Honglixincun	2
	Xinfeng	1		Mingjianxiang	3
	Jiupeng	2		Shenmu	3
Chiayi $D_{(county)}$**:2.24** **Standard deviation:0.64**	Rian	2	**Yunlin** $D_{(county)}$**:2** **Standard deviation:NA**	Dongxing	2
	Zhulu	3	**Tainan** $D_{(county)}$**:1.93** **Standard deviation:1.41**	Yujing	3
	Riman	2.5		Yantianli	1

3.4 Planning and design of the permanent housing settlement

In this section, some important aspects of the planning and design issues were discussed. The critical aspects include 1. settlement configuration analysis, 2. settlement area analysis, 3. settlement construction period analysis, and 4. settlement land ownership analysis.

3.4.1 Settlement configuration analysis

This section reviewed the actual configuration of Taiwan's permanent housing settlements and proposed six types of configurations. The classification system was deprived and modified according to the four-type configuration used by Ishimaru et al. (2015), which included 1. single loop, 2. grid, 3. community central, 4. single-sided linear, 5. double-sided linear, and 6. compound type (Figure 3.4; Ishimaru et al., 2015).

The categories of the configuration types were based on the relationship between the road and the housing allocation. The single loop type referred to the settlement was planned in a single ring-shaped road, with more than 50% of the houses allocated inside the ring. The grid type indicated that the single ring-shaped road multiplied in a grid pattern, with more than 50% of the houses in the ring. Usually, this type of configuration was suitable for the multi-communities relocated project, given that different relocated communities can be placed in a different blocks of the settlement. Community central type was shaped as a grid with an additional community plaza. The design implied that the community facilities had been taken into account. The single-sided linear type showed that all housings were allocated on the single side of the road. On the other hand, in the double-sided linear type, some housing were allocated on either side of the road. Compound types referred to the settlement configuration integrated more than two of the above-mentioned planning approaches. Figure 3.5 showed the configuration diagram for the 35 permanent housing settlements nationwide. The type of the planning approach was marked in parentheses aligned with the name of the settlement (Refer to Figure 3.4). According to the classification result, five settlements belonged to the single loop type, six to the grid, six to the single-sided linear, and double-sided had 11 cases. Only three settlements adopted the community central type, and four the compound type.

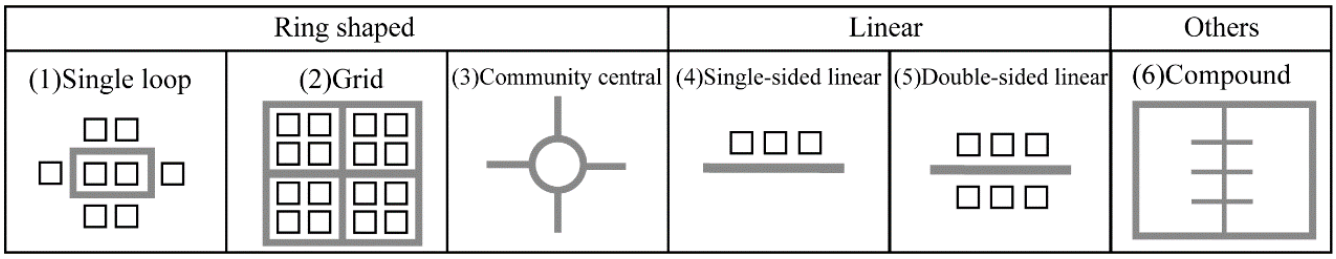
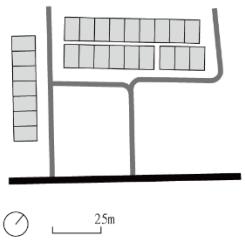
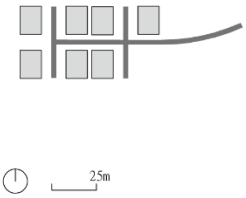
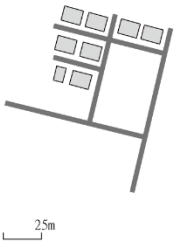
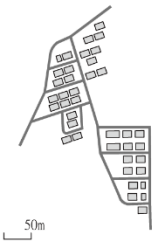
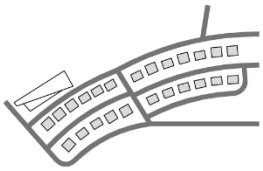
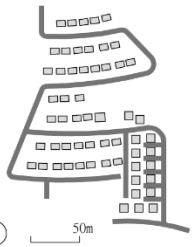
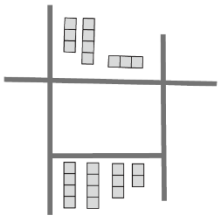
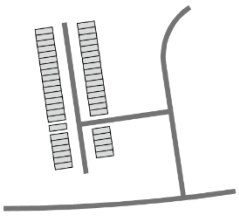


Figure 3.4 Six types of configurations of the permanent housing settlement

1. Taitung/Dawu(3)	2. Taitung/Daniao(5)	3. Taitung/Binmao(5)	4. Taitung/Dazhu(2)
 25m	 25m	 25m	 50m
5. Taitung/Jialaneast(2)	**6. Taitung/Jialanwest(5)**	**7. Taitung/Deqi(4)**	**8. Tainan/Yantianli(2)**
 50m	 50m	 25m	 25m
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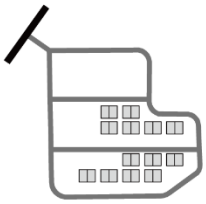
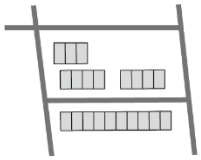
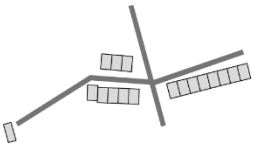
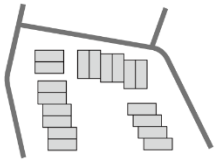
 25m	 25m	 25m	 50m
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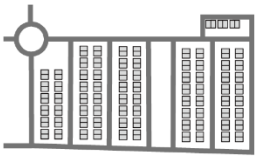
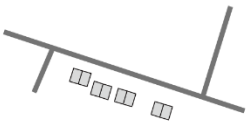
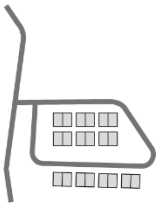
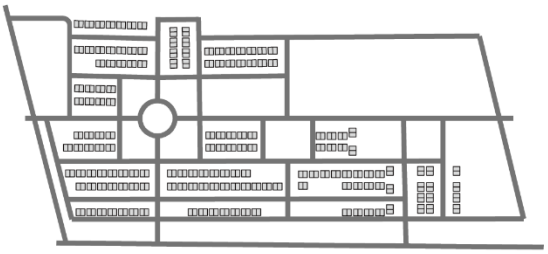
 50m	 50m	 50m	 25m
17. Pingtung/ Jiupeng(1)	**18. Pingtung/Xinlaiyi(3)**		
 25m	 50m		

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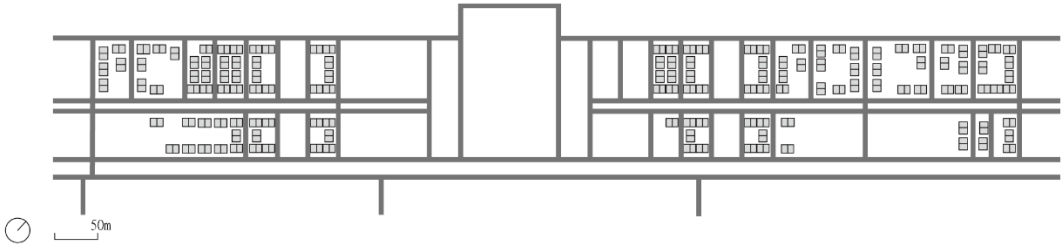

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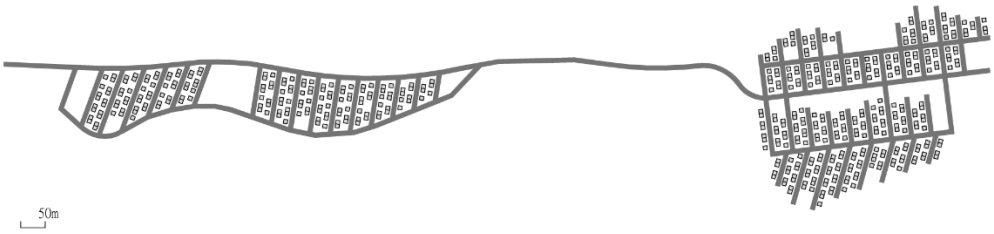

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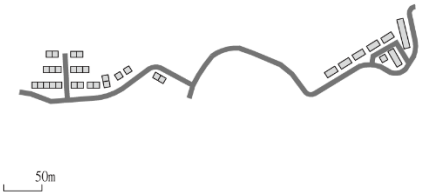

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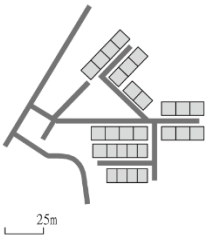

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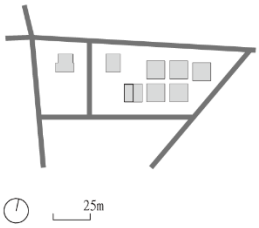

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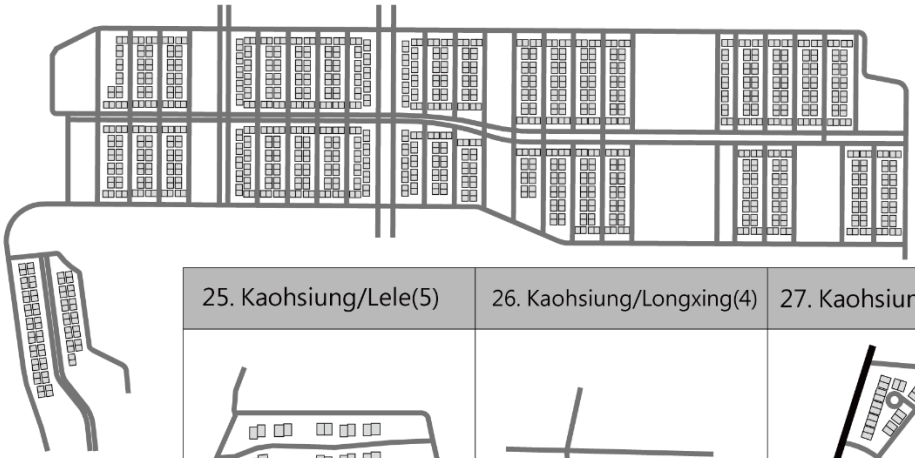

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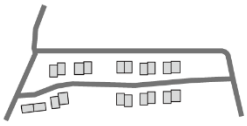

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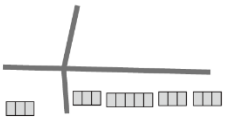

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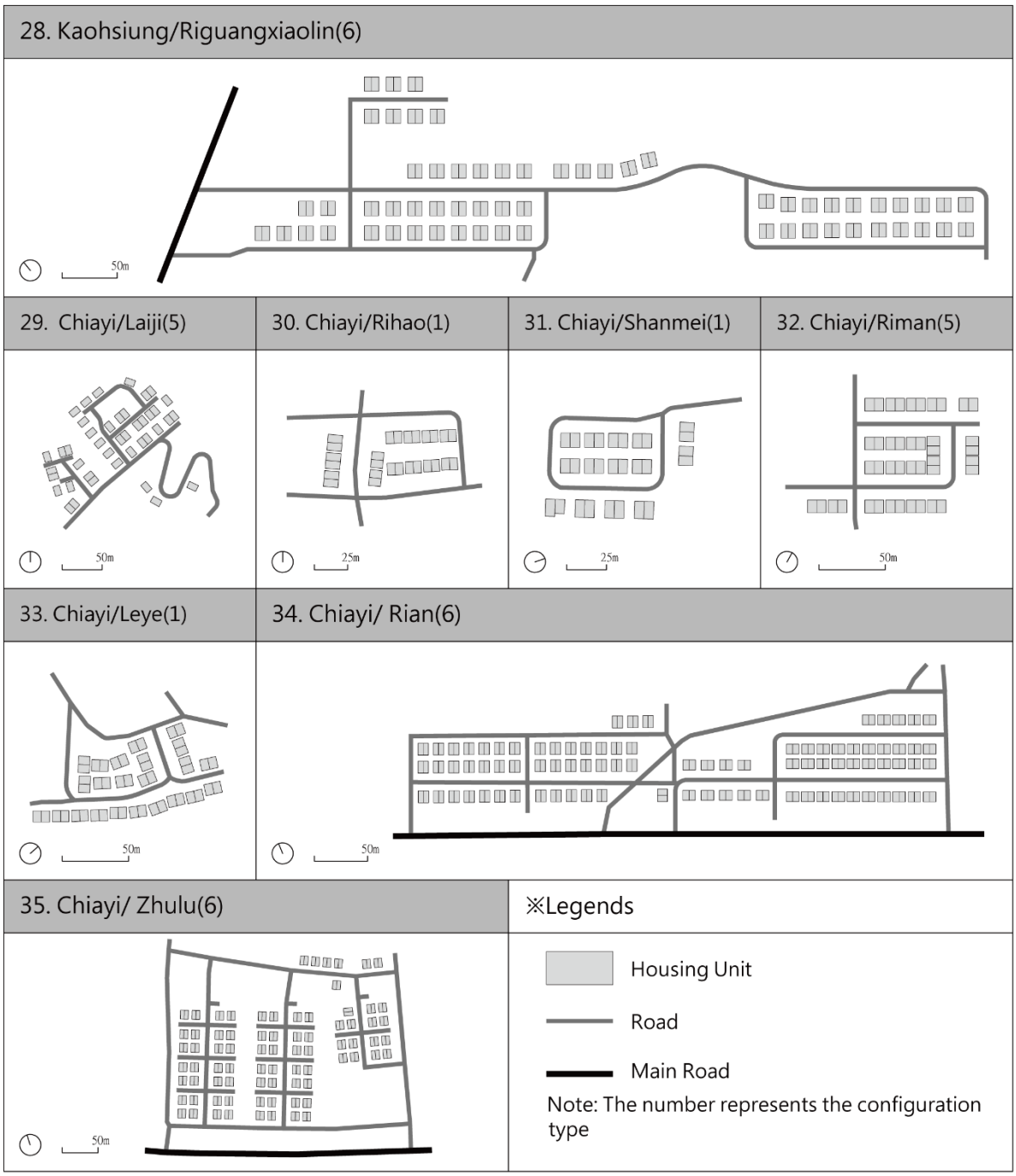

Figure 3.5 The configuration figures for the permanent housing settlements in Taiwan

Next, this section analyzed the relationship between settlements' configuration types, located areas, constructing NGOs, and housing quantity, as shown in Figure 3.6. Regarding the location, the Kaohsiung City and Pingtung County showed an even distribution of the configuration types among the six configuration types. The settlements located in Chiayi County were concentrated in the single loop, double-sided linear, and compound types. On the other hand, in Taitung County and Nantou County, the settlements mainly concentrated on the grid, single loop, and double-sided linear types.

Regarding housing quantity, the relatively simple structure of the single loop, single-sided linear, and double-sided linear types were mainly used in the small-scale household settlement planning project. On the other hand, the grid type—the extensive version of the single loop type, was used by some large-scale settlement planning projects. The community central and the compound types were also shown to have a significant presence in the large-scale settlement project.

Regarding the NGOs, this section found that the Red Cross planned for five different configuration types except for the single-sided linear type. The works of Red Cross were evenly distributed in all the regions, given that they cooperate with different local government sectors. Thus, the design and planning also varied because of the counterpart's ideology and the local conditions (e.g., housing quantity, construction land size, and settlement configuration). Tzu Chi used the grid type for most of its projects. The constructed permanent housing settlements' scale had high variance. The works distribution was limited to Kaohsiung City and Pingtung County. As for World Vision, except for its largest settlement—the Rinari settlement, with 483 households located in Pingtung County—the rest of the projects were in Taitung County. Most of the Taitung affected indigenous communities had received help from the World Vision, which explained why the group had a significant presence in the region. In Taitung County, most of the projects were small-size planning. Therefore, the single-sided linear and double-sided linear types were widely applied in the region.

The interview results showed that residents were unsatisfied with the grid-type configuration due to the lack of privacy, the scarcity of arable land, and the public facilities (C1, X8). Although the community central type was similar to the grid type, the resident interpreted it differently. For instance, the Kaohsiung Wulipu settlement had a community square with a disaster-related museum and a traditional community center. Pingtung Ulalijuc and Xinlaiyi settlement applied a loop road as the community center, with a sculpture describing the communities' spirit. The community plaza can also accommodate the community facilities and boost the identities of the community (X7, U6). The compound type had the most complex structure, as it applied more than two configuration types. However, it had been highly rated by the residents. For example, in the Rinari settlement—a work completed by the World Vision—the main road provided access to the exterior as well as the buffer space among three relocated communities. Conversely, the community roads were planned between permanent housing to maintain the privacy of the households in the settlements (A1, R3). The residents also expressed that the communities approved the design strategy using a participatory approach (R2, R6, R7).

The settlement configuration analysis showed that the configuration might vary due to the number of housings in the settlement and the local geographical condition. Additionally, the design strategies among stakeholders, as well as the involvement of the local residents, can influence the settlement design and planning. In the case of the large-scale planning project, compound planning seemed to be preferable for the residents.

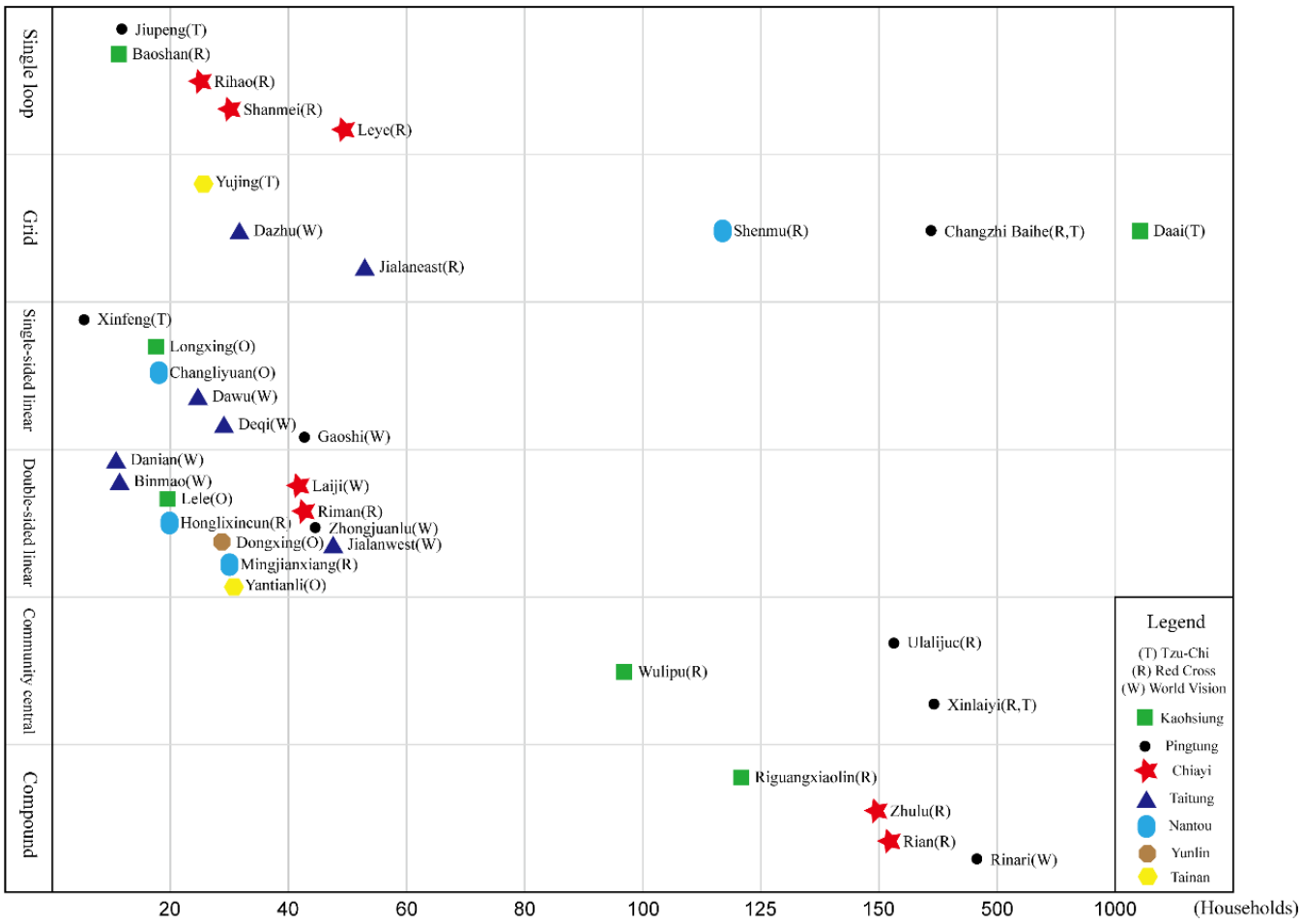

Figure 3.6 The relationship of permanent housing settlements' configuration types, located area, constructing NGO, and number of households

3.4.2 Settlement area analysis

The total planned area of permanent housing settlements was 73.48 hectares in Kaohsiung City, 98.78 hectares in Pingtung County, 22.28 hectares in Chiayi County, 14.35 hectares in Taitung County[7], 6.47 hectares in Nantou County, 1.47 hectares in Yunlin County, and 2.53 hectares in Tainan City. This study found that the planned area of all permanent housing settlements was less than 30 hectares. According to the regulations, if the land area was larger than 30 hectares, environmental assessments such as soil and water conservation plan need to be conducted. However, given the limited time available for post-disaster reconstruction, decision-makers and planners mostly controlled the development area to less than 30 hectares to avoid problems such as soil and water conservation reviews to speed up the construction of permanent housing (CG1, LG1).

After dividing the area of settlements by the number of the permanent housing units, each household in Kaohsiung City was allocated an average area of 557.93m^2, in Pingtung County 751.75m^2, in Chiayi County 437.72m^2, in Taitung County 626.64m^2, in Nantou County 353.55m^2, in Yunlin County 525m^2, in Tainan City 468.52m^2, and 603.63m^2 as the nationwide average. According to Ishimaru et al. (2015), the average

[7] Taitung Daniao was excluded from the calculation given no data available. However, given the area of the settlement is small, which did not influence the result greatly

permanent housing settlements area per household was 629.71 m^2 in Kesennuma City after the Great East Japan Earthquake. Suppose the allocated area per household in Kesennuma City compared with the one in Taiwan. In that case, it is clear that the average allocated settlement area per household was inadequate in some regions (e.g., Chiayi County, Nantou County, Yunlin County, and Tainan City). However, due to the discrepancies of the regulations, PDR strategies, consideration of planning, and land use policies, the comparison of the Taiwanese and Japanese cases still needs more justification. The result of the settlement area analysis was presented in Table 3.8.

In the face of the limited construction area and tremendous affected households, the provision of the settlement facilities was sacrificed in some cases. For example, the residents of Changzhi Baihe mentioned that there were no public facilities such as the elderly daycare center in the settlement (C5, C8). In addition, some community organizations needed to share a common space for multiple activities. In the case of Goshi, the hinterland was so small that only one basketball court was provided, which limited the activities in the settlement. In Rinari and Changzhi Baihe, residents pointed out that the inadequate construction space constrained allocating the arable land for agricultural activities (C10, R6).

Table 3.8 The average distributed area per household calculated by counties

Jurisdictions	**Settlement total areas (hectare)**	**Allocated settlement area per household (m^2)**	**Jurisdictions**	**Settlement total areas (hectare)**	**Allocated settlement area per household (m^2)**
Kaohsiung	73.48	557.93	**Nantou**	6.47	353.55
Pingtung	98.78	751.75	**Yunlin**	1.47	525.00
Chiayi	22.28	437.72	**Tainan**	2.53	468.52
Taitung	14.35	626.64	**Total**	219.36	603.63

3.4.3 Settlement construction period analysis

The relationship among the location of the post-disaster settlement, construction period, and housing quantity was analyzed, which showed in the upper part of Figure 3.7. The graph showed the sporadic numbers of the constructed housing and the few permanent housing settlements in Nantou County, Yunlin County, and Tainan City. The entire construction work in these three regions was under 400 days. In Kaohsiung City and Pingtung County, despite the large number of permanent housing settlements constructed and the divergence of settlement size, the NGOs and local government only used an average of 252.86 days and 251 days, respectively, to finish the projects in the regions.

Due to the cooperative relationship with the Kaohsiung City government, Tzu Chi rushed to finalize its construction project in the region. As mentioned before, given the cooperative counterparts allocated nationwide, there was no prominent characteristic of the Red Cross's construction period. The World Vision spent more time on relatively small projects with the cooperation of the Taitung County government. The result was shown at the bottom part of Figure 3.7.

According to the interview, the Pingtung government and Tzu Chi representatives prioritized the speed of construction (LG1, N1). However, the residents complained about the substandard housing quality as well as

the reckless implementation and planning of the permanent housing settlements in the region without consultation from the communities (R10, C7, X6). In contrast, in the case of Taitung County, regardless of its relatively small-sized settlement, the participation of the local residents had been greatly emphasized by the local government and World Vision (N2). Therefore, although more time was spent during the planning and construction, the implementation had been praised by some of the residents in the region (J6, J10, J11). Interestingly, different regional governments and NGOs had distinct attitudes and concepts toward settlement planning and design. Moreover, the speedy implementation did not equivalent to the high evaluation from the residents.

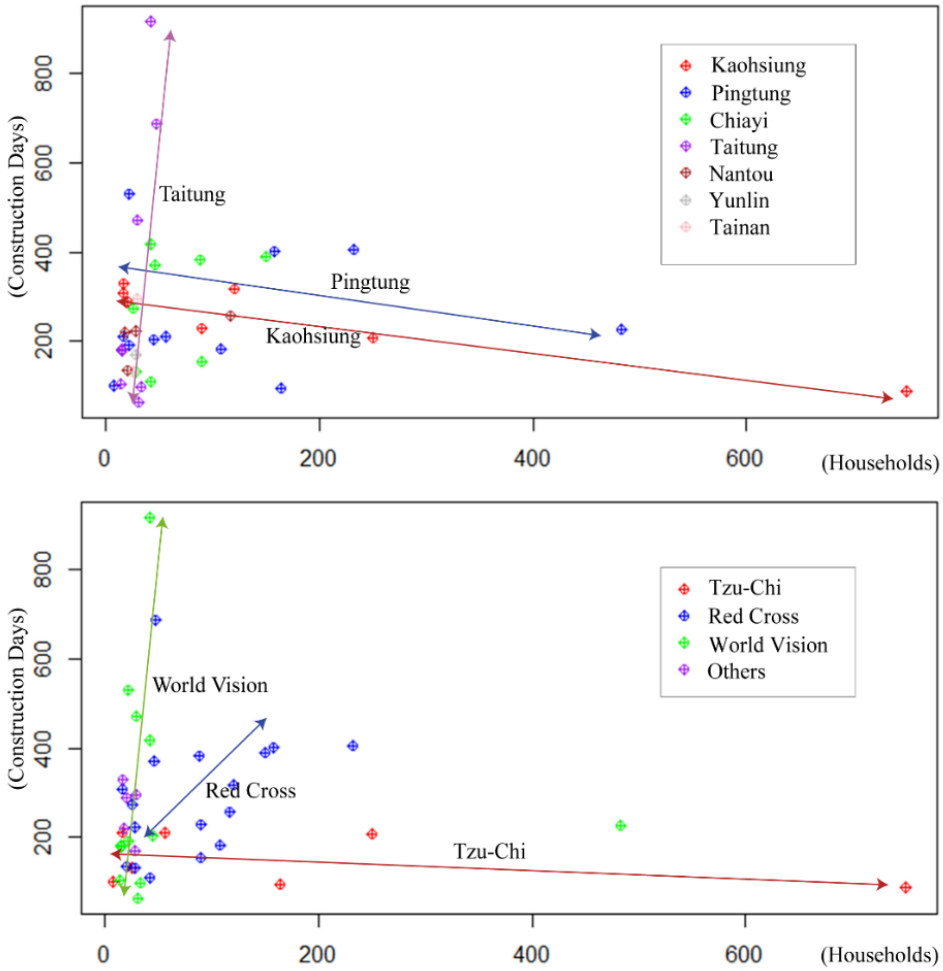

Figure 3.7 Relationship of days spent constructing, size of settlements, and constructing NGOs

3.4.4 Settlement land ownership analysis

This section focused on construction land ownership of the permanent housing settlements (Table 3.9). Given the relatively large size, completeness of the land, the lower acquirement price, and the simple land acquirement procedure, the Pingtung County government decided to use its government-owned land and government-owned company land for most projects (e.g., Taiwan Suger Company). Conversely, despite more time and money can be saved by utilizing government-owned land, the Taitung County government decided to talk to local landlords to acquire their land for the settlement projects. The local government believed relocating the communities close to the original habitats was beneficial for the residents and aligned with the *"leaving disaster but not the village"* principle. For instance, in the Jialan East and Jialan West settlement,

since the original community was a five-minute walk away from the newly reconstructed settlement, the linkage between the original community and traditional livelihood was maintained. It was fair to say the land ownership showed that the government's decision-making of the land usage might profoundly influence the evaluation of the residents to the settlement design and planning, which eventually affects households' recovery process. However, overall speaking, 82% of the constructions were implemented on government-owned land, which meant the budget-centered thinking still prevailed the community-centered thinking. Moreover, as mentioned before, the limited construction options also refrained residents from relocating to the nearest possible settlements.

Table 3.9 The land ownership of the construction land in each area

Area	**Kaohsiung**	**Pingtung**	**Chiayi**	**Taitung**	**Nantou**	**Yunlin**	**Tainan**	**Total**
Government-owned land (lot)	7	12	7	5	6	1	2	40
Private land (lot)	2	0	2	3	1	0	1	9
Proportion of the government-owned land	78%	100%	78%	62%	86%	100%	67%	82%

3.5 Text analysis

In this section, the text analysis result and the part of the interview result were presented. The result was discussed in four major aspects—post-disaster reconstruction phase, reconstruction strategies, socioeconomics and cultural reconstruction, and reconstructing stakeholders.

3.5.1 Post-disaster reconstruction phase

In the post-disaster reconstruction phase, four sub-categories ranged from 1. dangerous area delineation, 2. emergency shelter, 3. temporary housing, and 4. permanent housing was categorized. Their keyword accumulative graphs were plotted (Figure 3.8). Regarding the delineation of the dangerous area, the cumulative graph increased most rapidly from September 2009 to March 2010 (Section 1). The rapid increase period was about six months. Moreover, from November 2009 to October 2010, the total cumulative frequency was the most among four sub-categories; Regarding the emergency shelter sub-category, the related keywords increased rapidly from September 2009 to October 2009 (Section 2), which lasted for only one month and then slowed down. From September 2009 to December 2009, the cumulative frequency was the most among four sub-categories, which also lasted only for three months; The sub-category of temporary housing showed a gradual upward trend. However, the total cumulative frequency never outstripped any other sub-categories; Regarding the permanent housing sub-category, similar to the temporary housing sub-categories, a gradual upward trend was observed. However, the rate increased faster than the temporary housing sub-categories. After October 2010, the total keyword cumulation number exceeded the other three sub-categories and increased steadily throughout the data collection period (Section 3).

Through the cross-comparison of the text analysis and the interview results, it was found that the government unit urgently needed to grasp the potential reconstruction project and permanent housing numbers as soon as possible after the disaster. Therefore, the unsafe area delineation policy was announced on August 28th, 2009—three weeks after the disaster, but residents stated that they could not accept this harsh and reckless decision-making, given their rights and welfare had been ignored (R1, R3, C2, C5). In terms of the

reconstruction phase, The government was initially willing to provide temporary housing—a similar implementation was applied during the Ji-ji earthquake in 1999. However, the temporary housing policy was heavily criticized for lacking a phase-out mechanism and unfair distribution (Peng, 2019). Hence, on August 27th, 2009, the permanent housing policy was prioritized under the government—NGOs meeting (LG2). Therefore, there was only a sparse number of new-built temporary housing provided. Consequently, most of the residents either moved to their relatives' houses or resided in the public facilities provided by the government—not for the long-term living purpose—which upset several interviewees (R2, C5, C8, U7). The residents stated that temporary housing was essential to post-disaster recovery. On the other hand, the government tried to urge the NGOs to provide the mass among permanent housing. It explained the drastically increased permanent housing keywords cumulative rate from October 2010.

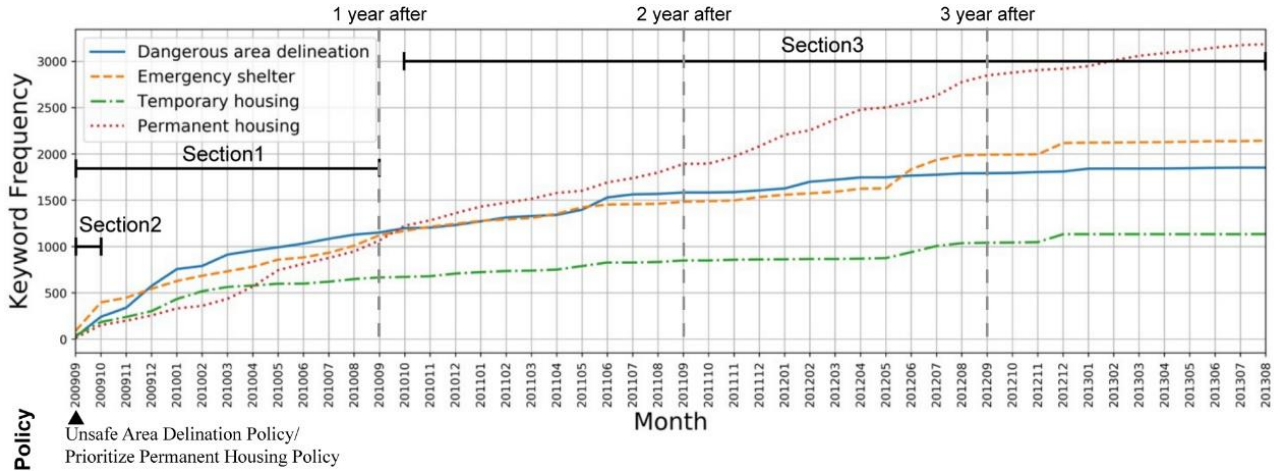

Figure 3.8 Keyword cumulative frequency of Post-disaster reconstruction phase

3.5.2 Reconstruction strategies

In terms of the reconstruction strategies, the two sub-groups were 1. house reconstruction policy and 2. relocation policy (Figure 3.9). In terms of the housing reconstruction policy, the keyword cumulated the most from September 2009 to May 2010 (Section 4). Regarding the relocation policy, the cumulating speed accelerated from April 2010 to January 2011 (Section 5). A subsequential relationship can be found in the graph, in which the discussion of the housing reconstruction policy was the paramount topic until May 2010. However, from April 2010, after the housing reconstruction policy had reached some consensus, the relocation policy gradually became the core of the PDR discussion. Overall speaking, the discussion regarding the relocation policy was obviously much higher than the reconstruction policy. After cross-validation with the government policy, as mentioned in the previous major aspect, the decision to prioritize permanent housing was decided within one month after the disaster. On the other hand, most of the issues of housing reconstruction policy discussed after May 2010 were whether to implement a participatory methodology in the PDR project or not. However, compared to the discussion between temporary housing and permanent housing, the discussions of the participatory process were obviously insufficient, which showed no significant increase in the cumulative frequency after May 2010; The discussion on the relocation policy had increased tremendously after April 2010 and exceeded the keyword frequency of the housing

reconstruction policy after June 2010. The period overlapped with the peak of the permanent housing planning stage. Since the relocation policy was related to the settlement site selection, which needed cooperation and negotiation with multiple stakeholders, the discussion of reconstruction in situ or relocation was one of the most challenging issues in PDR projects. Usually, the relocation process is an ad-hoc case-by-case procedure.

From the interview result, residents stated that because of the emotion and connection with the land, though they were fully aware that a similar disaster might reoccur in the original communities, residents still insisted that they should not be relocated. The interview result explained that the relocation policy issues had been discussed more frequently after April 2010, when the permanent housings were about to be designed and constructed (R7, R15).

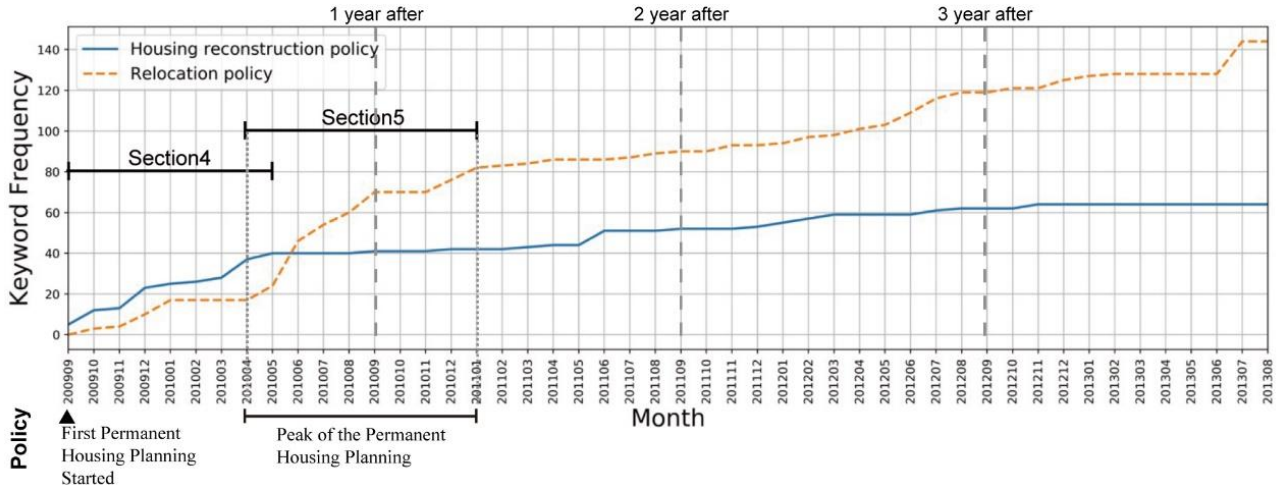

Figure 3.9 Keyword cumulative frequency of reconstruction strategies

3.5.3 Socioeconomic and cultural reconstruction

There were four important sub-categories when it comes to discussing the socioeconomic and cultural reconstruction issues, including 1. livelihood, 2. culture, 3. education, and 4. agriculture (Figure 3.10). However, the cumulative frequency line of the four sub-categories did not significantly increase rapidly. Instead, all of them increased steadily. Additionally, the livelihood cumulative rate outweighed the rest of the sub-categories.

According to the governmental documents, other than the physical PDR projects, the *"mental reconstruction*[8]*"* projects were launched right after completing each permanent housing settlement. The project included various working items, such as the reconstruction of livelihoods, psychological care, employment counseling, and industrial reconstruction. Therefore, in this major aspect, the discussion of livelihood and economics was active, given that the average income of the indigenous people was lower than the average income of the Taiwanese population (Council of indigenous peoples, 2017). Furthermore, it was

[8] A government-initiated project sponsered by the major NGOs to help restoration of the livleihood of the residents.

worth noting that the culture sub-category had a second-highest cumulative frequency after the livelihood sub-category. The result reflected that the cultural issues also play an essential role in the PDR since most disaster victims were indigenous populations (Hsieh et al., 2012). According to the interview, the residents believed the younger generations had lost their cultural identities and could not speak the indigenous language after migrating to the big cities (R9, C6, X8, J2). Moreover, the residents also requested the government to allocate monetary subsidies to decorate the front yard of the permanent housing since most of the permanent housing did not adopt indigenous cultural symbolism into the design motif (R5, R7, X5, W2). Thus, the culture and identity continuation was one of the paramount issues reinstated by the indigenous.

However, the graph also showed that the policy lacked concern for the agricultural industry. Residents said that after relocating to the new settlement, leaving the original agricultural life had forced many residents to encounter drastic lifestyle changes. They cannot maintain the traditional agricultural livelihood and need to work in the nearby cities (R7, C2). The unbalance of the mental reconstruction projects showed a significant impact on the residents from various socioeconomic perspectives.

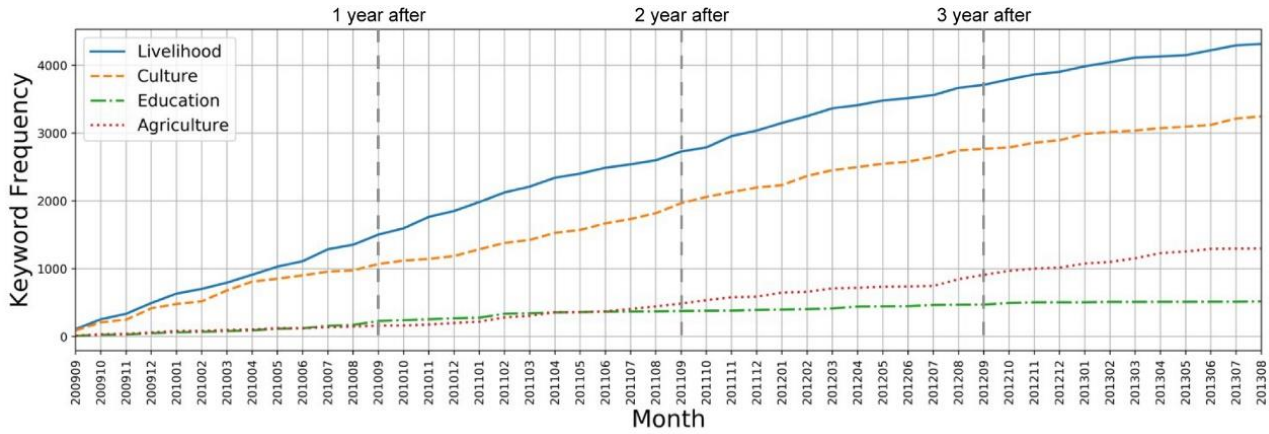

Figure 3.10 Keyword cumulative frequency of socioeconomic and cultural reconstruction

3.5.4 Reconstructing stakeholders

According to the literature review, 1. NGO group, 2. resident organization, 3. local government, 4. central government, and 5. design agency were five important sub-categories under the main aspect of reconstructing stakeholders (Figure 3.11). Except for the rapid increase of NGOs sub-categories after February 2010 (Section 6), the other four sub-categories did not have a tremendous increase. It can be clearly seen that the cumulative frequency of NGOs had reached active discussions after March 2010, which almost overlapped with the peak of the permanent housing planning period, followed by the central government, local governments, residents, and design agencies.

As mentioned previously, the government quickly decided that NGOs help with the permanent housing construction. However, despite the early ratification, during 2009, there were only a few permanent housing settlements under construction. Most of the permanent housing settlements started their planning and construction from April 2010, which explained the tremendous increase of the discussion regarding NGOs in the same period. On the contrary, according to Figure 3.11, the discussion of residents and design agency (e.g., architects, planners, and housing facilitators) was insufficient. The result showed that residents had difficulty participating in the discussion of reconstruction under the NGO-led PDR projects. It was also hard for architects to contribute their design opinion. The lack of participatory reconstruction was consistent with the situation in Figure 3.9—the housing reconstruction policy discussion (mainly the participatory related issues) did not increase significantly at the later stage of the PDR project. It was ironic to say that despite the government encouraged and incorporated the concept of participatory, the residents stated that most of the decision-making was determined by the NGOs and governments (R2, U4, U9, C5).

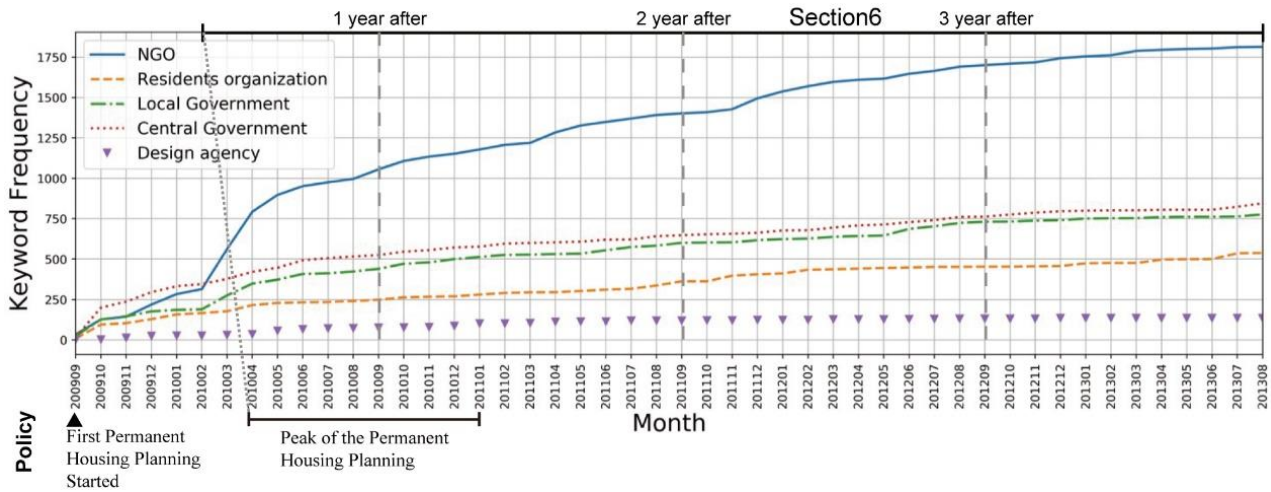

Figure 3.11 Keyword cumulative frequency of reconstructing stakeholders

3.6 Discussion and conclusion

In the first section, an analysis of relocated households and permanent housing settlements was provided. First, the section started with basic information such as the number of households and permanent housing settlements. The section identified Kaohsiung City, Pingtung County, Chiayi County, and Taitung County as the key areas for the PDR project since most of the relocated households and new permanent housing bases were located in these four counties or cities. A map of the permanent housing settlements distribution was provided. Second, the type of relocation analysis revealed that though there were many homogeneous relocation types, the proportion of unified, divided, and compound types was also high. The research confirmed that local governments might form complex relocation types due to time and budget constraints, which may negatively impact the relocated households. The relocation type in Taitung County was the homogeneous type with fewer households, while Kaohsiung City, Chiayi County, and Nantou County were mainly complex relocation types with more households. The finding highlighted that the Taitung County government was more concerned with residents' rights and interests. In contrast, the other local governments

were more concerned with the efficiency of the PDR projects. Third, in terms of the relocated communities analysis, Kaohsiung City, Pingtung County, and Chiayi County had the most of the relocated communities, while Kaohsiung City had more than 1,000 households in the Daai settlement and merged as many as 17 affected communities. However, residents expressed that this relocation strategy had seriously affected their post-disaster live adjustment. Forth, in terms of distance analysis, this study pointed out that most counties and cities with longer average relocation distances usually had multiple permanent housing settlements being built and planned spontaneously. For instance, Kaohsiung City and Chiayi County failed to fully satisfy the needs of the victims and implement the *"leaving the disaster but not village"* principle. Because of the relatively small number of households affected by the disaster, the strong sense of community ownership among the affected indigenous communities, and the local government's commitment, most of the households in Taitung County were relocated nearby their original communities. The research highlighted the significant differences among different relocation strategies of counties and cities.

The second section mainly discussed the planning and design issue of the permanent housing settlements. First, in the settlement configuration analysis, the 35 post-disaster settlements were categorized into six configuration types. The research showed that the number of relocated households, designer and planner's ideas, and the participation of communities could vary the result of the settlement planning. The residents preferred the compound type of settlement configuration among six configuration types. Moreover, the relationship of permanent housing settlements' configuration types, location, construction NGO, and household size was plotted. Second, the settlement area analysis showed that the area of the permanent housing settlements was less than 30 hectares, which was related to the planning regulations. However, due to the restriction of the regulations and the limitation of the construction area, the allocation and number of public spaces in the permanent housing settlements had not been appropriately considered. The problem was more severe in smaller size permanent housing settlements. Third, in the settlement construction period analysis, the study found that the Pingtung and Kaohsiung governments tend to cooperate with Tzu Chi and prioritize the project's implementation speed. However, this research showed that compared to the speedy implementation, the residents cared about the PDR project's implemented content and their involvement in the discussion. Fourth, most of the permanent housing settlements had been constructed on government-owned land. This sort of decision-making saved monetary and time resources. However, it undermined the social ties between the original communities and the new settlement.

In the third section, using the text analysis and semi-structured interview, this chapter applied four major aspects. First, the post-disaster reconstruction phase aspect showed that the resident passively accepted the government's delineation of the danger zone plan. The temporary housing policy was absent with the reckless implemented the permanent housing strategy, which caused the unsatisfaction of the residents. Second, the reconstruction strategies aspects showed that the in-situ or relocation strategies were debated long during the PDR implementation period. However, the participatory PDR scheme issues seemed to be ignored by the government sector. Third, given that most of the disaster victims were indigenous people, the reconstruction of livelihood and culture was considered an important issue. However, the agricultural

industry revitalization plan was not in place. Lastly, the whole PDR project was dominated by the NGO sector, given that they were the primary stakeholder in the permanent housing construction. However, the dominance also ousted the chance of participation of the local communities and other related stakeholders.

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Chapter 4

4. Vulnerability and social capital's influence in post-disaster recovery

Since the indigenous groups accounted for 73% of the total disaster victims after Typhoon Morakot, it is crucial to compare the disaster vulnerability and other factors that influenced the disaster recovery performance of different ethnic groups. Therefore, in this chapter, using the concept of vulnerability and social capital, the chapter explored the post-disaster recovery discrepancy of the indigenous and Chinese groups. As a result, the chapter confirmed that despite indigenous groups' high social capital capacity, their pre-disaster vulnerability greatly influenced their disaster recovery trajectories. Hence, this chapter argued that the issues regarding indigenous communities' long-term disaster recovery should be focused.

4.1 Context of the ethnic groups in Taiwan

As mentioned in the previous chapters, one of the distinct characteristics of the Typhoon Morakot PDR project was that the majority of the disaster victims were the indigenous population (Hsieh, 2012). This characteristic had been deemed important in this dissertation given the indigenous context PDR project had rarely been researched worldwide. Therefore, it is fair to say that the PDR project research based on the indigenous context deserved further attention. Hence, before unfolding the content of this chapter, the context of the ethnic groups in Taiwan as well as their background information, needed to be introduced at the beginning.

The earliest documentation of the indigenous settlements in Taiwan can be traced back to the 17th century when the Dutch arrived and colonized Taiwan. The indigenous is considered the first bath of residents in Taiwan (Mabuchi, 2014). Before the 17th century, the migration of the indigenous people often occurred because of their livelihood. Chinese, mainly from Fujian and Guangdong provinces in mainland China, gradually migrated to Taiwan after the 17th century because of overpopulation.

After the Chinese groups became the majority of the population in Taiwan, the fight regarding territory between the Chinese and the indigenous groups intensified. Due to the establishment of external regimes (e.g., the Dutch, Qing rule, the Japanese, and the National Government), tighter land rules were adopted to control the territory in Taiwan. Those regimes had forced indigenous groups to leave their traditional territories. For example, in the 1950s, the National Government relocated and merged several indigenous groups into larger settlements. The government also tried to *"modernize"* their traditional housing. The policy could facilitate the management of isolated indigenous communities. Today, 16 indigenous groups are officially recognized in Taiwan, though these groups only account for 2% of the total Taiwanese (576,792). The distribution of indigenous groups in Taiwan was shown in Figure 4.1. Moreover, according to the

statistics, the income of indigenous groups in Taiwan was 63% of the average Taiwanese household, with high poor households and low education backgrounds compared to their Chinese counterparts. It is fair to say that indigenous groups are the most marginalized group in Taiwan (Council of Indigenous People, 2017).

Figure 4.1 The distribution of Taiwanese indigenous groups

Source: Chang (2020)

4.2 Methodology of the chapter

To identify the discrepancy in vulnerability and social capital between ethnic groups and their influence on disaster recovery. A triangulation method—a combination of quantitative and qualitative methods (Mertens and Hesse-Biber, 2012) was applied, including the questionnaire survey and the semi-structured in-depth interview to cross-validate the research findings.

4.2.1 Questionnaire survey

As mentioned in chapter one, the *"Social impacts and recovery survey of Typhoon Morakot,"* which was conducted by the National Science and Technology Center for Disaster Reduction (NCDR), was used as the analysis material (Deng et al., 2011; 2012; 2013; 2017; 2020). The questionnaire survey was conducted over several years, in 2010, 2011, 2012, 2015, and 2019, covering a decade after Typhoon Morakot. The author did the afterward data analysis and interpretation.

The survey objectives were the households that applied for the relocation subsidy offered by the government, which was only dispensed to households whose dwellings were severely damaged by the typhoon and could no longer be repaired or inhabited. The survey was conducted by distributing sheets of the questionnaire to the local governments' statistical departments. The local governments then deployed staff to disaster-affected households and assisted them in the filling of the questionnaire. After the data screening process, 749 Chinese households and 553 indigenous households were selected for analysis in this chapter (in 2010, 2011, 2012, 2015, and 2019), given that these households participated in the survey throughout the entire survey period. Moreover, these households had relatively fewer misfiling and unanswered items. However, it is noticeable that due to the timing of visits, different household members (aged above 18 years) might have answered the questionnaire in different survey phases. This can cause fluctuation and some instability in the quality of the data[9]. The survey questions were organized into three questionnaire sections. Questions were designed based on the literature review mentioned in chapter two and pilot fieldwork[10].

The first section asked respondents about the vulnerability of the disaster-affected households, including their physical vulnerability (housing type) and socioeconomic vulnerability (occupation and income). The second section asked about the social capital of the households, ranging from internal and external stakeholders' resources distribution, the relationship with their family and friend (bonding network), the relationship with the NGOs (linking network), and the participation of the community in the PDR process. Finally, the third section asked about the recovery situation of the households. The outline of the questionnaire and related literature were listed in Table 4.1. Regarding the content of the literature reviews and the definition of vulnerability and social capital, please see chapter two.

Table 4.1 Summary of critical vulnerability, social capital, and recovery components identified from the literature and the questionnaire outline

Category	**Component**	**Questionnaire outline**	**Source**
Vulnerability	Physical vulnerability	Housing type	Hamideh et al. 2021; Peacock et al. 2007
	Social vulnerability	Income Employment	Kim 2012; Luchi and Esnard 2008 Guo et al. 2014;
Social Capital	Bonding	Meeting frequency with internal stakeholder	Aldrich and Crook 2008; Monteil et al. 2020
	Bonding Linking	Resource from the internal stakeholder Resource from the external stakeholder	Meyer 2018; Aldrich and Meyer 2014; Amaratunga and Haigh 2011
	Linking	Trust in the NGO[11]	Kilby 2008; Aldrich 2011; Amaratunga and Haigh 2011
	Bonding and linking	Participation	Lizarralde et al 2009; Archer and Boonyabancha 2011
Recovery		Recovery consciousness	Marin et al. 2015; Aldrich 2012; Roque et al. 2020

*Note: Bridging social capital was not included in the research scope.

[9] The survey project required local government staff to locate the same respondents for each survey phase if available.
[10] The pilot fieldwork for the questionnaire was from January to May 2010; the fieldwork primarily led to the adjustment and addition of the necessary options to the questions to match the local context.
[11] Non-governmental organization

4.2.2 Semi-structured in-depth interview

For the accountability of the quantitative analysis, qualitative semi-structured interviews were also conducted. Pilot fieldwork was conducted in two permanent housing settlements in Pingtung County (Rinari and Changzhi Baihe settlements) in August 2017 to understand the overall situation of post-disaster households. The formal semi-structured interview survey thus took place from February 2018 to March 2021[12] in eight relatively larger permanent housing settlements in Chiayi County, Kaohsiung City, Pingtung County, and Taitung County (Figure 4.2). The interviewees were selected based on purposive selection to diversify the demography and socioeconomic background of interviewees. The interviewees were aged 30 to 80 and included community leaders, teachers, public servants, housekeepers, farmers, and self-owned businesspeople. The interview abstract was outlined in alignment with the question in the questionnaire survey so that the result of the interview can be considered as the explanation and the cross-validation to the questionnaire survey's results. The interviewees' assigned codes, their affiliations, the settlements, the interviewees' numbers, and the interview abstract were listed in Table 4.2.

[12] The author was invited to participate in the "Permanent Housing Living Justice Conference" in March 2021. At the conference, the various representatives of Chinese and indigenous affected households presented their livelihood situation 10 years after the disaster.

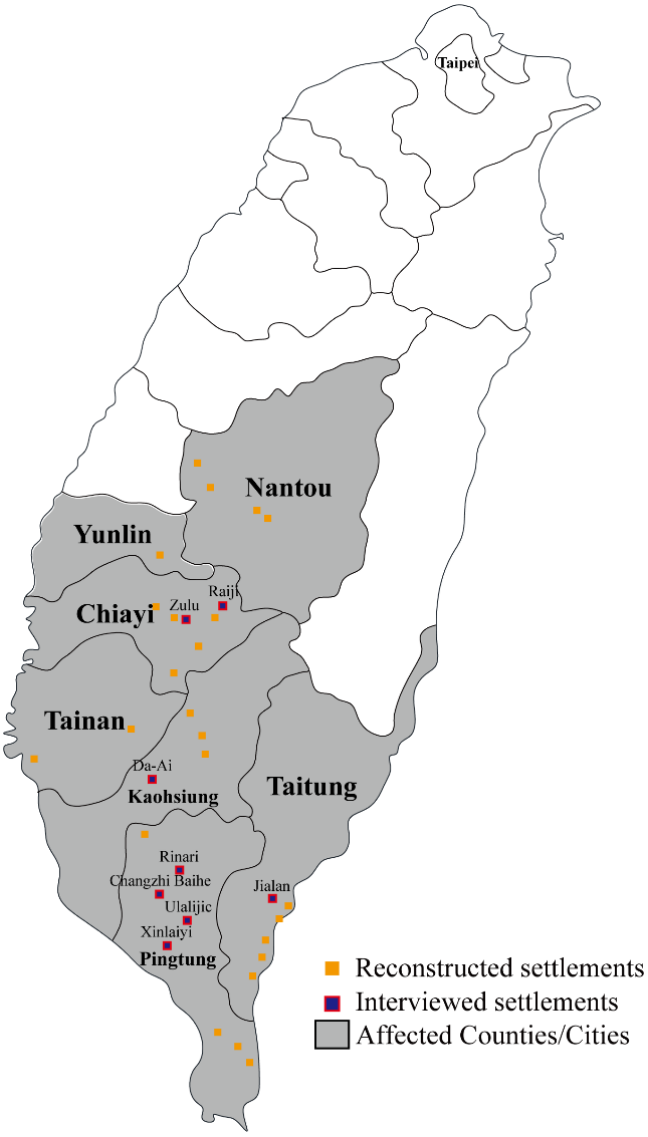

Figure 4.2 Affected areas and distribution of reconstructed settlements

Table 4.2 Interviewees information and interview outline

Code of interviewees	Interviewees	Location	Time	Number of interviewees	Abstract
CG1	Central government	Taipei City	March 2021	1	1. PDR strategy 2. Important implementation items
LG1-LG3	Local government	Pingtung City	November 2019; March 2021	3	
N1-N3	NGOs (the representative of Chi Zhi, Red cross, and World vision)	Taipei City ; Pingtung City; Taichung City,	August 2018; November 2019; March 2021	3	
A1-A2	Architects	Chiayi City; Rinari	August 2018; August 2019	2	Planning and design issues
R1-R16	Rinari residents	Rinari	August 2017; February and August 2018; April, August and November 2019; March 2021	16	1.Evaluation of PDR project 2.Relocation process 3.Evaluation of planning and design 4.Living satisfactory
W1-W14	Ulalijuc residents	Ulalijuc	August 2019	14	
X1-X19	Xinlaiyi residents	Xinlaiyi	August 2019	19	
C1-C16	Changzhi Baihe residents	Changzhi Baihe	August 2018; November 2019; March 2021	16	
J1-J16	Jialan residents	Jialan	August 2018; March 2021	16	
D1-D3	Da-Ai residents	Changzhi Baihe	April 2021	1	
Z1	Zhulu residents	Changzhi Baihe	April 2021	1	
Ra1-Ra2	Raiji residents	Changzhi Baihe	April 2021	2	

4.3 Vulnerability

4.3.1 Housing Type

According to Quarantelli (1982), Pardee (2012), and the pilot fieldwork, the housing type were categorized into rent housing, evacuation center, temporary housing, permanent housing, relying on relatives, and newly built or owned housing. The selected samples and the sample size was the same for each survey phase from 2009 to 2019 (749 Chinese household sample and 553 indigenous household sample). The frequency of response for each housing type was tallied in percentage in each group specifically (Figure 4.3).

Regarding housing type, three distinct characteristics could be observed. First, it was clear that the Taiwanese government offered more evacuation centers to indigenous groups than the Chinese groups one month after the disaster. Chinese groups mostly relied on their relatives as the evacuation center. Second, the temporary housing stock remained low throughout the survey period because the government was relucent to construct a large number of temporary housing. However, this decision-making made 8% of the indigenous households wait in substandard evacuation centers until the completion of permanent housing. The substandard

evacuation center inflicted mental pressure on some households (R2, R6, R9)[13]. Third, the percentage of households that moved to permanent housing in indigenous groups outweighed the Chinese groups. It can attribute to that for disaster-affected indigenous communities, if the original communities were recognized as *"dangerous areas,"* regardless of the extent of housing damage, a special approvement from the government was acquired for the whole community to be relocated—a solution to keep the solidarity of the indigenous communities (LG1, LG2). The policy boosted indigenous households' willingness to be relocated. On the other hand, because the related special policy was absent in the Chinese groups, more Chinese households sought a new house or moved to another house they owned. Thus, the housing type of indigenous and Chinese groups was distinct after the disaster.

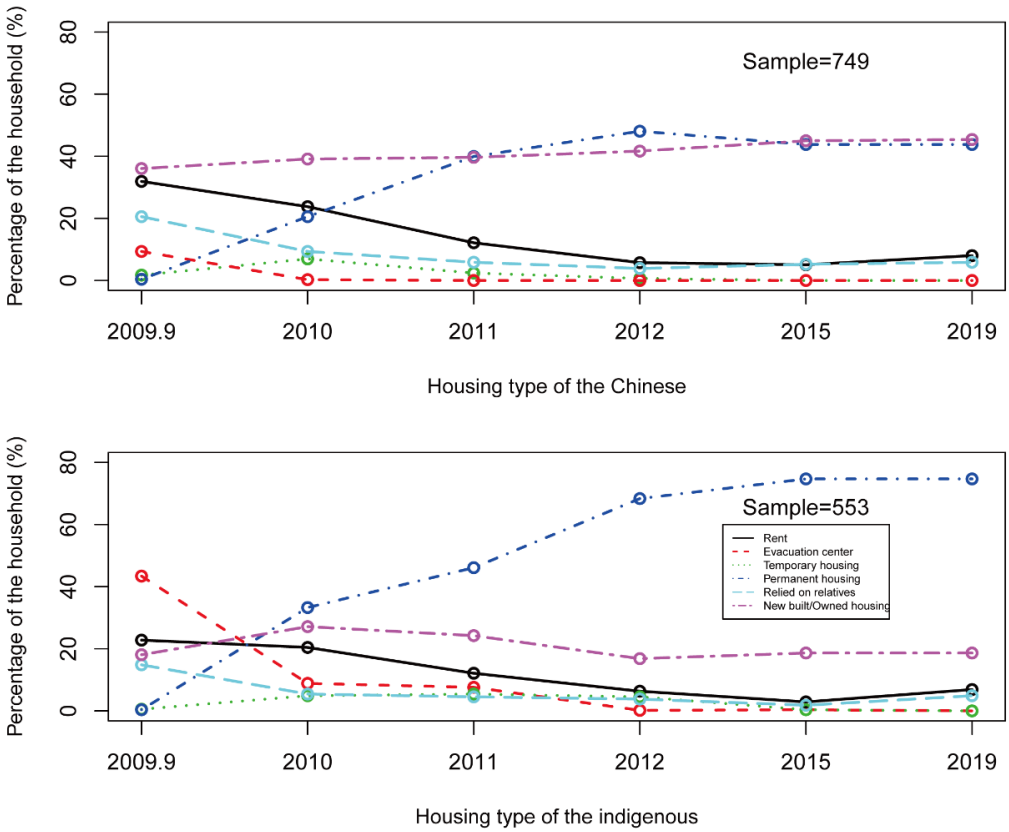

Figure 4.3 Housing type

4.3.2 Income and employment

To avoid the influence of inflation and the number of household members between households in the analysis, the indigenous groups' income, Chinese groups' income, and regional income (the average income of the seven affected countries and cities) were adjusted by using the individuals' personal disposable income (PDI; Figure 4.4).

One month before the disaster, the indigenous groups' PDI (1,670.2 New Taiwan Dollar [NTD]) was much lower than the Chinese groups (2,289.7 NTD), in a significant manner (p=0.003). Nonetheless, one year after

[13] The parenthesis indicated the sentence was quoted from certain interviewees, the code of interviewees in the parentheses were correspond with the one in Table 4.2.

the disaster (2010), the average income in both groups plummeted due to the impact of the disaster, which showed no significant difference (p=0.795). It was clear that the Chinese groups experienced a much more significant economic impact than the indigenous groups. From the interview, it was clear that most Chinese groups were working in paid occupations before the disaster, while most indigenous households only engaged in the self-sufficient agriculture industry, which was unable to generate computable income (R2, R8, C3 X15). However, from 2010 onward, the average income of both groups increased again, while the income of the Chinese outperformed the indigenous groups with significant differences (p values were <0.01, from 2012 to 2019). The reason can be considered correlated to both groups' pre-disaster livelihood and working skills—Chinese groups were easy to be reemployed given their relatively higher educational background and better working skill suitable for the paid jobs (LG1, R5, W1, X6).

On the other hand, the arable land loss and decrease due to the post-disaster relocation forced the indigenous households to engage in income-based work (R3, R6, C7, C9). Although some agricultural activities were possible, the resident had to rent the land from the private market, which afflicted more economic burden to them. Compared to the Chinese groups, a much more drastic livelihood change was observed in the indigenous groups—from a self-sufficient economy to an income-based economy (R2, R5, R8, C4, C8). The onerous and high rocketed daily expenditure after the disaster crippled the economic performance of the indigenous groups. Overall, the questionnaire survey and interview survey showed similar results.

From a macro perspective, the overall PDI of indigenous and Chinese groups was much lower than the regional average PDI. The regional PDI increased by 2,670.7 NTD in a decade, while in the Chinese and indigenous groups, the average PDI only grew by 1,222.3 and 573.3, respectively. It was evident that the income discrepancy had widened as time being between the two surveyed groups. Moreover, on a bigger scale, the two disaster-affected groups seemed difficult to catch up with regional economic growth.

Another way to examine the economic performance of both groups was to plot the percentage of manager class and non-manager class (including agriculture industry) of Chinese groups and indigenous groups respectively in Figure 4.5. It was evident that the percentage of disaster-affected households gradually shifted from the non-manager class to the manager class each year. However, generally speaking, more indigenous groups still concentrated in low-paid occupations. Namely, the non-manager class. As mentioned earlier, it was related to their working skill and pre-disaster livelihood.

Additionally, to boost the engagement and improvement of the victims' economic situation, the government initiated a temporary working scheme (TWS) for the resident in the relocated settlements to participate in the permanent housing construction process while receiving daily wages. The project was also followed up with livelihood reconstruction schemes to help disaster victims restore their socioeconomic wellbeing. Regarding the TWS, since more indigenous populations were collectively relocated and distributed permanent housing, more indigenous households were participating in the TWS project and engaged in the permanent housing construction (Table 4.3). However, since the housing construction only lasted for a few months, the TWS

project was only beneficial for the short-term livelihood of indigenous households (R2, R6, R7, R12). Without proper occupation training projects, after the TWS project, indigenous households still felt it challenging to participate in other industries (R1, R2, R15, C3, C14). As for the Chinese households, despite some companies establishing the farm and being willing to recruit the local residents, only limited residents are currently working there. The resident stated that the job opportunities were primarily filled by outsiders, which suppressed the working opportunities of the residents. Most residents need to seek a job remotely for the permanent housing settlement (D1, D2). Therefore, the long-term working opportunities seemed challenging to seek for the households living in the permanent housing settlements, even for the Chinese disaster-affected households (D1). Generally speaking, the result from the questionnaire was identical to the interview survey regarding the TWS participation between two ethnic groups.

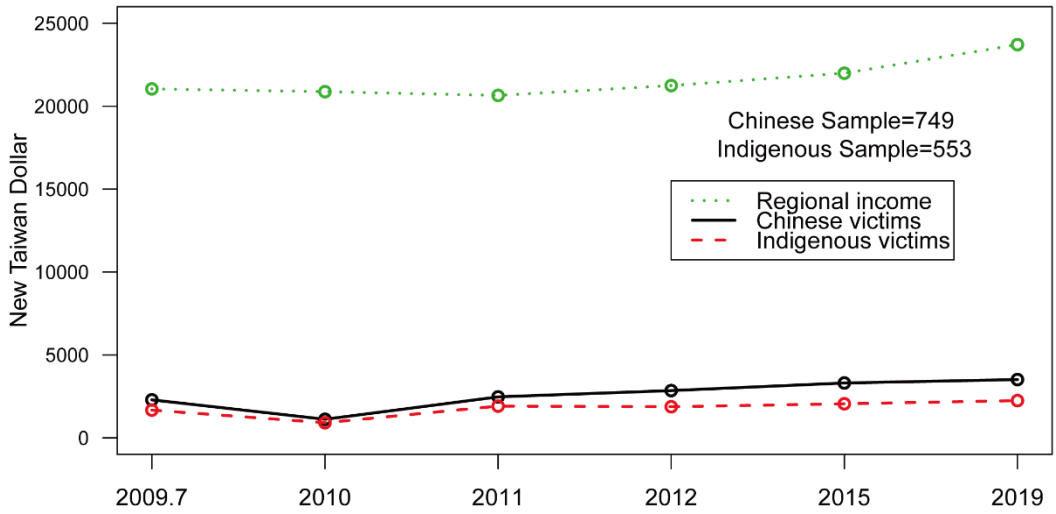

Figure 4.4 Income changes

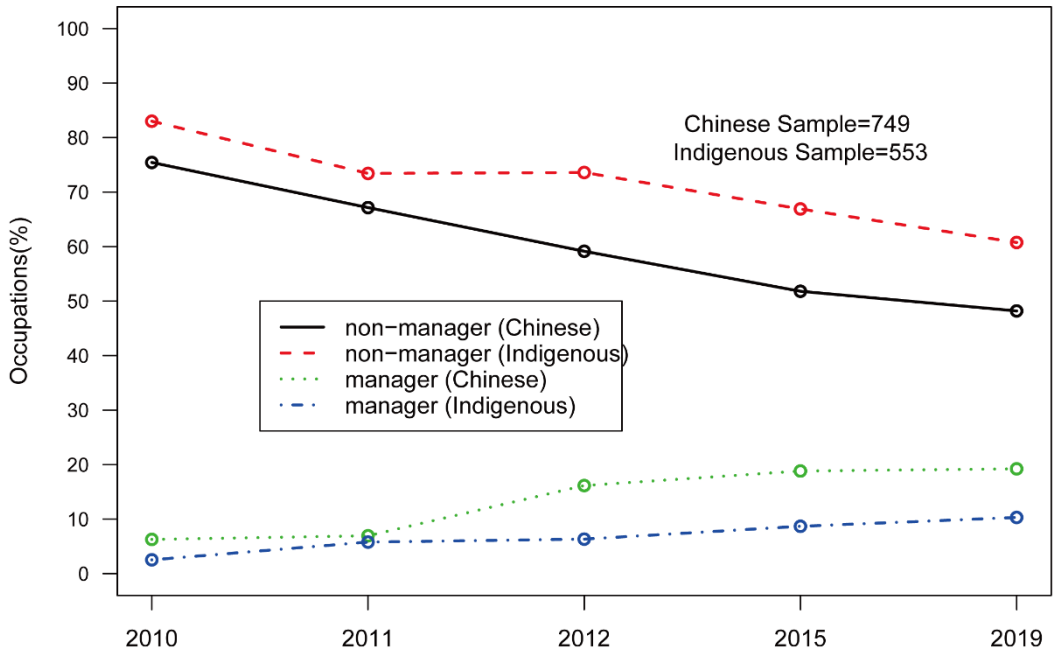

Figure 4.5 Employment situation

Table 4.3 The households and engaged population of the TWS project

	Sample	Engaged households	Engaged people per households	T value
Chinese	749	46	0.07	-5.2655**
Indigenous	553	95	0.21	

*p≤.05;** p≤.01

4.4 Social capital

4.4.1 Meeting frequency with relatives and friends

To understand the bonding network (the relationships between the homogeneous groups) of the disaster-affected households. The questionnaire asked about the meeting frequency of the household with their relatives and friends. Frequency was measured on a five-point scale (1= less than once per week, 2=once per week, 3=two to three times per week, 4= four to five times per week, 5=more than six times per week).

Before the disaster, no statistically significant difference was shown (p=0.7) between the Chinese and indigenous groups (one month before the disaster). However, from 2010 to 2015, a significant difference showed between the two groups, in which indigenous groups remained at a high meeting frequency. However, Chinese groups plummeted to a low level compared to their pre-disaster extent. It showed that the collective relocation policy applied in the indigenous groups did help to keep the interaction and relationship of indigenous groups with their relatives and friends (Monteil et al., 2020). Moreover, indigenous households tended to attend religious and tribal meetings in the community. Especially, the Taiwanese indigenous communities usually hold the tribal meeting to determine some critical decision-making, which requires every community member's attendance (R4, W12, J8). Conversely, the Chinese groups tended to move to newly built or other owned housing, as well as the self-relocation. This relocation pattern scattered the community members before the disaster to different places, which hampered the interaction (D2, D3). Thus, meeting frequency decreased after the disaster. Nonetheless, in 2019, the meeting frequency of the Chinese recovered to the same level as indigenous (p=0.96). The phenomenon indicated that the Chinese groups had formed a new bonding network with their new community or neighbors (Figure 4.6).

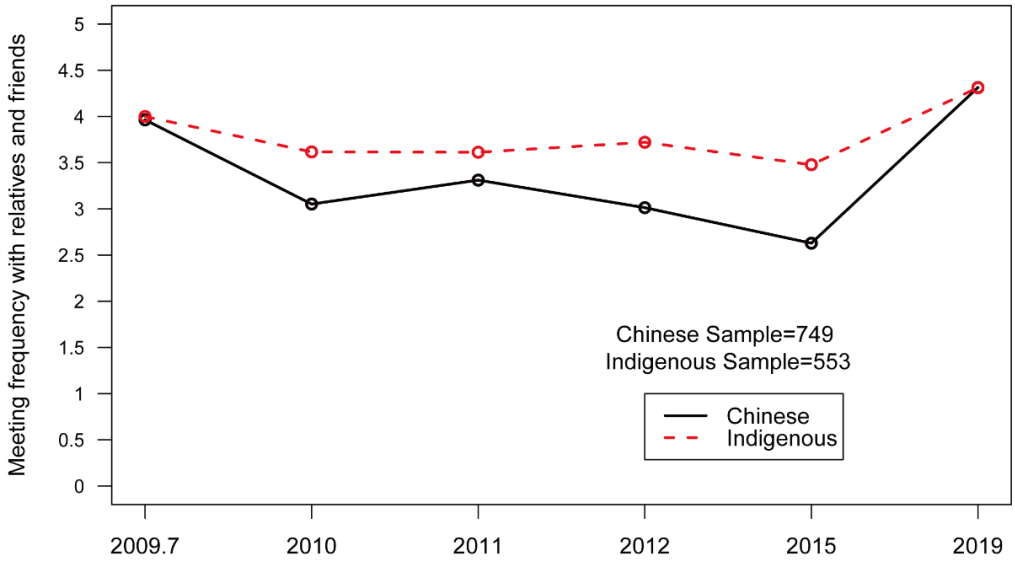

Figure 4.6 The meeting frequency with relatives and friends

4.4.2 Resources received after the disaster

Regarding the resources received after the disaster, the resources that households received after the disaster were categorized into internal resources (e.g., friends, neighbors, and relatives) and external resources (e.g., NGOs and government). The internal resources and external resources can further be categorized into ten different items according to the results of the pilot fieldwork: human resources, material resources, psychological assistance, dwelling, education, information and consultant, transportation, financial, and re-employment (the resource included the services). If households received one item of resources, they received one point, and so on. These ten items were identified based on pilot fieldwork.

Regarding internal resources, a gradually descending propensity in both groups was observed. A significant difference was not shown in 2010 ($p=0.05$) between the two groups. However, from 2011 to 2019, the internal resource items given to the indigenous groups outstripped the Chinese groups ($p<0.01$). Similar to the previous section, a tighter bonding framework let indigenous households receive more internal resources from their relatives and friends (Figure 4.7).

Regarding external resources, throughout the survey period, the item of external resources received on the indigenous side consistently outperformed their Chinese counterpart ($p<0.01$; Figure 6). For instance, the TWS project was one of the important external resources received from the government section. Moreover, there was the Council of Indigenous People (CIP), an indigenous affairs ministry dedicated to providing various resources to indigenous groups after Typhoon Morakot. For example, the CIP provided microcredit and agricultural revitalization programs. However, according to the indigenous households, the agricultural revitalization programs seemed to fail (C2, C9). For example, in Changzhi Baihe, although indigenous residents wanted to cultivate their traditional crops, such as millet and taro, the CIP denied the idea because CIP hoped the households could cultivate the crops with higher economic value. (LG1). Nonetheless, due to limited cultivation skills of high economic value crops as well as the lacking strategies to find the potential

market. As a result, the programs could not help the indigenous households' economic wellbeing subsequently (C2, C5). As for the Chinese groups, no specific government department was responsible for post-disaster resource distribution. This explained why the external resource items in Chinese groups were few throughout the survey period. Generally speaking, both the interview and questionnaire survey showed an identical situation of the external and internal aid distribution, in which indigenous groups had received more resources than the Chinese group.

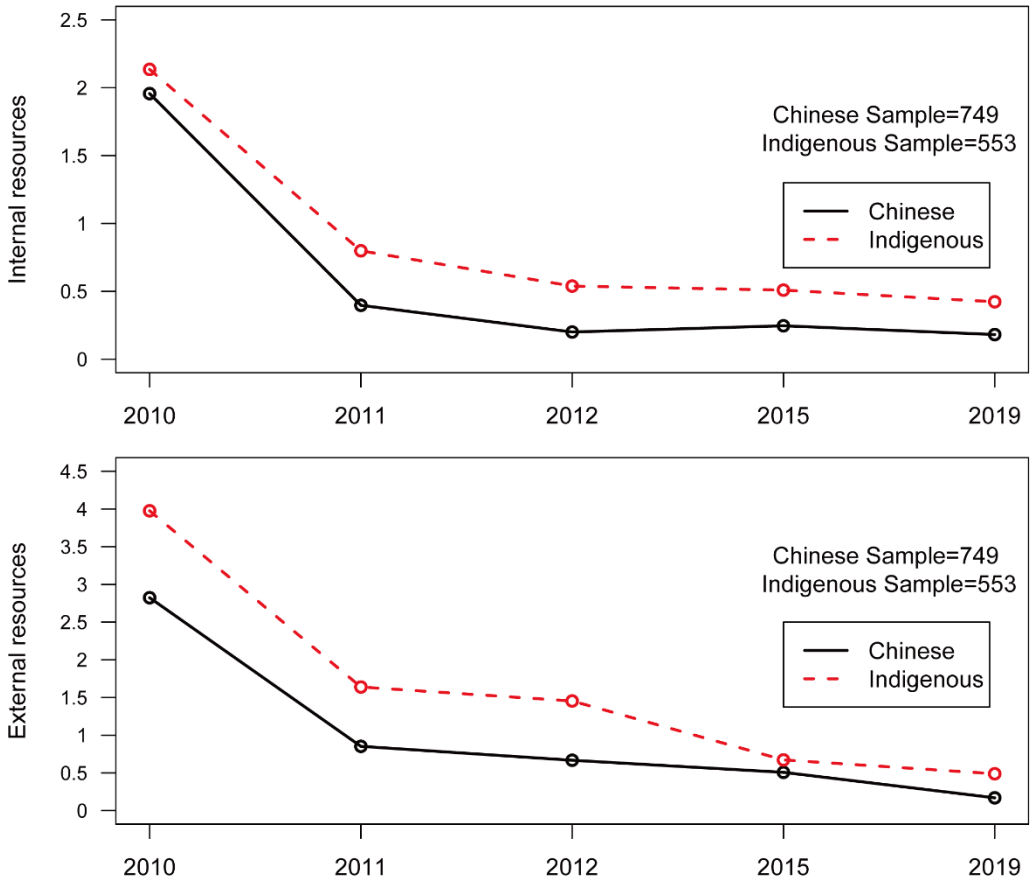

Figure 4.7 The resources from internal and external sectors

4.4.3 Trust in NGOs

Most Chinese households trust the Tzu Chi. The NGO constructed 1,276 permanent houses, which accounted for 36% of the total permanent housing stock. Among them, around two-thirds of the housing beneficiaries were Chinese. This explained why Tzu Chi's support population concentrated in the Chinese groups. The Red Cross constructed 1,407, or 39% of the total housing stock. As mentioned in chapter three, the Red Cross-built permanent housing had distributed evenly in the affected counties and cities. Because of the even distribution, half of the housing beneficiaries were Chinese households, and the rest were indigenous households. Therefore, the Red Cross received broad support from both groups. For the World Vision, though it only constructed 794 housing units, given the World Vision only targeted the permanent housing design and construction in the indigenous communities—mainly in Pingtung and Taitung County, the group received 26.22% trust from the indigenous groups, ranking second highest for the indigenous (Table 4.4).

According to the interview, World Vision and Red Cross had entrenched the support in the indigenous communities even before the disaster due to various relief programs. Moreover, residents stated that the World Vision and Red Cross empowered indigenous communities to make design decisions on the design and planning of the settlement and the housing—including the TWS project. On the contrary, indigenous groups had some conflicts with Tzu Chi. As also mentioned in chapter five, the Tzu Chi applied the module design of the permanent housing in the indigenous community, which ignored the indigenous culture. (C8, C10). Xinlaiyi residents stated that the Red Cross's design of permanent housing was better than that of Tzu Chi (X1, X3). Regarding the Chinese groups, because of the same religious background as Tzu Chi and less concern about the cultural issue of the architectural design, most Chinese households recognized Tzu Chi's performance in the PDR process. It was clear that the religious background, participation of communities, and the pre-disaster relationship can influence residents' trust in the NGOs.

Table 4.4 Trust in NGOs

	None	**Red Cross**	**World Vision**	**Tzu-Chi**	**Dharma Drum**	**I-Kuan Tao**	**Chang Yung-Fa**	**Fo Guang Shan**	**Others**	**Sample**
Chinese	19.89%	21.76%	4.41%	40.45%	4.54%	0.13%	0.53%	0.93%	7.34%	749
Indigenous	2.17%	39.96%	26.22%	22.24%	0.18%	0.0%	0.54%	0.9%	7.78%	553
Total	12.33%	29.56%	13.63%	32.77%	2.68%	0.08%	0.54%	0.92%	7.5	100.0%

4.4.4 Participation

The questionnaire regarding participation was outlined to align with the participation PDR framework proposed by Jamshed et al. (2018). According to Jamshed et al. (2018), the process of participatory PDR framework entails 1. dangerous area specification, 2. relocation planning, and 3. the planning process. Responses were coded using a five-scale or a two-scale measurement. Dangerous area specification meant the government's inspection in the disaster-affect communities (1=no engagement, 2=partly engaged, 3=half engaged, 4=mostly engaged, 5=entire engagement). Relocation planning refers to permanent housing settlements selection (1=no engagement, 2=partly engaged, 3=half engaged, 4=mostly engaged, 5=entire engagement). Finally, the planning process included design, planning of permanent housing and settlements (1=no engagement, 2=engagement; Table 4.5).

As shown in Table 4.5, In terms of the dangerous area specification and the relocation planning stages, more indigenous households had participated in the process. The indigenous residents protested against the government in the dangerous area specification. The resident stated that the government's inspection of the disaster-affected areas was based on the merely scientific-based result, which ignores indigenous groups' culture and human-land attachment (R2, R7, C6). Regarding the site selection, most of the settlements were located out of the *"traditional territories,*[14] *"* which hampered the connection between the original communities and permanent housing settlements. Conversely, Chinese residents generally had less concern about the new environment after the relocation. Additionally, the number of permanent housing beneficiaries in Chinese groups was less than the indigenous groups. Therefore, no severe objections (less participation in the process) occurred within the Chinese communities.

For architectural planning, more participation was shown in the indigenous communities than in the Chinese communities. Generally speaking, compared with Chinese households, indigenous households had proposed more housing design requests. In the Rinari settlement, the indigenous households preferred to use slate—a traditional Paiwan and Rukai building material—to construct their permanent housing (R2, R6). However, although World Vision understood the requirement, the constraint of time—the pressure from the central government—prevented most proposals from being implemented. Overall, a paradoxical result showed that the indigenous households had participated more than Chinese groups throughout the three PDR stages. However, because the active participation did not change the government decision, the resident—government relationship was undermined.

Table 4.5 Post-disaster reconstruction process participation

		Sample	Points	t
Dangerous area specification	Chinese	243	3.08	-2.70**
	Indigenous	436	3.31	
Relocation planning	Chinese	247	2.05	-2.94**
	Indigenous	434	3.28	
Architectural planning and design	Chinese	424	0.65	-6.22**
	Indigenous	427	0.83	

*p≤.05;** p≤.01

4.5 Recovery

To understand the recovery situation in both indigenous and Chinese groups, households were asked whether they felt that they had already recovered from the disaster or not (1=yes, 0=no). A higher point denoted that the residents thought they had recovered from the disaster, and vice versa (Figure 4.8). From 2010 to 2012, the results showed that the indigenous population overall expressed a lower recovery consciousness than the Chinese groups with great significance ($p < 0.01$). However, the recovery rate decreased from 2012 to 2019 in both groups. It showed that the overall disaster relief and the PDR project might only focus on the short-term recovery. However, the long-term recovery policies and countermeasures might be ignored (Finucane et al., 2020).

[14] Referred to the territory deemed by the indigenous communities as their community boundries.

According to Marin et al. (2015), vulnerability refers to the livelihood of being damaged, which is considered an external factor. On the other hand, social capital is interpreted as the ability of a group or individual to recover from a disaster, which is considered an internal factor. Therefore, disaster recovery is dependent on the performance of victims' vulnerability and social capital (Aldrich, 2011; Roque et al., 2020).

Regarding the influence of vulnerability on disaster recovery, from the above sections in this chapter, it is clear that the TWS can only do little for disaster recovery for disaster victims. It only provided limited and short working opportunities. Other post-disaster job training and livelihood restoration initiatives were also ignored or implemented without considering the local context—especially for the indigenous permanent housing settlements. Moreover, the previous section showed that the drastic livelihood changes and less suitability of the working skill of indigenous groups might explain the worse disaster recovery performance than the Chinese groups. It is also worth noticing that the collective relocation policy help to ensure indigenous communities' solidarity. Nonetheless, the policy also resulted in the relocation and disconnection of indigenous people from their land. It is plausible that this disconnection of the human-land relationship can worsen the disaster recovery (Lin and Lin, 2020).

Regarding the influence of social capital on disaster recovery, the overflow of internal and external resources might be problematic. The indigenous residents thought they were the marginalized group in Taiwan and therefore deserved more resources than the others (R6, R8). However, the over-reliance on the resources can paralyze their ability to rebound or betterment their post-disaster livelihood. Besides, there was some squabble regarding the dangerous zone designation and housing design issues, which might also worsen the relationship of indigenous communities with outside stakeholders and further deteriorate their post-disaster situation.

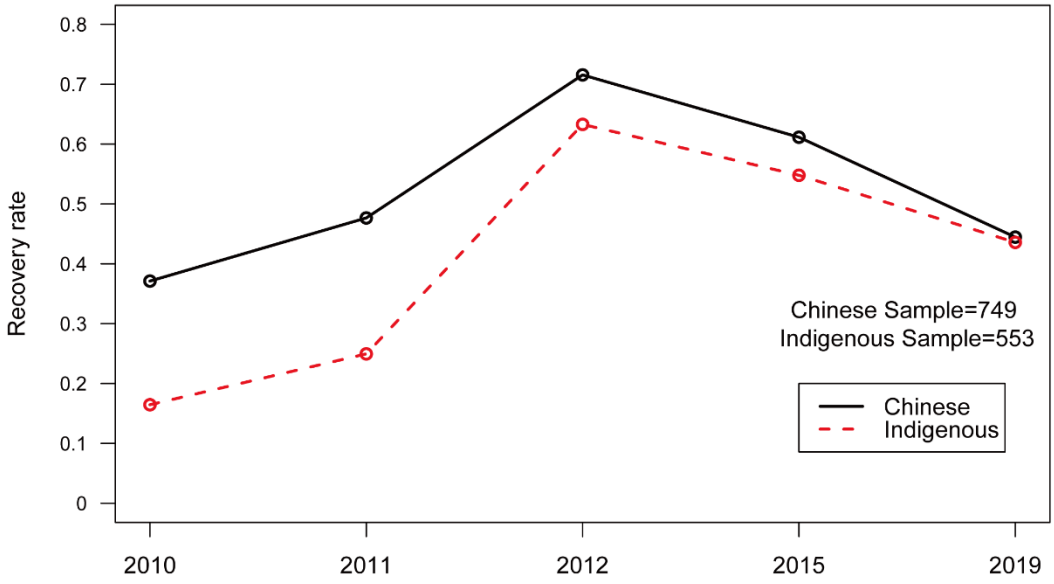

Figure 4.8 The recovery situation

4.6 Discussion and conclusion

In this chapter, three concepts—vulnerability, social capital, and recovery—were used as the research analytical framework to understand the discrepancy between indigenous and Chinese groups.

First, the chapter looked at the vulnerability discrepancy between the two groups. In the housing type analysis, the evacuated policy was more indigenous-centered thus more indigenous groups evacuated to the evacuation center than Chinese groups. In the temporary housing stages, the victims needed to suffer the substandard environment in the temporary dwelling because the government was reluctant to build the new temporary housing. The most distinct characteristic showed in the permanent housing stage. Given the group relocation of indigenous groups, the percentage of the indigenous population moved to the permanent housing settlements outperformed Chinese groups. Meanwhile, the Chinese groups tend to seek alternatives in the market. In the income and employment analysis, the research stated that pre-disaster livelihood could significantly influence post-disaster economic wellbeing. Given their disconnect with the market economic system, the indigenous groups' economy might not be severely affected by the disaster. However, after the relocation, the increasing reliance on the cash economy made them even poorer. Another issue highlighted was human capital. Given that indigenous groups mostly worked in self-sufficient agriculture, the mismatch of the working skill prevented them from working in the high-paid occupation after the disaster. Additionally, the government-driven reemployed program was also aimed at the short term. Therefore, the economic discrepancy with the Chinese was even more significant after the disaster.

Second, as the social capital section. The relationship with internal stakeholders (e.g., friends and relatives) was not different between the groups before the disaster. However, due to the relocation policy applied to the indigenous communities, the solidarity and relationship had been kept in the indigenous groups compared to the Chinese groups. The tighter relationships were also attributed to indigenous groups' culture and lifestyle (e.g., religious and gathering activities). In terms of the resources received, given the better indigenous communities network, more internal resources were received compared to their Chinese counterpart. Similar to the housing policy, the government projected more resources via the help of CIP. The indigenous groups also received more external resources compared to Chinese groups. Regarding the trust of NGOs, the research found that the relationship with NGOs correlated with the ethnic background of the housing beneficiaries, pre-disaster relationship, and involvement of the communities during the decision-making process. In the participation analysis, despite indigenous actively participating in the dangerous area specification and relocation planning, the participation was mainly a protest against the government. Although more opinions regarding architectural planning and design had been posed in the indigenous groups, most had been ignored.

Third, it was ironic that the recovery rate of indigenous groups was below their Chinese counterpart from 2010-2012 even though an indigenous-centered relocation policy was implemented and more resource was received. The section stated that disaster recovery was closely related to vulnerability and social capital performance. It indicated that if the human capital cannot be substantially improved for the adaptation to the

market economy, the indigenous groups cannot recover from the disaster. Moreover, community participation and a community-centered approach during the PDR should be implemented. Additionally, a declining trend in the recovery rate of both groups after 2012 indicated that most of the government-driven aid was short-termed, unsustainable, and ineffective in the long run. Overall speaking, compared to the Chinese groups, the indigenous groups seemed to lag behind the disaster recovery because of their unique livelihood, cultural, and socioeconomic context. Therefore, a closer look at the PDR project in the indigenous communities was further discussed in the following chapters (chapter five and six).

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Chapter 5

5. Post-disaster reconstruction in the indigenous context

As mentioned in Chapter four, it was evident that the indigenous groups had worse disaster recovery performance after Typhoon Morakot compared to the Chinese groups. Thus, the PDR project's target in indigenous communities needed to be further discussed. The objective of the chapter was to understand the cooperative relationship of NGOs with other essential stakeholders in the indigenous context. Specifically, the chapter looked at 1. the role of NGOs in the NGO-led PDR project in the indigenous communities, 2. the NGO—government and NGO—community relationship, and 3. the participation extent of the indigenous communities during the PDR implementation.

5.1 Background and objectives of the chapter

According to the discussion of the literature review, though NGOs are regarded as essential stakeholders in the PDR project, given they are able to fill the gap of the government and provide complimentary assistance to the disaster-affected communities, the interaction of NGOs and other PDR-related stakeholders was not explored until the 2010s, such as Lu and Xu (2014), Lu et al. (2020), and Lu and Li (2020). However, the abovementioned research targeted the earthquake PDR projects in China. Similar research in other localities is needed. Furthermore, the relevant case study merely focused on the multiple NGOs' different roles and underpinning ideology to the PDR. Nonetheless, the philosophy of NGOs might influence their decision-making during the PDR implementation profoundly (Siriwardena and Haigh, 2011). In view of this, to explore the role that different NGOs played in the PDR project under the indigenous context, this chapter focused on three crucial stakeholders in the NGO-led PDR programs—the NGOs, government, and community. According to Lu and Li (2020), the NGOs might successfully facilitate the PDR work of the government or hamper the task. On the other hand, NGOs might successfully assist the local people in rebuilding a sustainable community through the PDR project. However, in some cases, NGOs might further undermine the result of the PDR (corresponding to aims 1 and 2; Lu and Li, 2020). The analytical framework was shown in Figure 5.1.

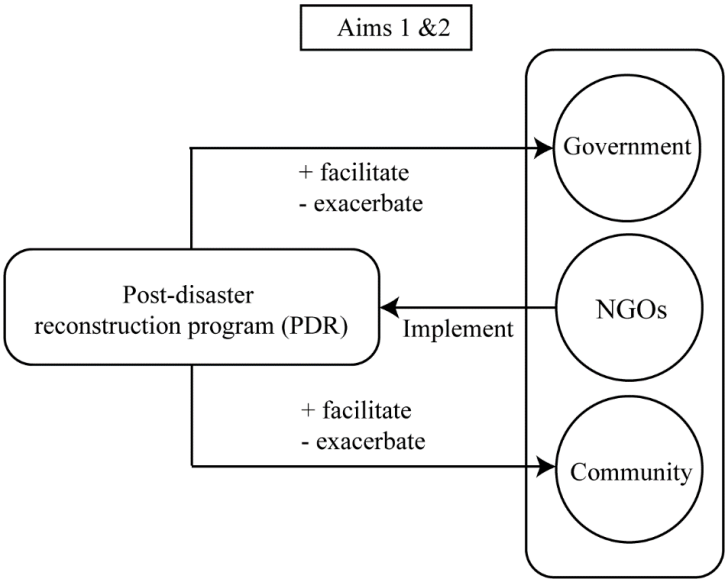

Figure 5.1 This chapter's analytical framework

Moreover, many studies had criticized the participatory scheme initiated by the government. Especially for the indigenous community PDR project, the awareness of the distinct indigenous cultural differences and adjustment of the way of communication proved crucial (Lin and Lin, 2016; Taiban et al., 2020). However, the process of consultation during the indigenous community PDR project was merely conducted, and the critical factors that hamper or facilitate a participatory PDR project have not been systematically analyzed.

Therefore, this chapter aimed to 1. examine how different NGOs implemented a PDR program in an indigenous context, 2. analyze the NGO–government and NGO–communities collaborative relationships, and 3. identify the decisive factors influencing the effectiveness of participatory PDR projects in the indigenous context.

5.1.1 The three large-scale NGOs

As mentioned in chapter three, three large-scale NGOs (LSNGOs) had helped the government with the reconstruction work, especially the construction of the permanent housing during the Typhoon Morakot PDR projects. As mentioned in the previous chapters, the NGOs' involvement was mainly due to the insufficient governmental budget and the constraint of the human force. Therefore, the Typhoon Morakot PDR project was a total NGO-led reconstruction project. Mainly three LSNGOs constructed the permanent housing. The three NGOs were Buddhist Compassion Relief Tzu Chi Foundation (hereafter Tzu Chi), World Vision Taiwan (hereafter World Vision), and the Red Cross Society of the Republic of China (hereafter Red Cross). Except for Tzu Chi, which is the Buddhism NGO, World Vision, and Red Cross are both Christian-based NGOs. Three LSNGOs' built permanent housing accounted for 96.2% of the total permanent housing stocks (35.9% from Tzu Chi, 22.0% from World Vision, and 38.2% from Red Cross).

Regarding the experience of the PDR project, Tzu Chi was a well-known essential partner in the international society. Starting from 1991, Tzu Chi had helped the post-disaster relief of the flood disaster in

Bangladesh. Until 2018, the group had expanded its footprint to 97 nations and regions. The organization was known for its PDR work in Aceh, Indonesia, after the 2004 Indian Ocean Tsunami. Given abundant post-disaster relief project experiences, Tzu Chi was also dedicated to developing innovative goods and technologies for the PDR project (Tzu Chi, 2018). As for the World Vision (Taiwan), since the main objective of the organization focus on the alleviation of the children's poverty, the disaster-related work was mainly concentrated on the disaster preparedness education in the communities and limited PDR projects (World Vision, 2022). Similar to World Vision, the Red Cross (Taiwan) mainly focused on post-disaster relief instead of the PDR projects.

The established year, religious background, number of settlements constructed, number of permanent housing been built, and percentage of the permanent housing were listed in Table 5.1. It was worth noticing that the total number of settlements constructed was 42, different from the number of total settlements introduced in chapter three (35). The reason was that some settlements were designed and constructed by multiple NGOs in different construction phases (Chuan, 2018).

Table 5.1 Information of three major NGOs

Name of the NGOs	Established year	Religious background	Number of the Settlement constructed	Number of permanent housing built	Percentage of the permanent housing
Tzu Chi	1966	Buddhism	6	1296	35.9%
World Vision	1964	Christian	10	794	22%
Red Cross	1904	Christian	16	1378	38.2%

Note: Total Number of the Settlements were 42 (count by the construction phases), and permanent housing assisted by all NGO agencies were 3603.

Source: Chuan (2018)

5.2 Study site and methodology

In this section, the methodology used in this chapter was introduced. First, the section explained the rationale of the case study selection. Second, the section discussed three methodologies used in this chapter.

5.2.1 Selection of case studies sites

In order to explore the different NGO-led PDR decision-making processes as well as the role of different involving NGOs, this research applied the comparative case study approach. The case study approach was used because the exploratory research objectives should draw on a case study. The case study approach can also facilitate the in-depth case investigation, survey, and analysis (Siggelkow, 2007). The conclusion drawn from the case study can further constitute the suggestion and framework in chapter seven—the conclusion chapter.

As a large-scale multi-NGOs-led PDR project, Typhoon Morakot's aftermath was deemed a suitable case to look at the PDR process of different NGOs working in the indigenous communities. Two permanent housing settlements were selected as the case studies to apply the comparative case study approach. There were some

selection criteria. First, two case studies need to be the indigenous settlements. Second, settlements need to had a certain scale to obtain an adequate number of samples. Specifically, the number of households should be over 100. Third, the PDR projects in the settlements need to contain three LSNGOs. According to the above criteria, Changzhi Baihe and Rinari permanent housing settlements were chosen as the case studies.

Changzhi Baihe was located in the Changzhi Township, Pingtung County, with an area of 29.6 hectares. Tzu Chi constructed the first phase of the settlement, the construction started on April 26, 2010, and 164 permanent housing units were completed on August 6, 2010. Then, the Red Cross built the second phase, which started on April 17, 2011, and was completed on October 17, 2011. As a result, 106 housing units were completed in the second phase (Hsieh et al., 2012). The residents came from seven different communities (villages), including Ali Village, Jilu Village, Jiamu Village, Dawu Village, Guchuan Village in Wutai Township. Other than that, there were Dalai Village and Dewen Village belonging to the Sandiman Township. The residents from Wutai Township were Rukai indigenous group, and the residents from Sandiman Township were Paiwan indigenous group (Hsieh, 2012).

Rinari settlement was located on the border of Sandimen Township and Majia Township. The settlement was 29.5 acres, similar to the size of Changzhi Baihe. The construction began on March 14, 2010, and finished on December 25, 2010, which was completed by the World Vision. The settlement had 483 permanent housing units, which accommodated residents from Haocha village in Wutai Township (Rukai), Dashe village in Sandiman Township (Paiwan), and Majia village in Majia Township (Paiwan; Chuan, 2018). The location of the resettled villages and the permanent housing settlements were shown in Figure 5.2.

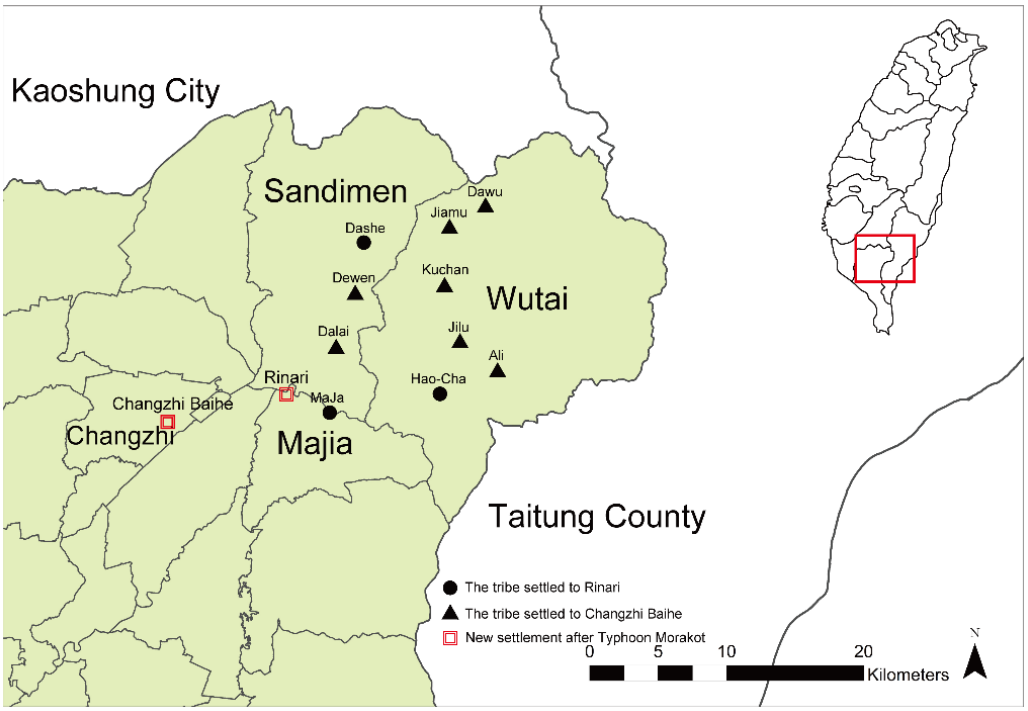

Figure 5.2 The location of the original settlement and new settlement

5.2.2 Methodology of the chapter

Regarding the data collection, similar to chapter four, the triangulation method combining quantitative and qualitative methods (Mertens and Hesse-Biber, 2012) was again used in this chapter, including 1. secondary documents review, 2. semi-structured in-depth interviews, and 3. questionnaire survey had been used.

1) Secondary documents review

First, the secondary information included local government e-newspapers, major Taiwanese newspapers (referred to Apple Daily, the Liberty Tines, United Daily News, and China Times), relative conferences, and other relevant documents related to the PDR of Typhoon Morakot were used to collect the information. Especially, the review process focused on the information related to the Changzhi Baihe and Rinari settlements.

2) Semi-structured in-depth interview

Second, as for semi-structured interviews, a Changhzhi Baihe and Rinari settlement pilot fieldwork began in August 2017. The purpose of the pilot fieldwork was to understand the involvement of NGOs in both settlements during the PDR program and the residents' participation throughout the PDR implementation. The interview abstract was designed based on the pilot field trip and aligned with some proposed PDR frameworks (Bilau et al., 2018; Jamshed et al., 2018). After the adjustment, the PDR framework was constituted in three different stages—initiation, planning and construction, and livelihood restoration stages.

As for the sample selection, the purposive sampling method was applied to choose the households in both settlements with different social backgrounds, ages, and occupations. The residents' representatives ranged from village leaders, teachers, shop owners, other occupations, and retired. Other than the local communities, government, academic, NGOs (three people from three large-scale NGOs), architects had also been interviewed. The outline of the interview was related to the policy, regulation, decision-making of PDR, interaction with different stakeholders, and the evaluation of different stakeholders. All residents were aged 30 to 80. The formal interviews were conducted between February 2018 to March 2021. The interviewed areas included Rinari, Changzhi Baihe permanent housing settlements, and the major cities in Taiwan (Table 5.2).

Table 5.2 List of the interviewees

Code of interviewees	Interviewees	Location	Time	Number of interviewees	Abstract
CG1	Central government	Taipei City	March 2021	1	1. Relationship to the NGOs 2. County government participatory PDR strategy and the characteristics of the two selected settlements
LG1-LG3	Local government	Pingtung City	November 2019; March 2021	3	1. Relationship to the NGOs 2. County and Township government participatory PDR strategy and the underlying problems of the two selected settlements
P1-P4	Academic representatives (Professors and researchers)	Taipei City; Pingtung City	August 2018; November 2019; March 2021	4	Drawbacks of a participatory PDR strategy and the underlying problems of the two selected settlements
N1-N3	NGOs (Tzu Chi-N1, Red Cross-N2, and World Vision-N3)	Taipei City; Taichung City; Pingtung City	August 2018; November 2019; March 2021	3	1. Decision-making in the PDR 2. Relationship to the government and residents 3..The experience of implementing the participatory PDR project in the selected settlements
A1-A2	Architects (work with World Vision)	Nantou County; Rinari	August 2018; August 2019	2	1. The experience of implementing the participatory PDR project in the selected settlements
R1-R17	Rinari residents	Rinari	August 2017; February and August 2018; April, August and November 2019; March 2021	17	1. Relationship and evaluation to the NGOs 2. Details of the participatory PDR project, the underlying problems in the communities
C1-C16	Changzhi Baihe residents	Changzhi Baihe	August 2018; November 2019; March 2021	16	

3) Questionnaire survey

Third, the questionnaire survey helped to analyze and verify the NGO-communities relationship and the participation process in the two settlements. Again, the data was extracted from the *"Social impacts and recovery survey of Typhoon Morakot,"* a large-scale survey project conducted by the NCDR (Deng et al., 2011; 2012; 2013; 2017; 2020). Two questions related to the NGO-communities relationship had been

presented in this research, including 1. do you trust the post-disaster reconstruction capability of the LSNGOs and 2. which NGOs do you appreciate most during the post-disaster reconstruction program? The sample number in Changzhi Baihe settlement was 76, and the Rinari settlement sample number was 84. As for the participatory related issues, four groups of questions, including the 1. delineating dangerous areas and identifying permanent housing beneficiaries, 2. site selection, 3. design planning and construction of the permanent housing, 4. the income and unemployment fluctuation were used in this chapter. The number of the respondents ranged from 32 to 71 depending on the questions and each case study community. The details were shown in Table 5.4, Table 5.5, and Table 5.6.

Due to the time-varying nature of the multi-stakeholder collaborative network, Lu et al. (2017) suggested the time dimension should be used to analyze the PDR process, given that the process is a continuous long-term process. Also, the collaborative network among stakeholders is dynamic and varies from time to time. Hence, the PDR process in two indigenous case studies was introduced chronologically in three different stages—initiation, planning and construction, and livelihood restoration stages. These three stages can comprehensively cover the activities of the PDR project throughout the process (Bilau et al., 2018; Jamshed et al., 2018). The questionnaire survey results were presented align with the three stages and at the very end of the research findings section.

5.3 Initiation stage

In the PDR initiation stage, the 1. post-disaster housing provision strategy, 2. delineation of the dangerous areas, 3. site selection and NGOs distribution, 4. permanent housing beneficiaries recognition, and 5. permanent housing type allocation were presented.

5.3.1 Post-disaster housing provision strategy

The first step in the PDR initiation stage was to decide the housing provision strategy. Regarding whether to prioritize the permanent house or temporary house as the transitional accommodation for the victims, on August 16, 2009, the central government invited the major NGOs for the discussion. The Tzu Chi representatives stated that though the temporary housing might be feasible options, the organization was confident to provide a great number of permanent housing stock in a short time given the goal of Tzu Chi was to help finalize the PDR programs as soon as possible and reach the efficient usage of the resources (Feng, 2009).

During the 8th Working Group Meeting of the Reconstruction Conference on August 27, 2009—a NGOs-government meeting, the conference more clearly ratified the regulation that prioritized constructing the permanent house (CG1; Executive Yuan, 2009). Therefore, the post-disaster housing provision policy mainly prioritized the construction of permanent housing. Meanwhile, some indigenous communities and the World Vision opposed the policy (N3, R2, R5, C3, C8). They insisted that the affected residents should be resettled in temporary houses first. Temporary housing could buffer the disaster impact and facilitate the discussion of planning and design of permanent housing.

In response to the opposed idea, the central government rebutted that the temporary housing policy had not been completely pulled off. The reason for prioritizing the permanent housing policy was that government could not afford two sets of land, funds, human resources, and time to construct temporary housing and permanent housing (Executive Yuan, 2009). To compensate for the inadequate stock of new-built temporary housing, some public facilities were utilized as temporary dwellings. For instance, the resident from the Haocha community moved into an abandoned military camp before the completion of the permanent house. However, the residents complained that the military camp's environment was unsuitable for long-term residence and lack of privacy (R3, R5, R8; Figure 5.3).

Figure 5.3 (a), (b) Living situation in the military camp
Source: Taiban (2016)

5.3.2 Delineation of the dangerous areas

After Typhoon Morakot struck Taiwan, the government passed the *"Post Typhoon Morakot reconstruction special regulation"* as the basic guidelines for the PDR projects. Based on the special regulation, the government prioritized *"land conservation policy"*—the government understood the disaster as the over development of the mountainous areas (CG1). Therefore, instead of the in-situ PDR approach, the relocation method had been widely adopted in various disaster-affected communities—including the indigenous communities that moved to the Changzhi Baihe and Rinari settlements afterward. In resettling the disaster-affected households, the central government stated that if the original communities had been designated as dangerous or potentially dangerous, they should not return to the communities according to the special regulation. In return, they were eligible to receive a free permanent housing from the NGOs and government. After that, the decision prompted a massive confrontation between the indigenous population and the central government (Figure 5.4 and Figure 5.5). Given that the two settlements had an intimate connection to their original land, the residents blocked the government committee from entering the villages (Beng, 2009). The residents stated that a merely scientific-based investigation report completed without consulting the indigenous communities was unreasonable. Some residents stated that their ancestors used to live on the steep slope safely with the indigenous architecture structure and local knowledge (R4).

Figure 5.4 Protest against Pingtung County

Source: The 88 Morakot Disaster Network (2010)

Figure 5.5 Protest in front of the Executive Yuan, Taipei

Source: The 88 Morakot Disaster Network (2010)

After the protest, the government had held some meetings and briefings, and during these meetings, the government urged the resident to agree on the trilateral contract[15]. The government reassured them that the trilateral contract was negotiable in the future. It was fair to say that the meetings and briefings were merely platforms of policy announcements for the government. After ten years, because of the subsequent conflict between the government and residents in the Rinari settlements, the residents requested the government to abolish the trilateral contract—lift up the ban for returning to the original communities (R1, R9). The detail was discussed in chapter six.

5.3.3 Site selection and NGOs distribution

Due to the absence of related regulation and preparation, there was no land designated in advance for the post-disaster permanent housing construction. Thus, after the disaster, considering the land acquisition fee, the size of the construction land, and the concentration relocation scheme adopted by various local governments, most of the local governments decided to use the government-owned land and the government-owned company land (e.g., Taiwan Suger Company) for the permanent housing settlement construction, including the Pintung County Government (PCG). However, as also mentioned in chapter three, the new settlements were far from the original settlements because of the limited option.

Although the PCG wanted to gather all disaster victims from Wutai Township to the Changzhi Baihe settlement, the well-organized Haocha community organization rejected the proposal and suggested that the Haocha community should be resettled to the Rinari settlement—a Taiwan Suger Company owned vacent land (LG1, R12). The residents believed that the Rinari settlement was closer to their original Haocha community. Moreover, the environment was believed to be similar to their previous community. Actually, this was not the first time for the Haocha community to negotiate relocation with the government. 1996 Typhoon Herb also struck the community once. By the time, the PCG had already made a consensus with the Haocha people to move the community to the Rinari in 2007. However, after the stuck of Typhoon Morakot,

[15] The trilateral contract was signed by the government, NGOs, and permanent housing beneficiaries; it regulated the property ownership, rights, and obligation of the permanent housing beneficiaries.

the Majia and Dashe villages also expressed their willingness to move to Rinari (R15, R16).

The rest of the seven communities who *"chose"* the Changzhi Baihe settlement—the communities that followed the Pingtung government's proposal—complained about insufficient discussions between the communities and the government. Therefore, most of them disliked the new site. For instance, the residents complained that Changzhi Baihe settlement had poor air quality and was remote from their original communities (C5, C8).

After the relocate-needed communities and construction sites of new settlements were decided, the next task was for the PCG to find cooperative NGOs to construct the permanent housing. Initially, Tzu Chi expressed their willingness to construct both Rinari and Changzhi Baihe settlement (N1). However, according to the poll of residents, the construction work in Rinari had been replaced by World Vision. The reason was that before the disaster, World Vision had already established some relief programs for the low-income indigenous households (R11, R13). Moreover, most indigenous households were Christian, which shared a common religious background with World Vision. On the other hand, though Changzhi Baihe's residents agreed with the construction assistant from Tzu Chi, the second phase of construction in Changzhi Baihe was taken over by Red Cross—another indigenous-trusted NGO—due to the subsequent conflict.

5.3.4 Permanent housing beneficiaries selection

As mentioned in the delineation of the dangerous areas section, due to the residents' fierce protests, the government compromised on land delineation and housing beneficiaries selection: permanent housing was made available not only to households in the designated dangerous areas but also to those who passed recognition in the tribal meeting—a traditional indigenous negotiation mechanism, which mean the housing beneficiaries can be eligible if a household was recognized by the tribal community (LG1, LG2).

After Typhoon Morakot, the whole Haocha village was buried by the massive landside; thus, all the community members became disaster victims and were subjected to relocate. However, due to well-functioning tribal meetings, desperate situations, and the previous negotiation experience of the 1996 Typhoon Herb, the community swiftly reached the consensus that everyone should be eligible as permanent housing beneficiaries (R1). Meanwhile, the Majia and Dashe villages were only partially affected. Nonetheless, because of limited negotiation skills with the government and limited understanding of the relocation process, some unaffected residents refused to be resettled due to mistrust of the trilateral contract. As a result, the negotiation faced several bottlenecks in Majia and Dashe villages (R15, R16).

Moreover, although during the tribal meeting, Majia alleged that the village needed 150 permanent housing units, while the Dashe village should have 245, the government disputed that some households did not have official household registration in the villages, thus not able to receive the permanent housing. To solve the problem, World Vision—the assisting NGO in the Rinari settlement—proposed that the households rejected by the government can *"rent"* the permanent houses for 33 USD per year to become eligible permanent

housing beneficiaries (N3).

For the seven villages that moved to the Changzhi Baihe settlement, similar to Majia and Dashe villages, they were all partially disaster-affected thus the discussion of permanent houssing beneficiaries stagnated. Moreover, it was reported that the community leader rigged the decision-making regarding the housing beneficiaries (C14, C16). Therefore, the rigged decision-making deterred some community members from moving to Changzhi Baihe settlements.

5.3.5 Permanent housing type determination

Since multiple LSNGOs performed reconstruction simultaneously, the central government regulated the floor area of permanent housing units so that NGOs could construct permanent housing units according to the standards to ensure the fairness of the housing distribution (Table 5.3; Executive Yuan, 2010). Also, the number of household members in each household had been investigated beforehand by the PCG.

Table 5.3 The three types of the permanent housing standards

Type	Number of the household member	Size of the housing
A	Less than two people	46.2m^2
B	Three to five people	92.4m^2
C	More than six people	105.6m^2

Source: (Executive Yuan, 2010)

Although precise regulation was provided, three LSNGOs had very distinct permanent housing size determination criteria. Tzu Chi strictly followed the central government standard. Furthermore, to reach better resource management, Tzu Chi even dispatched some volunteers to scrutinize the number of household members and revised the housing size distribution data provided by the PCG (N1). Therefore, some households' permanent housing had been downgraded to a smaller size. This behavior also spurred the conflict between the Changzhi Baihe residents and Tzu Chi. The households that moved into the first phase of permanent housing in Changzhi Baihe complained about the limited living space in the housing unit (C4, C8). Some family member did not have their own bedroom and needed to sleep in the living room or front yard. In the second phase of construction, Red Cross's housing type distribution concentrated on Type-B and Type-C after the active discussion with the local residents. World Vision in Rinari distributed the housing type more lenient than Tzu Chi. After the meeting, World Vision understood that most pre-disaster housing in the affected communities was usually around 80-100m^2. Therefore, World Vision decided to provide only housing Type-C to every eligible household regardless of the number of household members (N3). Though the distribution scheme of three LSNGOs violated the regulation imposed by the central government, the decision eventually been recognized by the PCG and constructed.

Regarding statistical data on the delineation of dangerous areas, 69% of Rinari and 60.6% of Changzhi Baihe households who responded to the survey participated in the related discussion. The two groups showed no significant difference. About 67.9% of Rinari and 60.6% of Changzhi Baihe households who responded to

the survey participated in the site selection process. Similarly, no significance was observed between both groups. However, only 50% of Rinari and 30.3% of Changzhi Baihe residents were satisfied with the results of above mentioned two processes. The questionnaire result reflected that the government and NGOs generally did not really consult with the residents at the initial stage of the PDR, which was identical to the result shown in the interview survey (Table 5.4).

Table 5.4 Questionnaire results on the delineation of dangerous areas, identification of permanent housing beneficiaries, and site selection

Degree of participation in the delineation of dangerous areas				
	No opinion[16]	No participation	Participated	$\chi 2$
Rinari (N = 71)	16.9%	14.1%	69.0%	
Changzhi Baihe (N = 33)	24.2%	15.2%	60.6%	0.9
Degree of participation in the site selection				
	No opinion	No participation	Participated	$\chi 2$
Rinari (N = 71)	22.5%	9.9%	67.6%	
Changzhi Baihe (N = 33)	15.2%	24.2%	60.6%	4.0
Satisfaction about the delineation of dangerous areas and site selection				
	Unsatisfied	No opinion	Satisfied	$\chi 2$
Rinari (N = 70)	25.7%	24.3%	50.0%	
Changzhi Baihe (N = 33)	30.3%	39.4%	30.3%	3.9

Note:* and ** denoted significance at the 5% and 1% levels, respectively. No asterisk denoted no significance between the two groups.

5.4 Planning and construction stage

Regarding the planning and construction work in Rinari, the World Vision had long-term cooperation with the experienced architect back to the Ji-ji Earthquake reconstruction in 1999—another destructive natural disaster to Taiwan. Therefore, the World Vision's design and construction team not only had abundant knowhow regarding the PDR, but they were also familiar with the indigenous groups. Before the planning and the design process, the World Vision initiated an NGOs-community discussion platform—the *"Rinari Three Communities Reconstruction Committee"*— to empower residents in the design process. The platform regularly invited the important community leaders in three villages to discuss permanent housing design and planning issues and polled the design proposal (Chuan, 2018). Although World Vision believed more discussions with residents were necessary, the PCG's pressure urged the World Vision to speed up the design discussion process (LG1). For instance, the grading work was necessary before constructing the permanent housing given the Rinari settlement was located on the mountain slope. However, due to the limited time schedule, the work was done without proper management and resulted in poor quality (R2, R8). Moreover, some design proposals from the residents failed to be accomplished. For instance, residents proposed to use the slate on the permanent housing—the traditional building material of Rukai and Paiwan indigenous

[16] No opinion denoted that the households did not know about the opportunity to participate.

groups. Nonetheless, the proposal was revoked by PCG because the proposal might take longer the construction period and exceed the budget. Afterward, a light steel structure was proposed by the team of World Vision (N3; Figure 5.6).

The advantage of the light steel structure was that it was easy to assemble by the residents. Therefore, the World Vision initiated a *"Self-Construction Project"* (it was part of the TWS projects mentioned in chapter four) in the Rinari settlement—the residents were able to participate in the construction process while receiving daily wages (Figure 5.7). The project was implemented under the supervision of the architects and staff. The project provided additional income to the households and the participation of the residents in the PDR project (R9, R10). However, some residents thought the short-term program could not solve their long-term institutional marginalized socioeconomic situation, as mentioned in chapter four. Since Taiwanese indigenous communities are mostly Christians or Catholics, the church was deemed essential for residents to gather. Therefore, World Vision reserved some construction sites for the churches in the settlement and partly sponsored the construction fee. The number of the churches was planned and designed based on the churches' distribution in three original communities before the disaster (Chuan, 2018; Figure 5.8).

Figure 5.6 Light-steel structure permanent housing designed by World Vision

Source: Chuan (2018)

Figure 5.7 Self-Construction Project in Rinari

Source: Chuan (2018)

Figure 5.8 Churches design in Rinari

Source: Chuan (2018)

In the first phase of the Changzhi Baihe project, Tzu Chi already had a set of standard dimensions and modules for permanent houses because of many years of overseas PDR experience. The permanent housing that Tzu Chi proposed featured rapid construction and module design, which saved the construction cost. The proposed permanent housing was the conventional reinforced concrete structure (N1). Moreover, Tzu Chi reduced the design discussion time to shorten the construction period and achieve the most efficient reconstruction. Therefore, the design and configuration were determined at an early stage, without much re-design work from the cooperating architects. After the design was confirmed, many volunteers and contractors flowed into the construction site during the construction period. The design used white and gray colors on the facade and the roof, which presented the organization's representative colors (Figure 5.9). However, the design did not account for the indigenous culture (C11, C15). Moreover, at the entrance of Changzhi Baihe settlement, there was a sign that presented the name of the Tzu Chi. After the discussion, the sign was removed (C3). After completing the settlement, the volunteer in Tzu Chi often visited the settlement and advocated residents not to consume meat and alcohol according to the religious background of Tzu Chi. However, this contradicted the indigenous lifestyle (C1, C5).

Figure 5.9 Permanent housing designed by Tzu Chi

Due to the housing size allocation and the lifestyle intervention, many conflicts with the residents occurred. Consequently, the residents declared that they refused Tzu Chi to construct the second phase of the permanent house (C8). Therefore, the Red Cross took over the second phase of the permanent house construction. No module design had been proposed like Tzu Chi. The design of the permanent housing had been discussed with the residents through the workshops and the community meeting. Residents said that the second phase of the permanent house used a more vivid and light color on the facades with an indigenous pattern. The permanent housing structure was reinforced concrete for future maintenance (C1, C2; Figure 5.10).

Figure 5.10 Permanent housing designed by Red Cross

Regarding the questionnaire results on the planning and construction of permanent housing, 95.4% of Rinari households and 81.2% of Changzhi Baihe households who responded to the survey participated in the questionnaire survey participated in the decision-making process. The result showed significant differences between the two groups, while the participation rate of Rinari residents outweighed the one in Changzhi Baihe. Likewise, the satisfaction level for the Rinari settlement was also significantly higher than the Changzhi Baihe settlement. According to the questionnaire result, the presented result was in line with the interview result discussed above (Table 5.5).

Table 5.5 The questionnaire results on the design, planning, and construction of permanent housing

Design, planning, and construction of the permanent housing				
	No participation		Participated	$\chi 2$
Rinari (N = 65)	4.6%		95.4%	
Changzhi Baihe (N = 32)	18.8%		81.2%	5.1^{*}
Satisfaction regarding the design and planning of the permanent housing				
	No opinion	Unsatisfied	Satisfied	$\chi 2$
Rinari (N = 67)	35.8%	23.9%	40.3%	
Changzhi Baihe (N = 32)	59.4%	31.2%	9.4%	10.1^{**}

Note:* and ** denoted significance at the 5% and 1% levels, respectively. No asterisk denoted no significance between the two groups.

5.5 Livelihood restoration stage

In Rinari, after the completion of the construction work, the central government initiated the *"Life Reconstruction Plan"* to help permanent housing households restore their livelihood. Cooperating with PCG, World Vision established the *"Life Reconstruction Center*[17]*(LRC)"* in the Rinari settlement (N3). As a result, projects such as industrial training and community disaster preparedness were launched in the settlement. However, because this was a government-funded project, the project was halted after three years. Compared to the government-initiated projects, the resident stated that the community-initiated livelihood restoration programs seemed to be more effective (R1, R2).

Additionally, in the Rinari settlement, three communities had distinct livelihood restoration strategies due to different tribal cultures. Majia people were good at food culture, Dashe people were good at handicrafts, and Haocha focused on the tourism industry—all programs were residents initiated. After a decade, the Haocha community was the most profitable one (P2).

The success of Haocha was attributed to the well-organized industry promotion groups cooperating with external companies and organizations. The tourism industry appealed to more than 40 Haocha households participating. Align with the expansion of the tourism industry, the cluster also included the restaurant and grocery store— one of them even qualified for listing in the Michelin Guide. Since Rinari is the only habitat for the Haocha resident, the Haocha community has tried hard to develop the industry. However, on October 15, 2020, one of the three-floored housing extensions—a hybrid facility for host families and restaurants—was demolished by the local government for safety reasons (UDN, 2020). The industry's success also busted the confrontation between the young and old residents in the Haocha community (R1, R3). The situation was explained in detail in chapter six (Figure 5.11).

Figure 5.11 Tourism industry in Rinari

[17] Base on government's plan, the Life Reconstruction Center is to set up a life reconstruction service which provided by the central government and NGOs in order to provide residents some services such as: (1) Phycological services (2) Schooling services (3) Employment services

On the contrary, the residents in Majia and Dashe hesitated to invest in their industries, given that their original settlement still existed. They still hoped the government could lift the ban to return to their original habitat (R15, R17).

After the two phases of the reconstruction in Changzhi Baihe, Tzu Chi and the Red Cross withdrew from the site. Similar to the Rinari settlement, in the Changzhi Baihe settlement, the LRC was established by World Vision. After the end of the LRC programs. The following agricultural industry program was carried on by the PCG's administration of indigenous people affairs (AIPA), which is in charge of the indigenous-related affairs at the local level.

The AIPA assisted the residents in acquiring 10 hectares of arable land from the Taiwan Sugar Company with the land rent exemption in the first three years. Furthermore, the resident received assistance from the AIPA for the budget to buy equipment, fertilizer, and seeds (LG1). Initially, the residents wanted to grow traditional indigenous crops such as taro and millet. Nonetheless, the AIPA required the residents to cultivate dragon fruit for better economic value. However, due to the lack of cultivation knowhow and the low human capital, the residents found it challenging to outline a sales strategy after the government withdrew from the dragon fruit project (C5, C7). After a decade, the Taiwan Sugar Company revoked the arable land since residents could not pay the land rent.

Regarding the questionnaire results on livelihood restoration performance, the household's average monthly income in the Rinari settlement significantly increased from 34,583 to 41,000 NTD (1,243.1 to 1,473.7 USD[18]) after ten years. On the other hand, the income in Changzhi Baihe settlement slightly decreased by 3070 NTD (74.4 USD). Likewise, the number of unemployed personnel per household in the Rinari settlement improved slightly, from 0.2 personnel per household to 0.1. In contrast, in the Chagzhi Baihe settlement, the situation worsened significantly from 0.2 to 0.4. The questionnaire results were similar to the interview survey results (Table 5.6).

[18] According to the exchange rate of 2021 January 28th

Table 5.6 The questionnaire results on livelihood restoration

Income fluctuation within ten years after the disaster			
	Period	Average monthly income per household (NTD)	t
Rinari (N = 60)	One year after the disaster	34,583	-2.0*
	Ten years after the disaster	41,000	
Changzhi Baihe (N = 57)	One year after the disaster	44,561	0.6
	Ten years after the disaster	41,491	
Unemployment rate fluctuation within ten years after the disaster			
	Period	Average unemployed personnel per household	t
Rinari (N = 63)	One year after the disaster	0.2	1.2
	Ten years after the disaster	0.1	
Changzhi Baihe (N = 57)	One year after the disaster	0.2	-1.9*
	Ten years after the disaster	0.4	

Note:* and ** denoted significance at the 5% and 1% levels, respectively. No asterisk denoted no significance between two groups.

According to the discussion in the above sections, it is fair to say that the PDR projects in Rinari and Changzhi Baihe settlements differed from the initial to the livelihood restoration stage. Compared to the disaster recovery trajectory in Rinari, the one in Changzhi Baihe was relatively complicated given that two LSNGOs (Tzu Chi and Red Cross) were involved in the permanent housing planning and construction. Moreover, the livelihood restoration project was taken by other LSNGOs (World Vision). The overall time span and the relationship had been plotted chronologically in Figure 5.12.

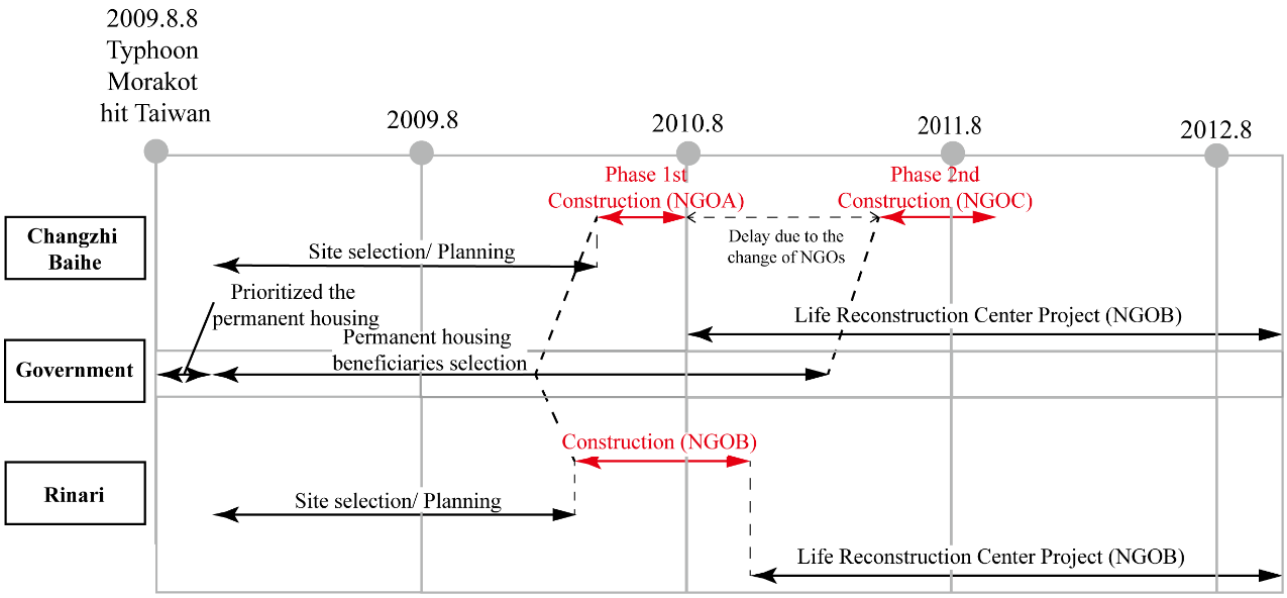

Figure 5.12 PDR process of two settlements with the timeline

5.6 Questionnaire result: NGO-community relationship

To further understand the communities' evaluation of the LSNGOs, this research used a questionnaire survey to investigate 1. the trustworthiness of large-scale NGOs during the PDR program and 2. the most appreciated NGOs during the PDR program.

Regarding question 1. the five-continuous scale is used (1 = strongly distrust, 2 = distrust, 3 = neutral, 4 = trust, 5 = strongly trust). The average points showed 3.26 and 3.3 in the two settlements, respectively—no significant different shows in the two settlements. The result indicated that Changzhi Baihe settlement and Rinari settlement generally believed that large-scale NGOs could implement the PDR projects (3.26 and 3.3 are between neutral and trust; Table 5.7).

Table 5.7 Do you trust the PDR capability of large-scale NGOs?

	Settlement	Number of households	Mean	Std. Deviation	t
Trust to the NGO	Rinari	84	3.30	0.533	-0.365
	Changzhi Baihe	76	3.26	0.661	

Note:* and ** denoted significance at the 5% and 1% levels, respectively. No asterisk denoted no significance between the two groups.

Regarding question 2. the answer lists up all NGOs that assisted during the PDR period of Morakot Typhoon[19](Not only three LSNGOs, but some small-scale NGOs also included in the PDR programs). In Changzhi Baihe settlement, the survey showed that the residents were equally grateful to World Vision and Tzu Chi, with a rate of 39.5%. In the Rinari settlement, 92.9% of the residents thought the World Vision was the most thankful NGO during the PDR program (Table 5.8).

Table 5.8 Which NGOs do you appreciate most during the PDR program?

Settlement	Tzu Chi	World Vision	Red Cross	Number of households	t
Rinari	2.4%	92.9%	0.0%	80	56.498**
Changzhi Baihe	39.5%	39.5%	14.5%	71[20]	

Note:* and ** denoted significance at the 5% and 1% levels, respectively. No asterisk denoted no significance between the two groups.

The questionnaire survey results showed that the residents generally trust the PDR project implementation capability of three LSNGOs. However, there were significant differences regarding the most appreciated NGOs in the two settlements. Interestingly, although Tzu Chi and Red Cross participated in the first and second phases of the construction project in Changzhi Baihe settlement, residents were equally grateful to Tzu Chi and World Vision—World Vision did not have any construction projects but only the limited LRC

[19] The NGOs including: Red Cross, World Vision Tzu Chi, Dharma Drum Mountain, I-Kuan Tao, Chang Yung-Fa Foundation, Chinese Christian Relief Association, Canlove Social Service Association, Chinese Regional Bishops' Conference, The Presbyterian Church in Taiwan, Zhi-Shan Foundation Taiwan, Children Are Us Foundation, and United way and Association of Indigenous people of Pingtung are including in the questionnaire selection.

[20] The answer other than the three large-scale NGOs are excluded in the statistical result

projects conducted in after the construction in the Changzhi Baihe settlement.

5.7 Discussion and conclusion

Based on the different disaster recovery and PDR project implementations in the targeted two settlements. This section discussed the NGO—Government and NGO—community relationship. Moreover, the section also identified the decisive factors influencing the effectiveness of the participatory PDR project in the indigenous context.

5.7.1 Government and NGOs: NGOs can fill the gaps left by the government but also dominate the decision-making process

It was evident that the NGOs could play a complementary role to the government and provide necessary aid and resources during the PDR program. The involvement of NGOs was based on the time and budgetary consideration of the Taiwanese government. The lack of capacity to implement the PDR project was because of the scarcity of pre-disaster countermeasures and the preparedness policy in the government sector.

As Yuan et al. (2018) stated, most of the government's PDR activities have been dominated by the government, with NGOs often acting as the subordinate role rather than partners. The involvement of NGOs only completed the mission allocated by the government without NGOs' own initiatives. On the contrary, in the Taiwanese case, the LSNGOs were invited to participate in the core policy formation process regarding the PDR project, such as the post-disaster housing provision strategy. This seemed to be beneficial since the NGOs could represent the voice of civil society (Nikkhah and Redzuan, 2010).

Nonetheless, the underpinning philosophy and PDR ideology of LSNGOs might profoundly influence government decision-making. For instance, in this case study, due to the firm opinion of Tzu Chi that temporary housing provision might be costly and delay the PDR implementation, the government abandoned the new-built temporary housing solution. However, the decision-making resulted in a substandard temporary housing environment for the disaster victims, such as the Haocha people. On the other hand, World Vision opposed the opinion but could not reverse the decision-making. The standpoint of LSNGOs also became evident during the housing type determination process. Tzu Chi revised the provided housing type allocation list by downgrading it. On the other hand, the World Vision and Red Cross upgraded some of the allocated housing's size. It is fair to say that in the Taiwan context, LSNGOs played a very dominant role compared to the government—the initiator of the PDR project. The difference in the goal and value of each LSNGOs can lead the PDR project to very distinct scenarios. Despite the dominant role of LSNGOs, sometimes, the decision-making of LSNGOs can still be influenced by the government. For instance, the time-prioritized PDR program and pressure from the government also suppressed the World Vision-designed participatory PDR scheme. The lack of government support also constrained the livelihood restoration activities of World Vision in both settlements.

Contradicted the finding of Lu et al. (2020) that NGOs might evolve as more PDR experience is gained from the field, facilitating the next PDR event more smoothly. The Taiwanese case showed that the most experienced NGO might be more assertive in decision-making and take their previous experience for granted,

thus hampering PDR programs' effectiveness. For instance, the module design and effective resource control became the doctrine in Tzu Chi. On the other hand, the less experienced tend to perform better, especially in the indigenous community PDR project. For instance, without a connection with the architect, Red Cross needed to find a design partner and start the design proposal from scratch. Nonetheless, the proposal had been approved by the resident in Changzhi Baihe compared to the one designed by Tzu Chi.

5.7.2 Community and NGOs: NGOs can facilitate the PDR programs but also exacerbate the effectiveness of post-disaster recovery

Echoing the finding that NGOs can better address the community's needs with more flexibility, the Taiwanese case study showed a similar phenomenon (Xu et al., 2018; Nikkhah and Redzuan, 2010). Moreover, flexibility even proved to be essential in the indigenous context. For instance, in the permanent housing type decision, the incentive and reason for World Vision to upgrade residents' allocated permanent housing size was because of the understanding of indigenous living styles and culture. Moreover, World Vision's idea of proposing the annual rent for the eligibility of permanent housing was because the organization valued the tribal communities' solidarity.

Another finding was that indigenous people tend to participate in decision-making if the participation opportunities are given. For example, the World Vision and Red Cross provide a discussion route regarding the permanent housing planning, which resulted in a more indigenous-center design. In the Rinari case, the participatory process even extended to the construction process.

Usually, NGOs focus on socioeconomic reconstruction while the government emphasizes housing and infrastructure reconstruction (Lu and Li, 2020). Nonetheless, in this case study, except for World Vision, other NGOs withdrew from the construction site after the housing construction task was finished because the livelihood restoration project merely attracted public attention and sponsors. However, without the aid of NGOs, indigenous communities faced difficulties in outlining a proper livelihood restoration strategy. Moreover, when they had a conflict with the government, it was crucial to have NGOs as the communication bridge (Taiban et al., 2020).

Moreover, this case study also showed that the communities were not always passively accepting the NGO's decision-making. For example, in the site selection and NGOs distribution, the community rejected the help from the Tzu Chi given that the NGO had a limited understanding of indigenous culture. On the contrary, the PDR implementation in Rinari settlement had been done smoothly, given that World Vision had already established pre-disaster mutual trust with the indigenous communities. As pointed out by Lu and Li (2020) and Méheux et al. (2010), mutual trust is essential in the PDR program—the community might replace the partner NGO, which lose its trust. The questionnaire survey again highlighted the trust issues. Despite the LSNGO's PDR capability not being suspected by the communities, understanding indigenous culture, religious background, and the long-term relationship tended to be critical factors for the indigenous communities to trust the NGOs in the PDR projects.

The community and NGOs relationship under the PDR context can vary among different implementing NGO groups. The underpinning ideology of PDR programs, the extent of understanding of indigenous culture, and the extent of mutual trust with the indigenous community seemed to be essential in the indigenous context PDR project.

5.7.3 Decisive factors that influence the effectiveness of participatory PDR projects in the indigenous community

After martial law was lifted in the 1980s, Taiwan became a democratic regime, and various NGOs were established from 1980 onward. As a result, society has valued participation as a method for decision-making. Therefore, the participatory concept was also integrated into the recent PDR project agenda and bolstered by several kinds of research (Jha et al., 2010; Cronin and Buthrie, 2011). According to the chapter, six key factors (policy, flexibility, community organization, extent of damage, mutual trust, and the understanding of the participatory concept) were related to the effectiveness and the quality of the participatory PDR projects in the indigenous context. The six key factors were further explained as follows.

1) Government: Participation-friendly policy

First, the contradictory and non-indigenous-centered government policy hampered the participation of indigenous residents in the PDR project. As mentioned previously, the government prioritized the land conservation policy. However, the idea contradicted the indigenous groups' rooted human-natural and human-land concepts. Without a common understanding of land use and relocation, the author argued that it is difficult for the government and indigenous communities to agree with each other.

Second, weak legislation failed to ensure the execution of the participatory program, despite the government being aware of the importance of community participation. For instance, the Morakot Post-Disaster Committee endorsed the concept of participatory PDR implementation. Nonetheless, there were no detailed implementation guidelines and no incentive for the local government and NGOs to implement the participatory PDR projects in their construction sites. The participatory concept was limited to lip service. For instance, during the initial housing provision policymaking process, the community members were not invited into the discussion. The government had pre-decided the trilateral contract without consultation with the community. In the design and construction phase, the participatory frameworks were arbitrarily implemented by different NGOs without supervision and guidelines from the government. Thus, the quality of participation varied among NGOs. Lastly, the government proposed a livelihood restoration project in Changzhi Baihe nonetheless did not listen to the community's voice.

Third, the chapter highlights that overall, implementation of the PDR project was rushed. It only took less than three years to finish the permanent housing construction on both sites. However, proper implementation of housing relocations takes time. An immediate resettlement solution might neglect cultural aspects and undermine the possibility of community participation, especially in the indigenous communities (Siriwardhana et al., 2021). For instance, despite World Vision being willing to implement the participatory

design process in Rinari settlement. The time limitation rendered it hard to apply.

2) Community: Community organizations

Community organizations were also vital in facilitating the participatory PDR projects. The chapter showed that the Haocha community could mobilize its community organization swiftly. Thus, the community was able to urge the government to change the permanent housing settlement's site for them and NGO distribution decision-making. The healthy community organization structure attributed the previous disastrous typhoon event to 1996. The community organization had already been formed by the time, thus functioning right after Typhoon Morakot's aftermath. Meanwhile, other tribal villages' community organizations had functioned later, which hampered the early decision-making opportunities and the change to negotiate with the government regarding unreasonable policy. Moreover, the opaque decision-making processes of the community organization even undermined harmony among the residents, which even divided the communities and delayed the PDR process. Moreover, a well-functioned community organization also proved to be helpful in the livelihood restoration stage. For instance, Haocha people could outline the community-initiated livelihood restoration plan and successfully attract tourists.

3) Community: Extent of damage

In totally damaged communities, a consensus regarding the housing beneficiaries was easily reached during the tribal meetings (e.g., the Haocha community) since the overall habitation had been rendered uninhabitable. On the other hand, if the damage level varied among households in a community, such as other tribal villages, the relocation census seemed hard to achieve. The slightly damaged households might be unwilling to be relocated, while the heavily damaged households might want to be relocated as soon as possible. However, if a consensus can not be reached, the disaster-affected tribal community would not be applicable for the collective relocation policy or the permanent housing beneficiaries proposed by the government.

The extent of damage can also influence the development and discussion of livelihood restoration strategies. Heavily damaged communities, such as Haocha, had focused more on the relocated settlement's livelihood restoration issues, given they had nowhere to develop other than the new settlements. The households of Haocha were also willing to invest their asset in the new industries and build up some industry development organizations. On the other hand, the partially damaged communities still desire to return to the pre-disaster community once the government lifts the ban. That is to say, the residents would be unwilling to invest much in the livelihood development of their new settlements if they still have hope to return to the original settlements.

4) NGOs: flexibility

The flexibility of NGOs can lead to the success of participatory PDR projects. For example, the study revealed that in the Rinari settlement, a World Vision-initiated solution helped unqualified households receive permanent houses by imposing the annual rent scheme. Moreover, A permanent housing design

committee comprised of the leaders of three communities was subsequently established to facilitate the permanent housing and settlement planning discussion. Furthermore, instead of hiring massive professional construction workers, by applying an innovative housing structure, the residents were able to engage in the construction phase and boost their recognition and economic well-being at the same time. A similar scenario happened in the Red Cross-initiated PDR project, in which residents were able to engage in the permanent housing design process. On the contrary, due to the size and rigid organizational structure, the PDR project executed by Tzu Chi followed the protocol based on previous experiences. However, it rendered them unable to adjust and involve the community in the discussion.

5) Government/ Community/ NGOs: Understanding of the participatory concept

This chapter revealed that a limited understanding of the participatory concept among the government, NGOs, and communities undermined the effectiveness of the participatory PDR projects.

First, there was a deviation in the government's participatory concept. According to the questionnaire survey, although more than half of the residents stated that they *"participated"* in delineating the dangerous areas, identifying the permanent housing beneficiaries, and the site selection process. However, the residents stated that the government utilized the meetings merely to announce the PDR policy, which expected the resident to obey. For instance, the trilateral contract. The chapter showed that the extent of participation provided by the Taiwanese government was only limited to *"inform"* rather than *"empowerment"* (Davidson et al., 2007).

Second, in the case of NGOs, the research showed that in the Changzhi Baihe settlement, the Tzu Chi played a much more assertive attitude in the PDR projects, which might favor the organization rather than the affected residents (Siriwardena and Haigh, 2011). Therefore, it is fair to say that some NGOs' members were still not yet fully open or aware of the concept.

Third, in the affected communities, the chapter found that indigenous residents did not have the adequate human capital to engage in the decision-making process because of their low educational background and lack of experience (Méheux et al., 2010). In this study, because of poor negotiation skills, except for the Haocha community, which could negotiate with the government regarding the condition of relocation. Without relevant disaster experience, most affected communities can only passively accept the government's relocation policy due to their limited understanding of PDR and knowledge of related regulations. Moreover, indigenous residents had difficulties finding a lucrative market by themselves to gain post-disaster income (Taiban et al., 2020), given that they were unfamiliar with cash-based livelihoods. Eventually, the residents can only passively follow the livelihood restoration project made by the government.

6) Government/ Community/ NGOs: Mutual trust and understanding

Mutual trust is the foundation of participatory programs. As mentioned before, the study showed that the residents trusted NGOs that share a common religious background as well as the one who had assisted them before the disaster. Moreover, this chapter also stated the importance of mutual trust and understanding

between community and government. If the pre-disaster trust and understanding were obtained, the indigenous-friendly relocation policies could be imposed. The resident can also avoid protecting against the government if they know a better way to convey their voice. The subsequent squabble regarding the housing extension can also be prevented. Moreover, the communication means can be maximized by enhancing the mutual trust and understanding of the community and government. It is widely agreed that NGOs serve as the communication bridge between government and community. However, it might be risky if NGOs acted assertively, such as in the case of Changzhi Baihe, the community would be able to skip NGOs and reach the government directly.

Incorporating all these findings, Figure 5.13 illustrated the relationships between the critical factors and the stakeholders.

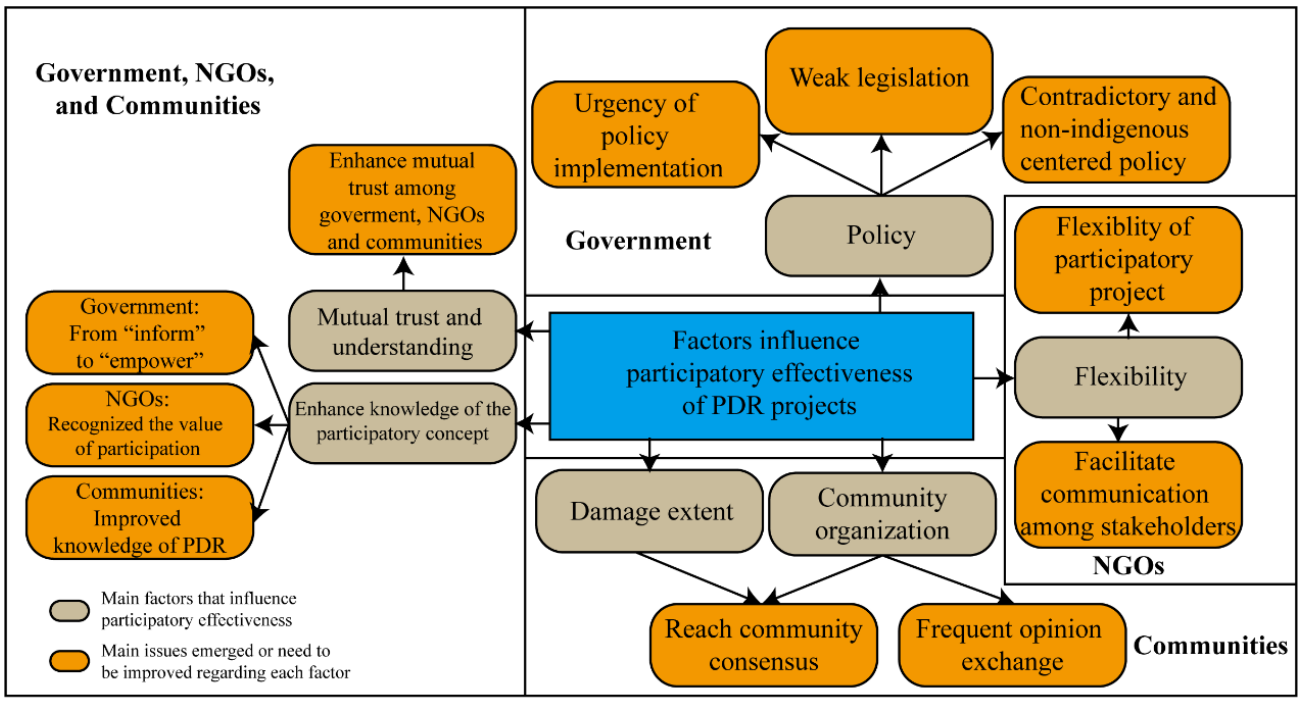

Figure 5.13 Issues related to different stakeholders

NGOs have been found to have a role in PDR projects. By looking at PDR projects implemented in different permanent housing settlements after Typhoon Morakot, different NGOs' roles and decision-making were compared—from the initiation to the livelihood restoration stages. In addition, the government–NGO and community–NGO relationship had been further extracted. Also, during the PDR project, community participation was considered essential. Thus, aligned with the three-stage PDR framework, the PDR process was analyzed from a participatory perspective. The chapter found that a participation-friendly policy, community organization, extent of the damage, flexibility of NGOs, understanding of the participatory concept, and mutual trust and understanding are essential factors that profoundly influence the effectiveness of indigenous community participatory PDR projects.

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Chapter 6

6. Ten years after the reconstruction in the indigenous community

After introducing the PDR process in two indigenous communities, to explore how residents modified and altered their living environment and the impediments that hamper the socioeconomic recovery progress, this chapter discussed the post-PDR era—ten years after the reconstruction in the indigenous community. Specifically, the chapter discussed some critical issues regarding 1. the housing extension's relationship to the indigenous livelihood and 2. the long-livelihood and living issues in the indigenous context.

6.1 Background and objectives of the chapter

Due to NGOs' different underpinning ideologies, government pressure, and limited community participation, the mismatch of the housing design and narrow housing floor area had urged many indigenous households to modify and extend their permanent housing ten years after the disaster. As stated in chapter two, these housing modifications can be deemed the community resilience capacity for the residents to adjust to the new livelihood and environment after the disaster (Ghaffarian Hoseini et al., 2014). However, the tremendous housing extension had been deemed illegal by the government and spurred the disputes between government and community.

In addition, although multiple stakeholders had supported the PDR project after Typhoon Morakot. Some related policies had been imposed. However, as mentioned in chapter four, the disaster recovery performance was less than satisfactory, especially among the indigenous households. According to the *"Social impacts and recovery survey of Typhoon Morakot,"* the recovery consciousness of indigenous and Chinese-affected households was once over 60% in 2012 then declined from 2012 to 2019 (Deng et al., 2010; 2012; 2013; 2017; 2020;).

According to the above mentioned unsettled problems and issues, this chapter 1. retrospectively traced the indigenous population's livelihood, culture, and spatial characteristics before a disaster, 2. clarified the relevant PDR background and post-disaster permanent housing spatial characteristics, analyzed in organized patterns the housing modification that occurred in the indigenous permanent housing settlement, and discussed the modification incentives into pre-and post-disaster driven ones, 3. understand the livelihood development issues in the indigenous community, and 4. discuss the housing extension demolish event.

6.2 Study site and methodology

First, the section explained the criteria of the case study selection. Second, the section discussed three methodologies used in this chapter.

6.2.1 Selection of case study sites

In this chapter, Haocha community—a disaster-affected community that moved to Rinari settlement afterward— was chosen as the study object. There were several reasons to select Haocha community. First, the original settlement had been eradicated due to Typhoon Morakot. The residents had no choice but relocated to the Rinari settlement. Thus, the change in the livelihood and living environment was tremendous. Second, as mentioned in the previous chapter, the Rinari settlement is the second-largest relocated settlement in terms of the accommodated households (473), while Haocha community accounts for 177 households—the most considerable portion among the three communities which moved to Rinari (36.6% of overall households). Third, according to a drone survey, the Rinari households had the most apparent housing extension, which was explained in the later section.

The Haocha community belongs to the indigenous ethnic group called the *"Rukai."* The total population of the Rukai is 13,443 people. The Haocha community accounts for 3.7% of the Rukai groups' total population. The Haocha people believed to be the origin of the Rukai groups, which had the longest history (Taiban, 2016). The Haocha people were initially located at the North Dawu Mountain, Wutai Township, Pingtung County—600 m away from the South Ai-Liao River (Council of Indigenous Peoples, 2019). The locals usually named it the Old Haocha settlement.

Given that the Old Haocha settlement was isolated and without its electricity supply, aligned with the government policy, the residents were relocated (1975 to 1977) from the Old Haocha to the South Ai-Liao River terrace, an area which was 200 m from the South Ai-Liao River (Taiban, 2016). This new site was called the New Haocha settlement by the residents. However, due to the reckless decision-making of the government, the New Haocha was prone to typhoons and landslides.

On August 8, 2009, Typhoon Morakot brought unprecedented precipitation that caused a destructive landslide in the New Haocha settlement. Eventually, the housing in the New Haocha had all been washed away or buried under the earth. Afterward, as mentioned in chapter five, they concurred with the Pingtung County Government and moved to the Rinari settlement in 2010. Figure 6.1 showed the migration trajectory of the Haocha people.

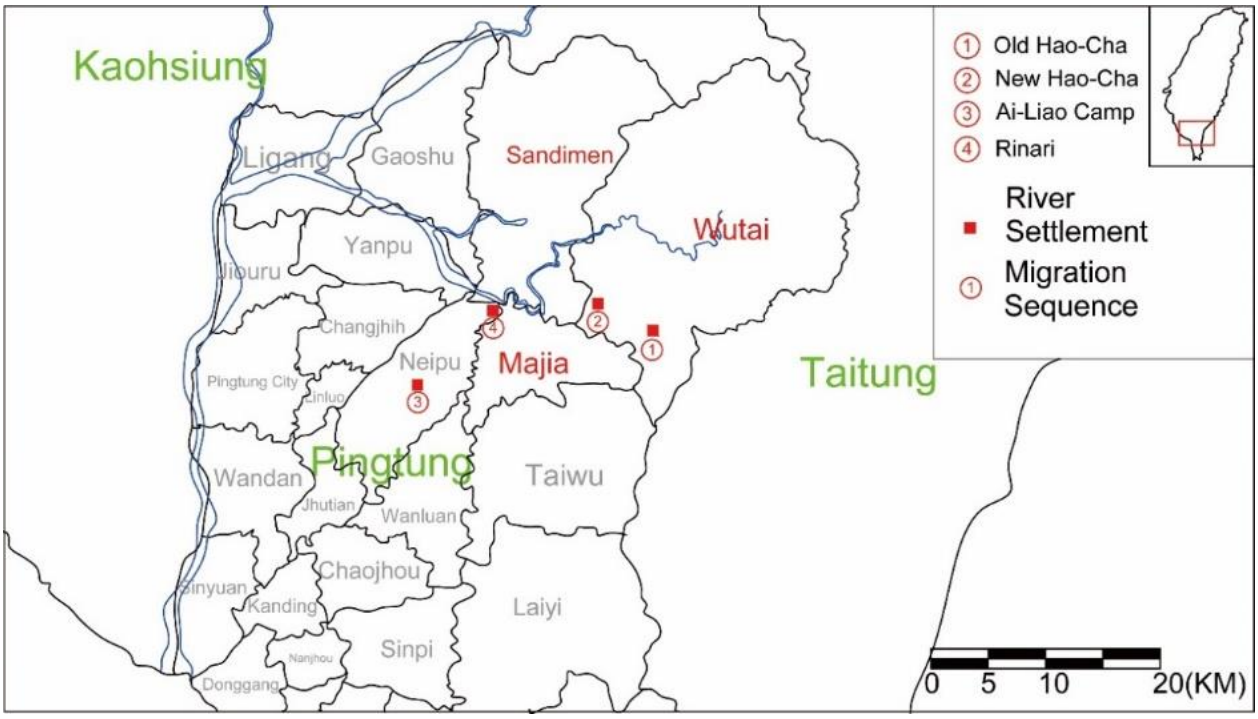

Figure 6.1 Migration trajectory of Haocha people

6.2.2 Methodology of the chapter

Due to the wide range of explored aspects, a triangulation method combining quantitative and qualitative methods was used for the data collection (Mertens and Hesse-Biber 2012). The chapter's methodologies included 1. secondary document reviews, 2. semi-structured in-depth interviews, and 3. housing measurement survey.

1) Secondary documents review

First, as for the secondary information, local government e-newspapers, major Taiwanese newspapers (referred to Apple Daily, the Liberty Tines, United Daily News, and China Times), relative conferences, and other relevant documents related to the PDR of Typhoon Morakot and housing demolition incidents were used to collect the information. Especially, the review process focused on the information related to the Haocha Rinari community.

2) Semi-structured in-depth interview

Pilot fieldwork to Haocha Rinari community began in August 2017. A few households were interviewed to understand the major changes in livelihood and culture after the disaster.

After the pilot filed work, the semi-structured interview was conducted from February 2018 to March 2021. Among 177 Haocha households, the researcher reached out to 20 households for the interview. Same as chapters four and five, the interviewees were selected based on purposive sampling. The sampling considered the respondents' background to make the survey result more diverse. All residents were aged around 30 to 80 years old.

Regarding the background of the interviewees, their occupations ranged from housekeeper (two people), teacher (two people), shop owner (two people), other occupations (16 people; including salaried employees and self-employed), and retired (six people). Other than the livelihood and housing extension-related issues, the list of the interviewees expanded to non-residents stakeholders, such as government, academics, NGOs, other organization representatives—to understand their position regarding the livelihood challenge and housing extension demolition issues. The profile and abstract of the semi-structured interview were presented in Table 6.1.

Table 6.1 Profile of interviewees and outlines of semi-structured interview

Code of interviewees	Interviewees	Location	Time	Number of interviewees	Abstract
CG1	Congress legislator[21]	Taipei City	March 2021	1	The position of the central and county governments on the demolition of illegal structures, interpretation of laws and regulations, and suggestions for the development of community industries
LG1	Pingtung County Government	Pingtung City	November 2019; March 2021	1	The position of the county governments on the demolition of illegal structures, interpretation of laws and regulations, and suggestions for the development of community industries
TG1-TG2	Wutai Township and Jinfeng Township Office[22]	Pingtung County	November 2019; March 2020; March 2021	1	The position of the township governments on the demolition of illegal structures, interpretation of laws and regulations, and suggestions for the development of community industries
N1	NGO（World Vision）	Taipei City ;	November 2019; March 2021	1	Permanent housing design and planning concept, planning process, NGO's position on the demolition of extended structures
R1-R20	Rinari resident	Rinari	August 2017; February and August 2018; April, August, and November 2019; March 2021	20[23]	1. Pre- and post-disaster livelihood and culture 2. Motivation and reasons for constructing housing extension 3. Housing spatial function 4. The position of community's industrial development, and the demolition of extended structures
A1-A3	Academic	Taipei City; Pingtung City	August 2018; November 2019; March 2021	3	Position on the demolition of extended structures and proposals for the development of community industries
X1	Other related organization	Taipei City;	March 2021	1	Position on the demolition of extended structures and proposals for the development of community industries

[21] The legislator served in the Pingtung County government during the Morakot disaster.
[22] Jinfeng Township in Taitung County was also the disaster-affected area, the Jialan settlement is in the Jinfeng Township.
[23] 17 people from Haocha, two from Dashe, and one from Majia community.

3) Field measurement and observation

During the pilot fieldwork in Haocha Rinari community in August 2017, the in-site observation had also been taken place. Based on the in-site observation, the author determined the housing extension pattern to five different situations. From February 2018, the housing measurement survey was conducted aligned with the schedule of the semi-structured interview survey. Some housing had been chosen to conduct the housing measurement. The criteria of housing selection were based on the five different extension patterns to secure the diversity of the extension samples. Eventually, the author reached out to 28 Haocha households. The breakdown of households' backgrounds was listed in Table 6.5[24]. The housing measurement data was obtained by hand measurement and drone video. The data was afterward drawn and presented by AutoCad to calculate the extension areas. All data screening and cleaning procedures had been implemented, and no data were outlier or missed. Moreover, during the spatial measurement, households were asked to clarify the usage and function of the extended space. Moreover, the reason and motivation for housing extension were asked.

Moreover, to obtain the overall housing extension situation nationwide, the drone survey was used to collect information aligned with the provided site plan. First, the settlements' configuration plans and housing layouts were obtained from the architecture office, NGOs, and the government. Second, several drone surveys were conducted in 29 settlements (6 settlements were unable to conduct the drone surveys due to the flying regulation). Eventually, the configurations with housing extension areas were plotted on the architecture drawing software *"AutoCAD"* to calculate the extension areas in the permanent housing settlements.

[24] Some of the households were overlap with the semi-structured interview's households.

6.3 Overall housing extension on the level of the settlement

According to Table 6.2, Table 6.3, and Table 6.4[25], it was evident that ten years after the disaster (the drone and photograph survey was done from 2019 to 2020), Rinari settlements had the most significant average extension area per household in the indigenous permanent housing settlements. The extension area per indigenous household ranged from 1.8-47.6 m^2 (17.04 m^2 in average). Most of the settlements had relatively high extension area per household compared to the other two groups. In the indigenous-Chinese-mixed settlements, the extension area per household ranged from 2.7-15.2 m^2 (7.9 m^2 in average). In the Chinese settlements, half of the settlements' extension area per household was below 10 m^2—the smallest among the three groups (9.58 m^2 in average). It was evident that the indigenous groups tended to extend their permanent housing after the construction.

Table 6.2 The extension area in the indigenous permanent housing settlements

Jurisdiction		**Pingtung**				
Name of Settlements		**Rinari**	**Ulalijuc**	**Changzhi Baihe**	**Xinlaiyi**	**Zhongjuanlu**
Extension area(m2)	**Front yard**	16055.7	1587.6	1897.8	2104.9	346.8
	Backyard	6954.1	2643.2	3331.1	4902.1	128.1
	2nd to 3rd floors	0.0	0.0	0.0	0.0	0.0
	Total	23009.8	4230.8	5229.0	7007.0	474.9
	Average per household	**47.6**	26.8	19.4	24.3	10.6
Jurisdiction		**Kaohsiung**		**Chiayi**		
Name of Settlements		**Baoshan**	**Lele**	**Shanmei**	**Zhulu**	**Laiji**
Extension area(m2)	**Front yard**	4.5	194.8	69.0	970.1	91.7
	Backyard	0.0	5.4	306.6	513.4	23.4
	2nd to 3rd floors	0.0	0.0	0.0	0.0	0.0
	Total	4.5	200.2	375.6	1483.6	115.1
	Average per household	0.3	10.0	13.4	9.9	2.7
Jurisdiction		**Chiayi**	**Taitung**			
Name of Settlements		**Leye**	**Daniao**	**Dazhu**	**Dawu**	**Jialan**
Extension area(m2)	**Front yard**	270.3	153.0	375.2	33.3	664.3
	Backyard	239.0	33.5	451.8	23.1	1107.7
	2nd to 3rd floors	0.0	0.0	0.0	0.0	0.0
	Total	509.2	186.5	827.0	56.5	1772.1
	Average per household	11.1	13.3	27.6	**1.8**	36.9

Table 6.3 The extension area in the indigenous-Chinese-mixed permanent housing settlements

Jurisdiction		**Kaohsiung**			**Nantou**	
Name of Settlements		**Daai**	**Wulipu**	**Riguangxiaolin**	**Shenmu**	**Mingjuanxian**
Extension area	**Front yard**	2046.2	477.9	876.4	0.0	19.1
	Backyard	5305.1	397.4	120.1	316.1	111.6
	2nd to 3rd floors	0.0	497.0	150.2	0.0	0.0
	Total	7351.3	1372.2	1146.7	316.1	130.7
	Average per household	7.3	**15.2**	9.6	**2.7**	4.7

[25] Some settlements did not have data due to the local regulation of the drone usage

Table 6.4 The extension area in the Chinese permanent housing settlements

Jurisdiction		Pingtung	Chiayi			Nantou
Name of Settlements		Xinfeng	Rian	Rihao	Riman	Changliyuan
Extension area	Front yard	0.0	197.8	28.3	19.7	0.0
	Backyard	134.3	700.7	126.7	165.3	0.0
	2nd to 3rd floors	0.0	0.0	0.0	23.5	99.1
	Total	134.3	898.5	155.0	208.4	99.1
	Average per household	16.8	5.0	6.0	13.4	5.5
Jurisdiction		Nantou	Yunlin	Tainan		
Name of Settlements		Honglixincun	Dongxing	Yantianli	Yujing	
Extension area	Front yard	25.6	0.0	153.5	125.2	
	Backyard	171.6	61.1	243.2	233.4	
	2nd to 3rd floors	0.0	0.0	0.0	0.0	
	Total	197.2	61.1	396.7	358.6	
	Average per household	9.9	2.2	13.7	13.8	

6.4 Housing extension of Haocha

Given the Rinari settlement had the highest housing extension per household, the extension situation of the settlement was focused. First, the Haocha people's pre-disaster livelihood was discussed in this section (the community which relocated to Rinari settlement, as explained in chapter five). This background information was useful the understand the architectural layout and lifestyle of Haocha people before the disaster. Second, the housing layout of Rinari was introduced. Third, fundamental analysis such as the housing extension pattern, function, and area was shown, as well as the linkage of the pre-and post-livelihood with the housing extension.

6.4.1 Livelihood and housing in Old Haocha settlement

In the Old Haocha settlement, housing was constructed using slate—the common and available building material in the nearby mountains. The residents stated that the slate material was strong against natural disasters such as typhoons and earthquakes. The slate housing was usually built under the supervision of the elderly in the community. Typically, the width of the slate wall was 25 cm, with a layout of 8 m x 8 m.

Generally speaking, Rukai's slate house can be divided into the main space, subsidiary space, and front yard. The main and subsidiary spaces were interior areas, while the front yard was an external space. In Old Haocha, the family's dining and social activities took place in the interior main space. The subsidiary space was located behind the main space, which was usually used to store agricultural crops, feed the pigs, toilet, and sleeping quarters. The traditional Old Haocha's livelihood was agriculture, which was practiced in a slash-and-burn manner. Since the isolation from the outside Chinese communities, the agricultural yield was usually for self-consume. Crops such as millets, sweet potatoes, taro, and peanuts were alternately planted or mixed. The traditional Haocha community was a hierarchical society. The Old Haocha settlement was led by the chieftain, which was hereditary for their son. After the chieftain was the noble class—usually the relatives of the chieftain. The rest of the people belonged to the civilian class (Figures 6.2, 6.3, and 6.4).

Aside from self-sufficient agricultural activities, handcrafting and weaving were part of the people's livelihood. Such activities can be seen in the front yard space. Moreover, the front yard space also served as the social and communication space for the community. As shown in Figure 6.4, the front yard space was significantly huge compared to the size of the interior area of the slate house. The pavement was decorated with large slices of slate and usually had slate tables and chairs.

Figure 6.2 The well-preserved housing in Old Hao-Cha settlement
Source: Huang S. M.

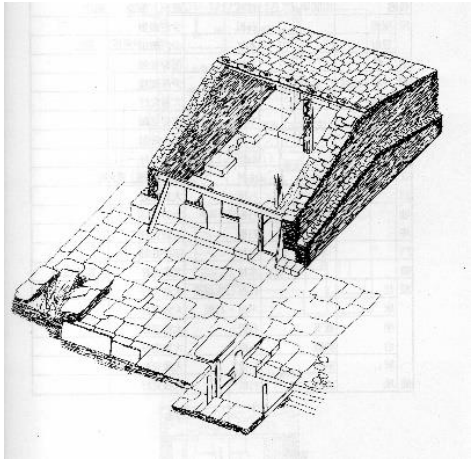

Figure 6.3 An axonometric illustration of the Old Haocha slate house
Source: Taiban (2016)

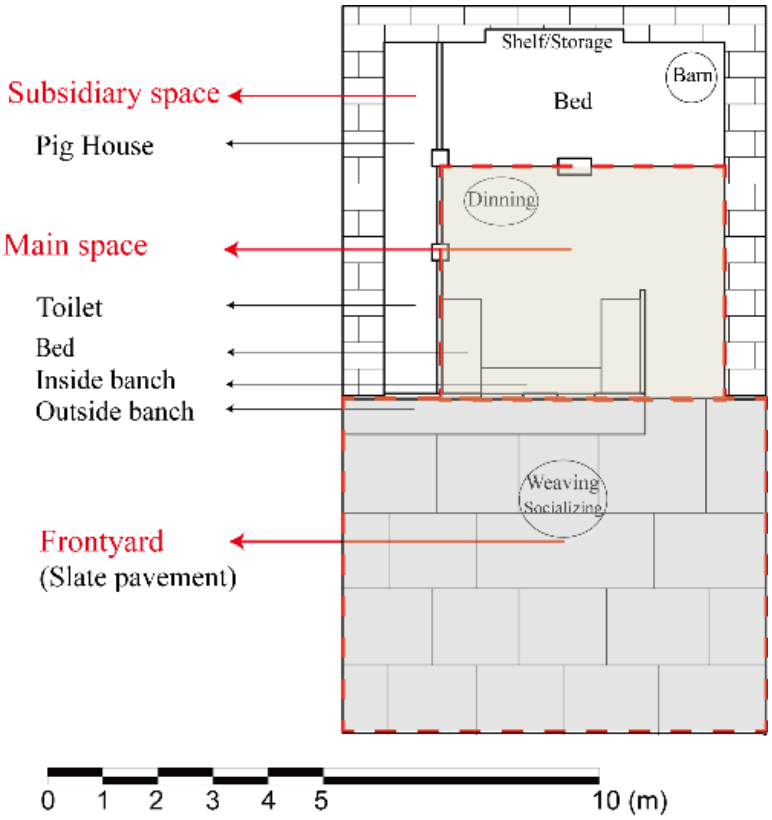

Figure 6.4 Traditional house plan in the Old Haocha settlement
Source: Taiban (2016)

6.4.2 Livelihood and housing in New Haocha settlement

Given the isolated geographical conditions and the difficulty of government resource delivery, aligning with the *"modernization policy"* for indigenous populations from 1950 onward, the Haocha residents were forcibly relocated to the New Haocha settlement in 1977—a place designated by the government with the road accessibility. The policy used a universally designed housing that in the 1970s was considered *"fashionable and civilized."* The universally designed housing had a brick structure with a sloped tiled roof. The housing layout was approximately 4 m to 4.5 m x 10 m, depending on the number of family members, which was much smaller than traditional slate housing (Figure 6.5). After 2000, Lee (2012) found that most households had extended their universally designed housing due to the lack of cultural concern and limitation of living spaces. Figure 6.6 showed a backyard extension added to the original housing to expand the living area. An annex to the main housing unit served as storage for agricultural products, which was evidence of the agriculture livelihood. Most importantly, the front yard space with the slate table remained in the front yard of the New Haocha housing. This spatial characteristic can be seen as the inherit from the Old Haocha—residents continued to conduct the social and other activities in the front yard. It is also noticeable that extension had already taken place in this period, considered a common means to adjust the living environment and their livelihood.

Figure 6.5 Original provided housing in the New Haocha settlement

Source: Lee (2012)

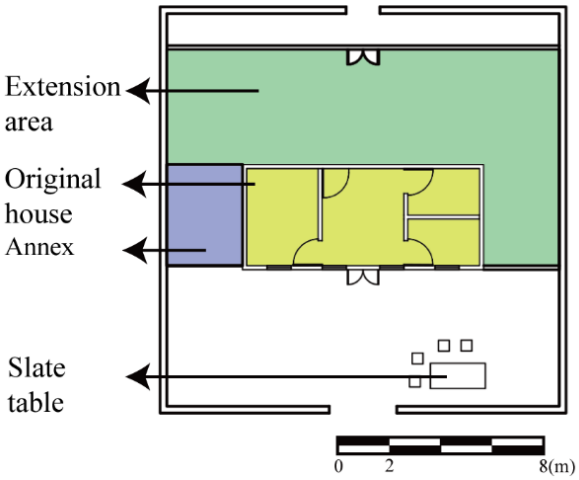

Figure 6.6 Original housing layout and housing extension patterns in the New Haocha settlement

Source: Lee (2012)

6.4.3 The design and construction of permanent housing in Rinari

After Typhoon Morakot, Haocha households were relocated to the Rinari settlement. As mentioned in chapter five, the design and construction were conducted by the team of World Vision. Because of understanding indigenous culture and livelihood, the team understood it was impossible to build a spotless and *"permanent"* housing for the indigenous population. After some workshops and discussion and the government pressure on the design schedule, the residents accepted using light steel for the structure and wooden stick material as the housing facades—a compromising proposal (Figure 6.7).

Figure 6.7 Picture of the workshop

Source: Chuan (2018)

For the design of the permanent houses, there were two types provided—single and duplex. The number of the single and duplex units was determined under discussion between the community and World Vision. As mentioned in chapter five, a unified 105.6 m^2 or 7.32 m x 7.32 m layout with two floors unit was allocated to each eligible household regardless of the number of members in the households. Therefore, the duplex type had a floor area of 211.2 m^2. One housing unit consisted of a kitchen, living room, bathroom, and bedroom on the first floor. The second floor had a bathroom and three bedrooms. The layout of the single and duplex type of permanent housing provided by the Word Vision was shown in Figure 6.8.

Figure 6.8 The layouts of single- and duplex-type permanent houses in the Rinari settlement

Though the residents had been fully consulted about the permanent housing design, the design was still distinct from their Old Haocha slate housing (R2, R9). Given the design mismatch, after completing the permanent housing in every indigenous settlement, the government dispended a 3,594.5 USD[26] subsidy entitled *"indigenous housing façade renovation budget"* to the indigenous household to renovate their housing facades further (Figure 6.9). However, residents stated that the money was far from enough. Some of the residents also want to spend the money on further spatial adjustment for their livelihood (R3, R5, R12).

Figure 6.9 Implementation of indigenous housing façade renovation project
Source: Chuan (2018)

[26] According to the exchange rate of 2021 January 28th

The World Vision team decided to locate housing entrance perpendicular to the main road. As for the traffic flow design, the main road line was connected with the secondary road, which could reduce the road's traffic flow in front of the house and secure the comfort and privacy of each resident. Moreover, there were some buffer spaces between the three communities to let tribes maintain their original neighborhood relationship (Figure 6.10). There were nine churches in the Rinari settlement, while four were located in the Haocha community.

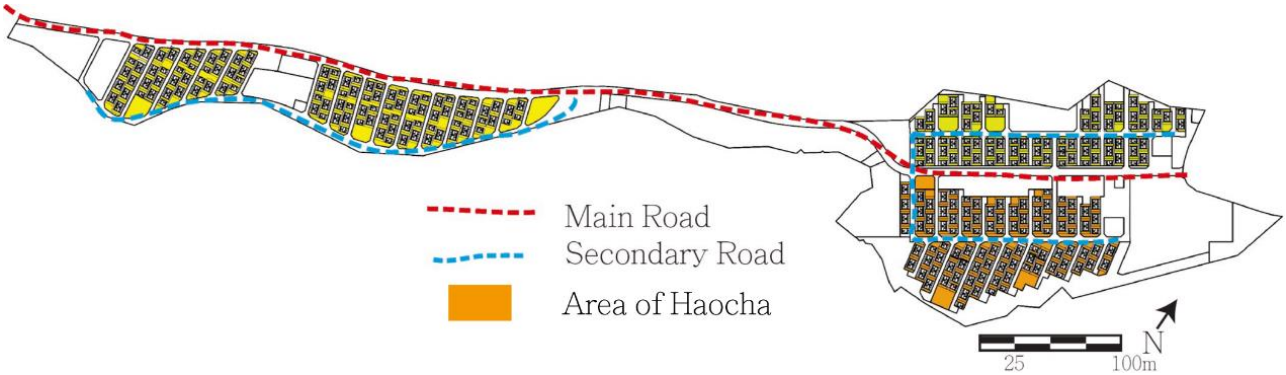

Figure 6.10 Site plan of Rinari settlement and local of Haocha community

6.5 Basic housing extension attributes of the Haocha community

This part provided the basic housing extension analysis of Haocha households. According to the pilot fieldwork, the 28 households can be categorized into five extension types: 1. front yard extension; 2. front yard and back yard extension; 3. front yard, left side, right side, and back yard extension; 4. front yard, left side, right side, back yard extension, and 5. multiple floor extension (Figure 6.11).

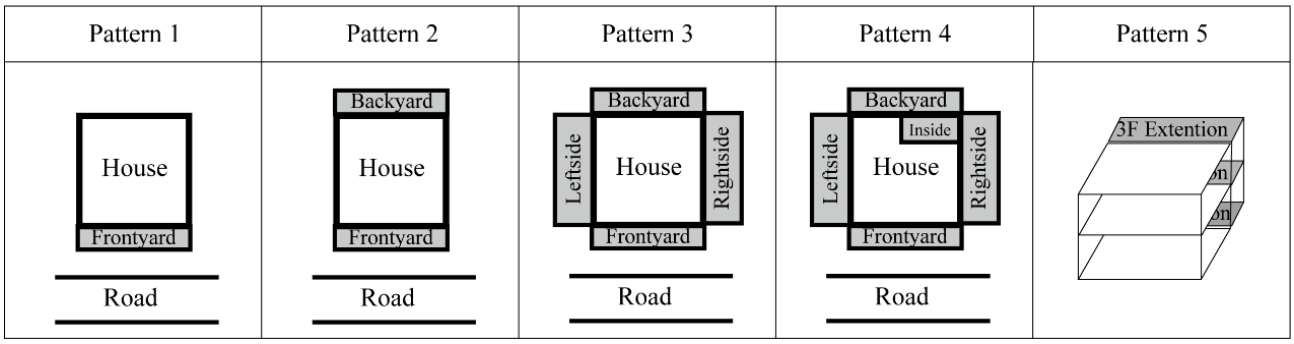

Figure 6.11 Three patterns of housing extensions

This research plotted the 28 measured Haocha households in Figure 6.12 following the above-defined five extension patterns, which showed the detailed housing plot, extended area, and functions in different colors. As shown in Figure 6.12, all of the 28 surveyed households had expanded their front yard space. Since Haocha people were still used to chatting and socializing with community members in front of the house, the interviewees stated that the front yard in the original layout was too narrow to accommodate neighbors for daily gatherings (R13, R16). Thus, the front yard extension was implemented. Another reason for altering the

front yard space was that the government allocated the *"indigenous housing façade renovation budget"* to the indigenous households to renovate their housing. The budget needed to spend on the façade of the housing (pattern one). Households that needed more living space spent their budget to expand the backyard space. According to the research, the backyard extension was usually used as the kitchen and dining area. Residents stated that as the original layout for the kitchen was placed on the back of the housing unit, it was reasonable to use the backyard extension to expand the inadequate kitchen or dining space (R10, R14). Nine households belonged to this category (pattern two). Meanwhile, left- and right-side extensions were built by ten households. Regarding the extended function on the left- and right-side, the working space, studio, garage, and storage were common (pattern three). Two other households further renovated their original kitchen space into a working space, as the new kitchen had already been placed on the backyard extension. The original kitchen space was useless therefore transferred to other purposes (pattern four). Finally, three households with a restaurant, shop, and hostel business extended their housing units with the additional floor(s). Two households added a second floor and one extending up to a third floor—the tallest in the community (pattern five). It was clear that these five patterns of housing extensions were made gradually and continuously. Since most of the housing extension needed to spend the household budget, the housing expansion was consistent with the household's economic recovery process. Each household made gradual improvements to the functions and the living area of the permanent housing units because the associated costs were a tremendous burden to these households (R7, R9).

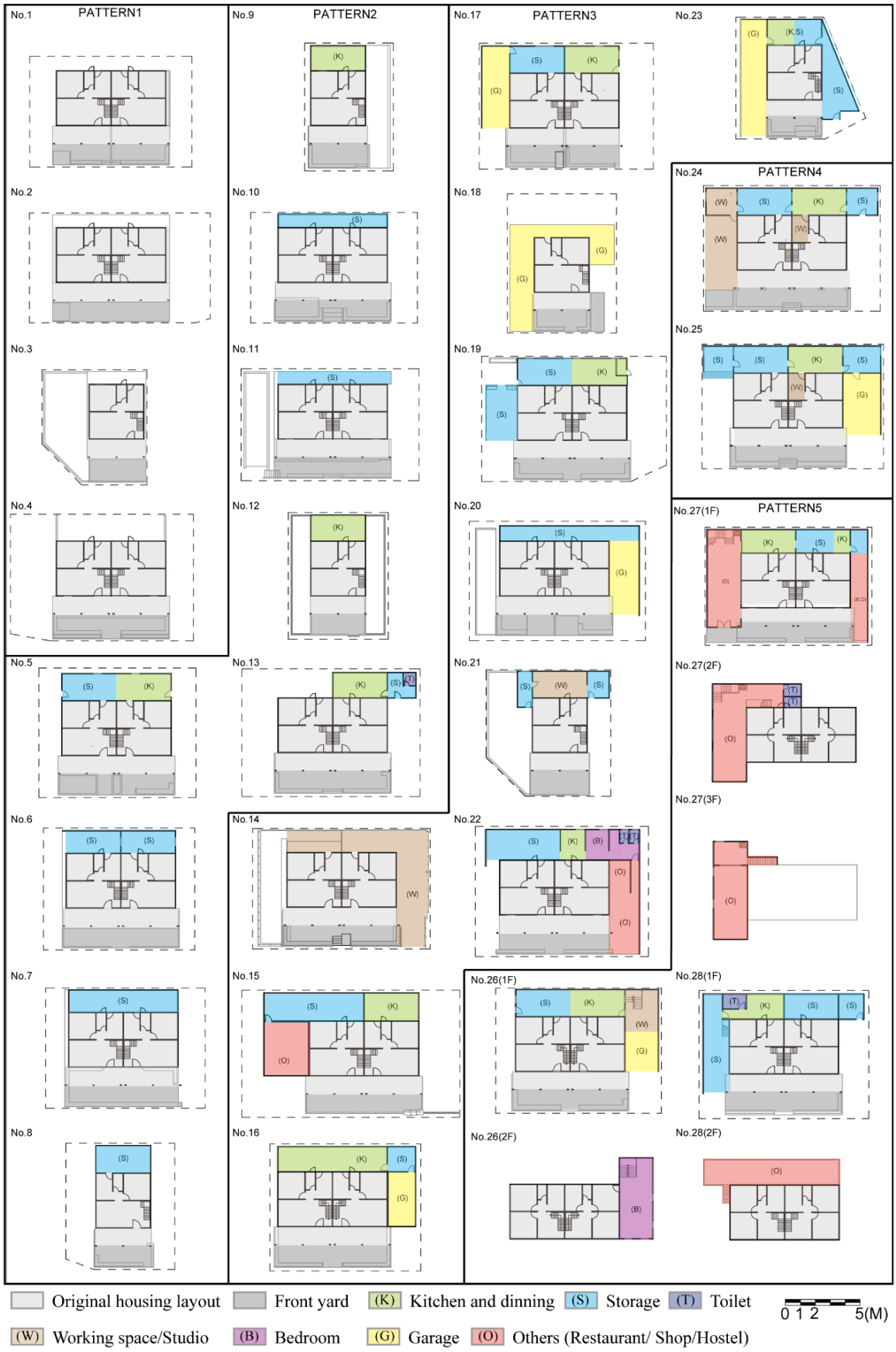

Figure 6.12 The floor plans of 28 Haocha households

Information on the gender, occupation, extension functions, number of family members, and extension floor area of 28 Haocha households was listed in Table 6.5. A Spearman correlation was used to calculate the correlation among the 1. housing extension floor areas, 2. the number of household members, and 3. extended functions. The results showed a positive correlation between the number of household members and the extension floor areas ($\rho = 0.44$). In addition, the results revealed a stronger significant positive correlation between the number of extended functions and the extended floor areas ($\rho = 0.87$). Therefore, it was able to conclude that the housing extension floor areas, the number of household members, and extended functions were all positively correlated (Figure 6.13). More specifically, the extension of the houses can be incentivized by the increase of the household member and the desire to diversify the housing function.

Table 6.5 The housing extension profile of 28 Haocha households

Housing Code	Gender	Occupation	Extended functions	Number of extended functions	Extended floor area	Extension pattern	Number of family members	Extension area (m^2)
1(D)	F	Housekeeper	None	0	1F	1	1	43.73
2(D)	M	Factory worker	None	0	1F	1	4	43.88
3(S)	F	Housekeeper	None	0	1F	1	2	24.52
4(D)	M	Office worker	None	0	1F	1	0	48.92
5(D)	M	Teacher (retired)	KS	2	1F	2	2	98.4
6(D)	M	Priest	S	1	1F	2	N/A	90.84
7(D)	M	Office worker	S	1	1F	2	4	88.82
8(S)	M	Office worker	S	1	1F	2	0	49.76
9(S)	F	Coffee retailer	K	1	1F	2	2	51.35
10(D)	M	Writer	S	1	1F	2	3	70.33
11(D)	M	Military (retired)	S	1	1F	2	3	70.48
12(S)	M	Community worker	K	1	1F	2	2	46.67
13(D)	M	Priest	KST	3	1F	2	2	85.32
14(D)	M	No occupation	W	1	1F	3	2	150.68
15(D)	M	University professor	KSO	3	1F	3	1(Rent)	164.28
16(D)	F	Office worker	KSG	3	1F	3	3	138.63
17(D)	F	Restaurant owner	KSG	3	1F	3	3	137.5
18(S)	M	Restaurant owner	G	1	1F	3	6	107.5
19(D)	M	Government related (retired)	KS	2	1F	3	9	143.12
20(D)	M	Former village leader	SG	2	1F	3	2	122.91
21(S)	M	Restaurant owner	SW	2	1F	3	4	73.92
22(D)	F	Shop owner	KSTBO	5	1F	3	4	174.47
23(S)	M	Retired	KSG	3	1F	3	3	130.48
24(D)	M	Government related	KSW	3	1F	4	2	193.88
25(D)	M	Carpenter	KSWG	4	1F	4	8	183.57
26(D)	F	Teacher (retired)	KSWGB	5	1F, 2F	5	3	198.71
27(D)	M	Association leader	KSTO	4	1F, 2F, 3F	5	4	319.27
28(D)	M	Shop owner	KSTO	4	1F, 2F	5	9	216.29

Note	
Interviewee Gender	F means female; M, male
Housing type	Housing code (S) means single-type housing; and (D), duplex-type housing.
Extended parts	K means kitchen extension and dining room; S, storage; T, toilet; W, work space; B, bedroom; G, garage; and O, other (business-related).
Rent	The house had been rented to people who were not eligible to live in the permanent house.
Number of family members	Only permanent member resided in the housing will be tallied as family member, zero means the households did not permanently resided in the housing.

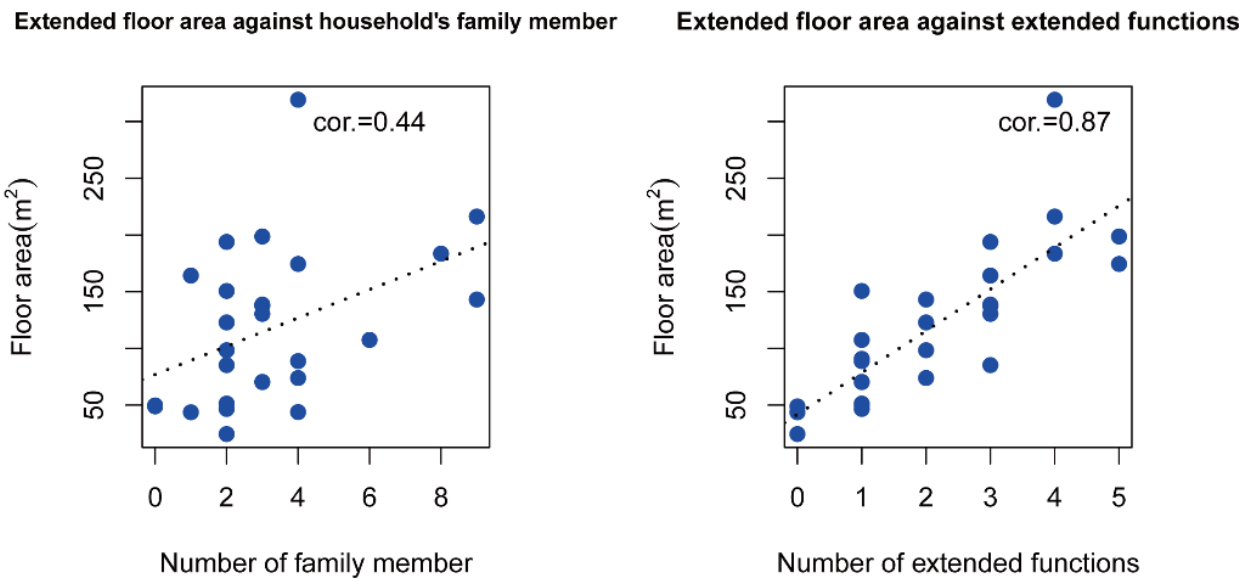

Figure 6.13 The relations between the extended floor area, the number of family members, and the number of extended functions

Regarding the distribution and number of extended functions, 20 (15) households chose to extend the storage (kitchen). This indicated that storage, kitchen, and dining functions were indispensable requirements for most Haocha households (Figure 6.14).

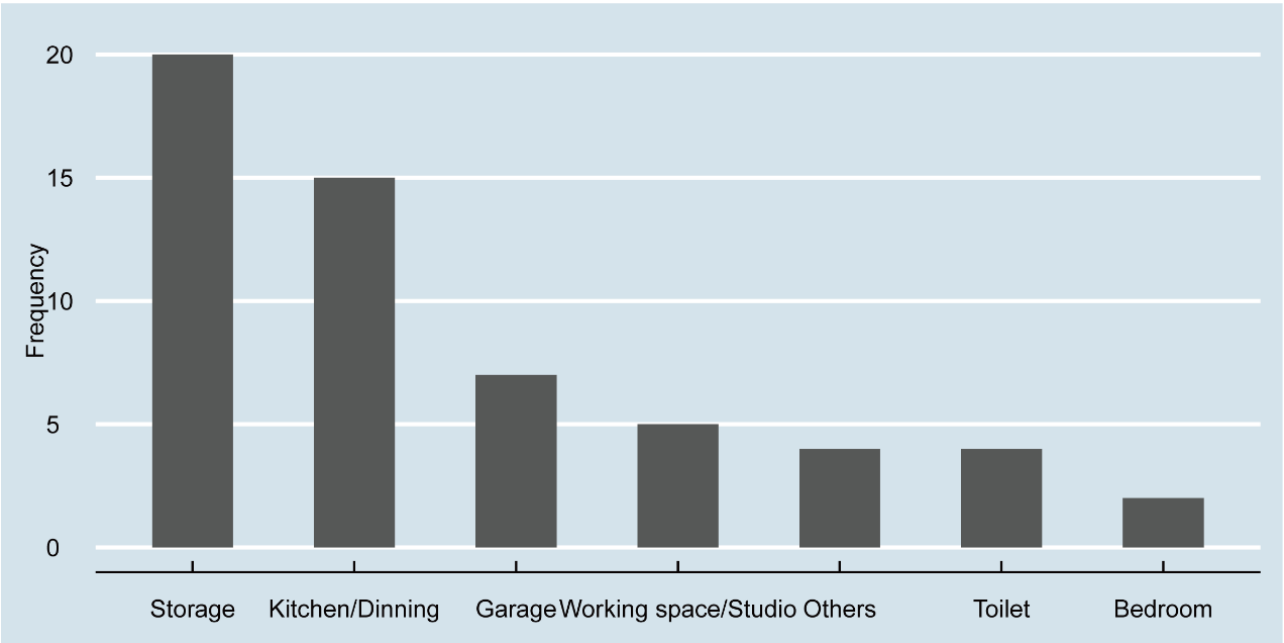

Figure 6.14 Distribution of the extension type in 28 households

6.6 How the housing extension relates to the residents' culture and livelihood

After the fundamental analysis of the spatial characteristic of the housing extension in Haocha community, in this section, the analysis discussed how spatial characteristics of extension related to the culture and livelihood of the residents.

6.6.1 Traditional culture and livelihood

It was confirmed that some housing extension characteristics were closely related to the traditional culture and livelihood before the disaster. First, 15 households extended their kitchen for making the traditional Haocha food (Figure 6.14). According to the residents, during essential ceremonies or activities (e.g., weddings, harvest festivals, and formal community gatherings), traditional food like the *"chinavu"* and "*abai"* is a must on the dining table. Chinavu and abai are made using the traditional crop millet bound by the leaf of the shell ginger. Afterward, the food will be put into steam cases for cooking by heat. Therefore, a sizeable kitchen that could accommodate the steam cases became crucial—the original kitchen was a completely modern style without enough space for the steam cases. Hence, the residents constructed additional kitchen space in the backyard of the house (Figures 6.15a and Figure 6.16a). In most duplex types of housing, because they were usually relatives, using the kitchen to merge the backyard was common in the case studies (Figure 6.15b). Meanwhile, the initially provided kitchen space was used for other purposes (e.g., food storage without cooking activities; Figure 6.16b).

Second, though most Haocha residents lost their arable land due to the relocation from New Haocha to Rinari, some households might borrow arable land from the other Chinese settlement nearby Rinari to maintain their agricultural livelihood—a more scaled and market-driven one. Thus, some residents tend to extend the barn for the millet behind the kitchen to preserve the millet (Figure 6.15c and Figure 6.16c). Sometimes, the residents might extend the cabinet for the agriculture tools. These findings indicated a profound relation between agricultural activities and housing extension patterns.

Third, as aforementioned, the Haocha people used the front yard space as the community common space—a legacy from the Old Haocha period. Noticeably, even the permanent housing was not related to their traditional housing style, all surveyed households decided to use slate material to decorate their front yard. As shown in Figures 6.15a-6.15c and Figure 6.16d, the slate material was used on the pavement and made into chairs and tables. Figure 6.16e indicated that some households portrayed their family stories on the parapet of the extended front yard to show their cultural identity. Additionally, some noble class households had an exhibition room in the living room to showed their family treasure and indigeneity (Figure 6.16f).

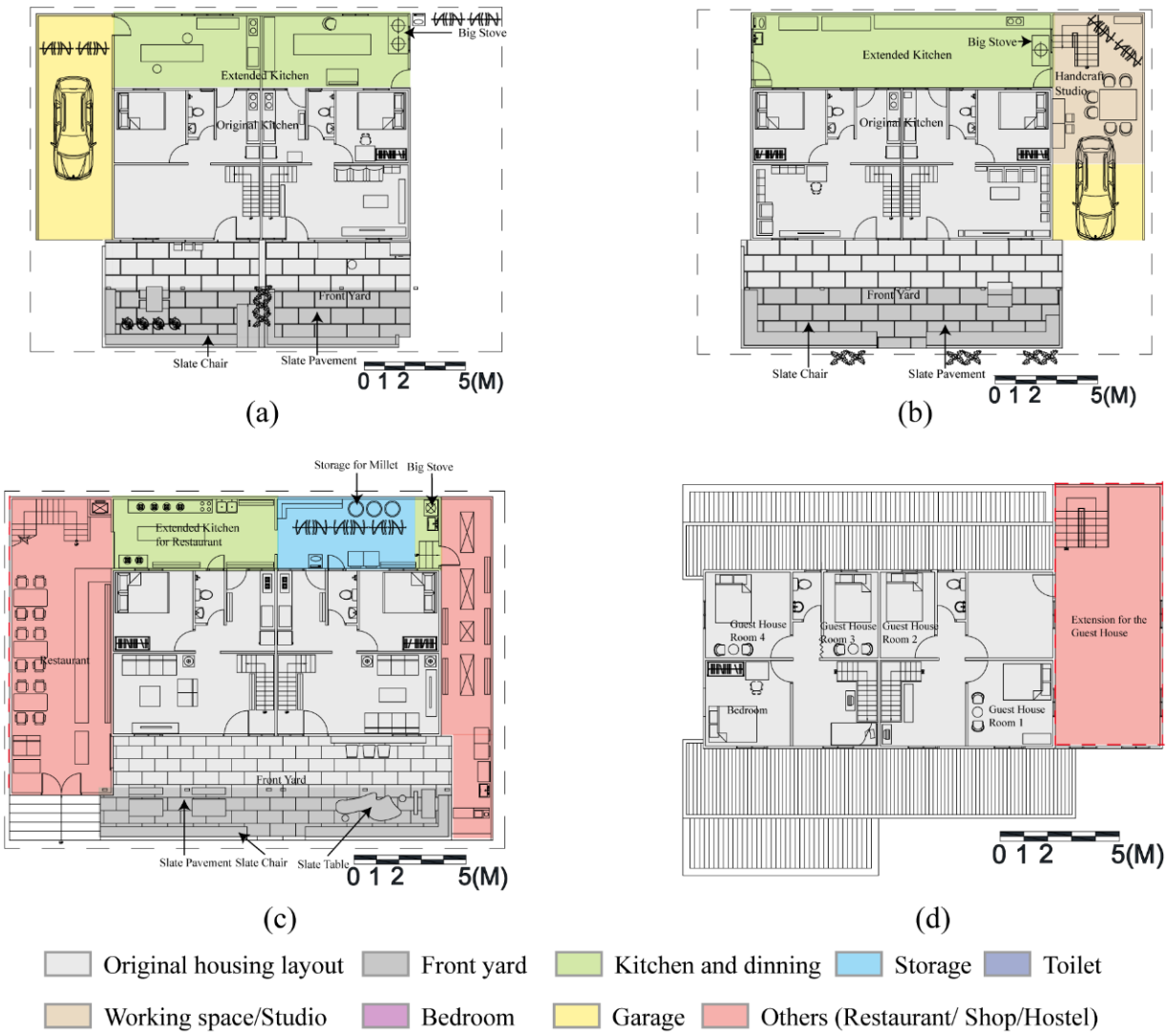

Figure 6.15 Permanent housing plan for the four selected extended households

Figure 6.16 Extension related to the traditional culture and pre-disaster livelihood

6.6.2 Post-disaster livelihood

The disaster had a significant economic impact on most of the households. Hence, to revive the industry in the community, as mentioned in chapter five, some Haocha households established restaurant and tourism businesses to earn extra income. As shown in Figure 6.15c, Figure 6.17a, and Figure 6.17b, the housing unit was extended to include a modern kitchen and dining space for serving customers with the indigenous dishes. Moreover, as shown in Figure 6.15d, a household had turned their extension space into an indigenous handcraft classroom. Some additional rooms were added on the upper floor to host guests (Figure 6.17c).

However, as mentioned in the previous section, the extension behavior relied on the household's own economic situation. As such, the financial discrepancy among households might widen as time being—unable to have housing extension equal to the loss of post-disaster income opportunity. In addition, the government deemed these housing extensions unlawful because no alternation to permanent housing was allowed according to the building code. As a result, disputes regarding housing extensions had been amplified ten years after the disaster. The issues were further discussed in the next section (UDN, 2020).

(a) (b) (c)

Figure 6.17 Photos of extensions related to post-disaster livelihood

Table 6.6 presented a summary of the findings regarding the post-disaster housing spatial characteristics. It was evident that the spatial characteristics were influenced by multiple perspectives and factors of communitie's pre-and post-disaster livelihood.

Table 6.6 Multiple perspectives that influenced the post-disaster housing spatial characteristics

Perspective	Spatial characteristics
Providing a satisfactory living space	1. Increased housing size to accommodate more household members 2. Diversified housing functions to boost livability
Catering to traditional livelihood	1. Space catered to agriculture activities for self-sufficiency (e.g., space for millet barn) 2. Space for perpetuating traditional food culture (e.g., space for steam case and an extended kitchen) 3. Extended front yard for gatherings (i.e., socializing)
Expressing one's identity and indigeneity	1. Slate pavement, table, and chairs in the extended front yard 2. Family stories portrayed on the slate parapet 3. Exhibition of one's indigeneity in the housing interior
Catering to post-disaster livelihood	1. Housing features catered to income-generating activities (e.g., restaurants, hosting guests, and shops) 2. Note that disputes between the government and residents, and disparities among households have occurred.

6.7 Long-term livelihood and living issues

As mentioned in the previous section, livelihood was closely related to the extension behavior in Haocha community. In this section, 1. the tourism industry development and 2. housing extension demolishing risk were further discussed to understand what were the long-term issues and problems in the Haocha community.

6.7.1 The tourism industry development

After the permanent house was completed, as mentioned in chapter five, the Life Reconstruction Center Program was provided in Rinari settlement. Nonetheless, the most flourishing and well-known one was the *"indigenous homestay project."*

The *"indigenous homestay project"* was a community-initiated project, which was supervised under the AIPA. The idea was initially proposed by resident R1. R1 believed that because of the unique background and long history of the Haocha community, aligned with the special permanent housing design in Rinari settlement, there was the potential to develop the tourism industry. Therefore, soon after completing the permanent house, the *"Rukai Industry Development Association"* was organized by R1 to implement the project. The association had about 40 Haocha households join the indigenous homestay project. The household vacated the rooms on the second floor of the permanent house and used them as guest rooms for the guests who came to Rinari for sightseeing—some of the households' younger generation had to work in the big cities, so the households might have extra empty rooms for the guest rooms. The project hoped to attract tourists from cities to stay and visit the Haocha community, thus boosting the community economy. In addition, the older residents, R2, who were representatives of Haocha village in Wutai Township[27], organized the *"Wutai Township Haocha Community Development Association,"* which also focuses on promoting the homestay project. Because of these two organizations, the community of Haocha had been able to flourish, which was considered by the government as the *"model community."*

Regarding the opportunity to establish the homestay project, R1 mentioned that:

> *"When I first came back to the community from the big city, I wanted to develop the tourism industry on a large scale and systematically. I think it is a "social enterprise" because whoever belongs to the community can join."*

At the same time, R1 also mentioned that he was often invited to travel trade expositions and overseas study trips because he was considered a de facto leader to lead the *"model community"* defined by the government. R1 himself extended his permanent housing as a restaurant—a modern kitchen extended to the backyard and a three-story space built on the side of the permanent housing for dining space. In addition, R1 planned to cooperate with a hotel group to provide education and training for the people in the organization to upgrade the level of service in the homestay and other tourism items.

[27] The local legislators, selected by the people from the Haocha community.

R3, a retired civil servant and elderly resident, was reluctant to join the organization established by R1 because he had many family members, thus challenging him to vacate the rooms from time to time. He also disagreed with the homestay project because he believed that the community belongs to the resident and Rukai and should not be *"consumed"* by outsiders.

R4, a retired teacher, and R5, the former village leader[28], complained that the host family led by resident R1 had invaded the privacy of the residents by attracting a large number of tourists. At the same time, they also felt that resident R1 should share the profit of tourism with the community (R4):

"Our traditional tribal life values "sharing." In the past, when hunting, the hunters would share the meat of the boar with the community, but after moving to Rinari, hunting has been banned, and the value of sharing was gone ....."

Resident R4 believed that young people did not understand the concept of sharing. In the cultural tour organized by R1, non-indigenous guides were hired to introduce the Rukai culture and tribal characteristics, resulting in some misleading content. R4 felt that their culture was not respected as it should be. Resident R4 also mentioned:

"The community faces a serious factional problem. Young people are versatile. They have a high grasp of internet information, often use outside networks and resources for internet marketing. They apply for industry development grants from the government in the name of the community, but the profit earned is not shared with the community ....."

Therefore, R4 did not join the industrial organization led by Resident R1 but earned a living by selling indigenous handicrafts together with the community's senior members. R4 also pointed out that Resident R2 is a better leader than R1 of the community, who had been contributing and leading the community to negotiate and communicate with the government during the relocation process. Moreover, with a better understanding of Rukai history and culture, R4 was more supportive of Resident R2 in promoting the community industry (R4):

"Without culture, what is the use of having an industry? R1's model will only make community lose traditional culture ...."

Resident R6, a middle-aged resident who was waiting for a job, said:

"I was actually very willing to help whether in New Haocha or Rinari, but my opinions were not adopted, and then I quit as the core member in the community organization (during the relocation process) because I was discouraged. ....."

[28] This is not refer to the chieftain in the community, but the formal village leader by the election

He believed that his lack of economic and social status in the community and the ignorance of his opinions made him not want to participate in the community's public affairs anymore.

Resident R1 also realized that if he wanted to expand the scale of the tourism industry in the future, he needed to gain the recognition of the community. Hence, he tried to challenge the traditional leadership (resident R2) by running for the position of local legislators. However, resident R1 believed that some old residents were unwilling to follow the *"rules of the game."*

"Some old residents make handicrafts that can be sold for a good price, as long as they do it properly. They should scale up the business... The older people do not want to let the young people do those things, so people are complaining now. ....."

Resident R1 felt that the older generation's concepts were outdated. R1 believed that if they only had traditional knowledge and memory but did not understand modern marketing strategies and techniques, the community would not thrive. The older generation should hand over the leadership of the community to the younger people.

It was clear that though the tourism industry in the Rinari Haocha community was prosperous, there were significant differences within the fractions regarding their idea of the community's future directions and prospects. This chapter divided these subgroups into four categories based on field theory—a lens to analyze the Haocha community's fractions relationship based on their economic and cultural capital (Bourdieu,1987; introduced in chapter two). The fractions included 1. high economic and cultural capital group, 2. high cultural capital group, 3. high economic but low cultural capital group, and 4. low economic and cultural capital group.

A. Group with high economic capital and high cultural capital

This category was in line with the role of traditional leaders in the Haocha community, for instance, resident R2. Resident R2 had led the community and engaged in the common affairs before the disaster. He spent his childhood in Old Haocha and became the leader in New Haocha. He had represented the Haocha community and negotiated with the government after the disaster (because of R2's status as a local legislator and village head). R2 also deemed himself the legitimate leader to lead the community in the Rinari settlement after the disaster. However, his leadership and status in the community were challenged by the high economic but low cultural capital younger generation.

As a traditional community leader, resident R2 had served as a public servant and scrivener as his career. R2 can be deemed wealthy in the community compared to other households. However, R2's economic capability was eroding gradually by high economic but low cultural capital younger generation due to his unfamiliar with the new technologies such as Facebook and Instagram. The younger generation had used SNS to attract

broader tourists nationwide.

B. Older groups with high cultural capital

This category was represented by the older generation (residents R3, R4, and R5). Most of the older generation were born in the Old Haocha period and spent most of their life in New Haocha settlements. The older generation had interacted with R2 before the disaster, thus understanding the contribution of R2 to the community—including the negotiation regarding the PDR project for the community. Moreover, they opposed the idea of commercializing indigenous culture for tourism and valued the sharing tradition in the tribal community. Hence, most of the residents who belonged to this group supported R2 more than R1.

Although the residents who belonged to this group did not have substantial financial resources, they had certain social status and steady income compared to other households. For instance, some were retired school teachers, public servants, and paster in the community church, which most residents respected. Moreover, after retiring, they had pensions to support their livelihoods. However, they also need to face the dilemma of increasing money expenditure after moving to the Rinari settlement. Some of them thus joined the community development association organized by R2 or established their own small-scale business.

C. High economic capital, low cultural capital group

This group was the emerging leaders of the community, represented by the younger generation R1, who grew up in the big city and had no experience living in the Old Haocha and seldom came back to New Haocha before the disaster. It is fair to say that despite R1 having a blood relationship with the community, R1 was not considered part of the community member before returning to the community. After the disaster, he returned to the community to develop the tourism business and bring in significant outside resources. However, his low cultural capital and misunderstanding of the indigenous culture had been criticized by R2 and other older generations, which posed some potential risks to his business development. R1 also realized that he needed to gain community support by challenging the traditional leader by election.

Due to the social network in the cities and high education background, R1 was able to bring external resources and stakeholders to develop the tourism industry in the community. Moreover, R1 was familiar with the new IT technology and could maximize the profit. With a good relationship with the government, he became the new community representative after the disaster. Most of the households that joined his organization tend to be the younger generation.

D. Low economic capital and low cultural capital group

Compared to the other three groups, the households in this group had neither economic capital nor cultural capital. They were considered the most vulnerable and marginalized group in the community. For instance, resident R6. Because of their low economic and cultural capital, their opinion had not been heard. They felt indifferent to most of the community affairs.

Based on the above analysis, this section graphically illustrated the interactions and four community subgroups in Figure 6.18.

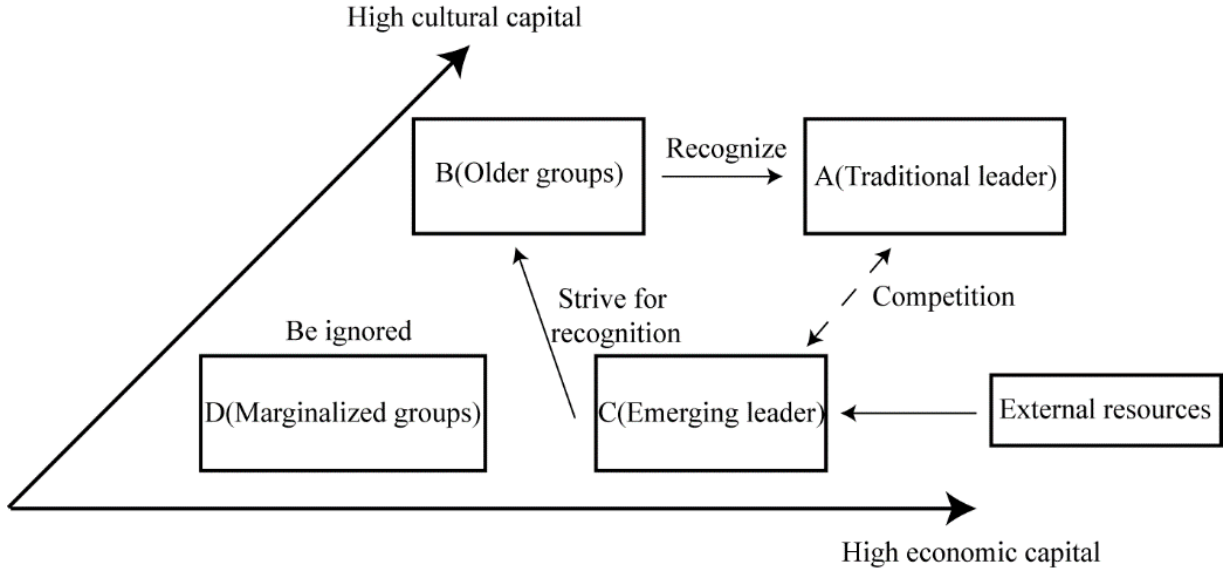

Figure 6.18 Interactions of the four community subgroups

6.7.2 Housing extension demolish incident

As mentioned before, the Rinari settlement had the most extension area per household, given their pre-and post-disaster livelihood and culture. However, the government deemed the extension unlawful since it had violated the building code. When the author visited the community in early 2020, resident R3 said that because of reports of permanent housing extensions, households occasionally received official warnings from the Pingtung County Government that they would soon demolish illegal extension structures that kept being built.

According to the interview, given that someone had reported R1's three-floor extension for the restaurant, the county government hoped R1 could demolish the illegal structures on his own since May 2020. Nonetheless, R1 was not willing to do so. The county government thus assigned more than 100 police officers to enforce the demolition operation on October 15, 2020 (Figure 6.19 and Figure 6.20). The organization representative X1 mentioned:

"Because the county government has been receiving reports but did not know who reported it. Therefore, the county government entrusted the village head and township government to check the community's illegal extension construction. The village head enlisted three households with more serious extensions (the three-floor extension with business purposes). However, those three households, including the R1, were young generation. The process ignited the conflict between the generations…. After coordination, except for R1, the other two households had demolished the extension by themselves."

TG1, a representative of the township government, also said:

"Pingtung County Government side did the coordination. In fact, before we issued the official demolish notification, we had already secretly notified R1 to ask him to dismantle the structure by himself. He also signed a letter of disclosure. Eventually, he did not do it. Therefore, we demolish for him."

After the forced demolition of the housing extension, the residents of Rinari and scholars who were concerned about the permanent housing issues quickly established the *"Morakot Post-Disaster Human Rights Promotion Association."* On November 24, 2020, they joined the residents from Changzhi Baihe, Gaoshi, Zhulu, and Raiji permanent housing settlements to hold a press conference in front of the Legislative Yuan, calling for a revision of the permanent housing policy and the triliteral contract signed at that time—in order for the permanent housing to be truly *"permanent"* and for the indigenous groups to live and work carefree in their settlements.

On December 4, 2020, members of the association and several officials from the central government ministries held a public hearing in Taipei—*"The Next Step of Permanent Housing without Commitment to Permanence."* In addition, the Congress legislators had questioned the relevant ministries. Members of the association also presented their case to the Supervisory Yuan, who immediately accepted the application and sent four members to investigate the demolish incident and inspect the housing extension in the Rinari settlement from February 22 to 25, 2021. During the inspection, representatives from the academic community, county government, township government, and village leaders attended. At this point, the demolition of permanent housing extensions had drawn the central government and local government into a swirl that attracted attention nationwide. The flow was arranged in Figure 6.21.

Figure 6.19 Residents protesting in front of the permanent house
Source: Lin (2021)

Figure 6.20 permanent housing extension was demolished
Source: Lin (2021)

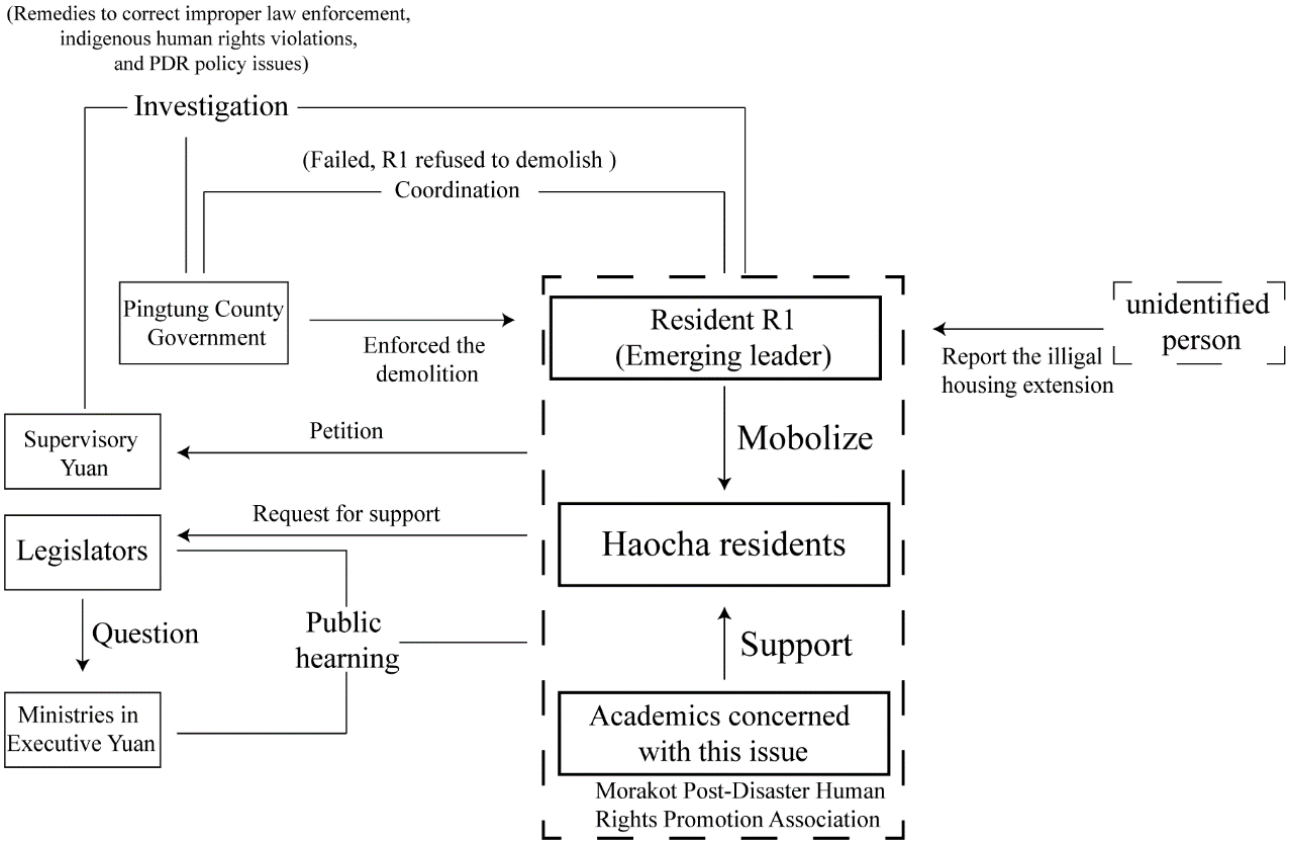

Figure 6.21 Stakeholders' interaction in the permanent housing extension demolition incident

6.7.3 The major issues, problems, and possible solutions regarding the long-term livelihood development

In this section, the relevant demands and questions raised by the residents in the permanent housing demolition incident, as well as the problems regarding the long-term livelihood develop had been investigated. The issues can be summarized into the following four points: 1. reasonable and fair enforcement of the permanent housing extension demolition, 2. legally extend the housing and obtain the land ownership, 3. returning to their original community and road repair, 4. industrial support in the permanent housing settlement. Moreover, in this section, after interviewing academics, NGOs, and government agencies, the following insights and suggestions that correspond to the residents' demands and suggestions were discussed accordingly.

1) Reasonable and fair enforcement of the permanent housing extension demolition

Resident R1 raised the concern that many of the government's policies were arbitrary. There was a general increase in the housing extension in permanent housing. The demolition regulation of the illegal structures did not set standards for the height, which lacked reasonableness and fairness in enforcement.

Legislator CG1 believed that the demolition and relocation could easily trigger the sensitivity of indigenous peoples because of their unique historical context and life experiences. However, he also believed that despite the past trauma of the relocation of the indigenous village, the authorities could not be lazy and lenient in the enforcement of the demolition of unauthorized structures.

"In Pingtung County, there are many indigenous enclaves in Changzhi, Neipu, and Majia (township), which is the result of relocating the indigenous communities during the National Government era for the effective projection of government resources. The relocation became part of the memory of the indigenous. However, in terms of demolition, this is a ubiquitous thing. As long as you have illegal construction, you will certainly be demolished. This is reasonable and legal. However, in the indigenous communities, this will cause many panics. They think that demolition is the prelude to relocation. The indigenous used to live where no building code existed, so they did not have a building registration. The thing is different in the permanent housing settlement. There is a management system. Our government will, of course, be in a reasonable standpoint to allow, for example, to build rain shelters and carports. Nonetheless, you use steel structures to increase the extension to three floors high and make a profit. This part is not acceptable."

The NGO representative, N1, also believed that R1 had misjudged the situation, thinking that using accusations against the government could win the public's sympathy to counterbalance the county government's decision to force demolition. However, the demolition was not a one-sided decision. It must be a deliberate decision after a coordinated discussion.

TG1 emphasized that the county government, the village head, and R1 were good friends and that there

should be a certain amount of consultation between them. The decision to demolish the illegal structures was not sudden but a result of mutual coordination. However, T1 also hoped that the central government should understand the fact that the livelihood of the residents in the permanent housing community is vital (TG1):

"A lot of Haocha villagers go to borrow the arable land for cultivation. However, they need to pay for the land rent. So they want to promote the homestay industry, this is good, many tourism wants to experience, more and more guests come… It is without a doubt that they need to expand the living and business space. However, the regulation is fixed. There is no way ..... We had received many reports (unlawful housing extensions)…. We just have to obey the regulation…."

2) Legally extend the housing and obtain land ownership.

The residents stated that because the trilateral contract stipulated that the land of the permanent housing was government-owned. Therefore, although the residents live in permanent housing, they only had the ownership of the house and the right to use the land, but no land ownership. Thus, any extension was considered an encroachment on government-owned land and was in danger of being demolished by the county government at any time. Therefore, resident R7 mentioned that:

"Now we have homeownership, but not land ownership. Has the government considered the vision of the permanent housing settlement 100 years from now? We have a sense of ownership and belonging to the land so that we can develop our industry without fear."

In addition, the residents R2 believe that because they did not have the ownership of the land, they could not take out mortgages and financing loans for their permanent homes, thus limiting their financial resources and limiting the succession of their permanent house.

Most of the extensions were due to the initial planning of the permanent housing area being too small. The households can only take the risk in view of the growing population. If permanent housing can be privatized and enhance the overall intensity of land use in the future, the current extended structures can be legalized. Resident R8 mentioned:

"If the land can be privatized, then the government's burden can be reduced. In the future, we can deal with problems such as the community's water pipes not working, and the government can save money. However, the most important thing is to legalize the current housing extensions. I hope the building shelter rate can lift up to 60% and the capacity rate to 180%. By doing so, the problem of space shortage can be solved."

As Legislator CG1 stated, there was room for discussion on land ownership, which was related to the policy direction—permanent housing was temporary accommodation rather than permanent living.

"The core problem is the lack of unity of land and housing. You have the right to own the house but not the land, so if you build a restaurant on the land outside of your permanent house (R1), you will, of course, be encroaching on the national property. Therefore, we must go back to the policy of permanent housing at that time. At that time, the central government formulated the policy not with the concept of "permanently relocating" the community but with "temporary resettlement." As a result, permanent housing is equal to the concept of temporary living. ..... But I think since the Post-Disaster Reconstruction Regulation of Typhoon Morakot had been repealed. We can certainly amend the trilateral contract of the permanent house. For example, the residents can use the land of their original community in exchange for the land of the permanent house settlement. Nonetheless, the government-owned land is restricted by the State Property Law, which cannot be given to the private sector, so there are difficulties at this stage."

N1 added that the lack of land ownership setting in the trilateral contract was due to the concern that there were too many cases in the past where the indigenous people sold their land to the Chinese at a low price. If the indigenous could mortgage their properties, it would be easier for them to become economically disadvantaged due to the mismanagement of their assets in the future. Moreover, if the Chinese entered the permanent housing community, it would threaten the solidarity of the indigenous community. Therefore, the then policy decided not to release the ownership of the land.

At the same time, LG1 also believed that when considering land management issues from the county government's perspective, the county should consider the land allocation within the county based on the concept of total land control. For example, suppose the land is given to permanent housing residents. In that case, it will be necessary to allocate additional government-owned land to make up for the county's quota of disaster preparedness land.

Regarding the restriction of privatization of government-owned land mentioned by legislator CG1, scholar A3 offered a different opinion. He believed that the *Post-Disaster Reconstruction Regulation* of Typhoon Morakot at the time specifically stated that the *State Property Law* did not restrict the land acquired for the construction of permanent housing. Therefore, the government needed to cope with the problem more flexibly.

X1 believed that if the land could be privatized, it should follow the residents' demands and the specific land use regulations of the current *Regional Planning Law*. The building shelter rate and permanent housing capacity should be reasonably increased within the service level of community roads and public facilities so that the housing extensions can be legally built in place. However, he also mentioned that the *National Land Planning Law* would be officially launched in a few years. Therefore, the land use's rationality and legal source will be reviewed once again after the *Regional Planning Law* is withdrawn.

Regarding the comments of X1, TG1 mentioned that it was a challenge for the residents to wait for another three to four years because of the transition period of the *Regional Planning Law* and the National Land

Planning Law.

The township government representative TG2 argued that since the *Typhoon Morakot Post-Disaster Reconstruction Special Regulation* had been repealed, the trilateral contract could be amended, the residents could acquire land ownership. The government can increase tax revenue (land tax), which is a win-win situation.

3) Returning to their original community and road repair

According to the trilateral contract, those living in the identified danger zone can be allocated permanent housing. In return, the condition was that the residents could not return to their original residence. However, the residents believe that indigenous life cannot be separated from the original community. Therefore, returning to their original community meant a lot to them. Furthermore, many residents had agricultural land in the original community. Thus, even though they had a permanent house, they still went into the mountains to do farming during the non-typhoon season (R8). R8 stated that the trilateral contract did not consider the actual way of life of the residents and their connection to their original communities. Therefore, the regulations were not binding in practice but still left the residents at risk of violating the rules.

In addition, the residents R9 hope that the government should pay attention to their right to return to their original communities and allocate a budget to build and maintain roads connecting the original communities.

Similar to the second issue, CG1 stated that it is not infeasible to let residents go back to their original communities and build a road back from the county government's standpoint. However, the core issue is the difference between the residents' imagination of their future lifestyle and the government's consideration of the land planning (CG1):

"Although the central government did not envision residents to stay in the permanent housing settlement permanently, given the residents are gradually copying the pattern of living before the disaster in the permanent housing settlement, I think some residents might want to stay in the settlement, but some might wish to go back. The consensus needs to be achieved under the discussion of the community before negotiating with the government. "

In addition, CG1 believed that it is legally feasible to return to the original community because of the Post-Disaster Reconstruction Regulation of Typhoon Morakot's repeal. The trilateral contract is not the regulation, thus able to be adopted according to the will of communities and government. The legislator CG1 stated that if residents still want to keep their homes in the permanent housing settlements, they can renew the trilateral contract to the renting contract—a solution not violating the State Property Law and keep the permanent housing available for the residents. The government should also conduct regular surveys in areas that are currently designated as dangerous. If the previous dangerous area becomes safer, the government needs to ensure that residents have the right to return to their original community. The government should not restrict

people's property ownership rights (to return to their hometowns) without a reasonable reason.

Regarding the road back to the original hometown, CG1 believed that the central government should establish a mountain and forest conservation policy so that the local government can appropriately build the road back to the original community under the clear guideline. On the other hand, the residents should also consider that more tourists will flock to the original community if the road service level is upgraded. Therefore, the indigenous community should carefully consider the balance between the traditional culture and tourism revenue.

A2 agreed with L1's view:

" Going back may be applicable to certain communities (Dashe, Majia), but what about Haocha? They do not have a house in their original community anymore. Some people want to go back, and some want to stay in their permanent house, so how will government solve the difference? Even the residents can live in the original communities, how can the young generation go back? At present, each family has different views, and a consensus can not be made. The county government had their challenge."

In addition, TG1 also made his observation about the indigenous communities:

"Do residents really have the ability to grow millet back in original communities? Actually, only the elderly might want to return. Therefore, we should pay attention to the different needs of generations."

4) Livelihood support in the permanent housing settlement

There was not enough space for farming in the Rinari settlement. In addition, the residents believe that the government should actively support the community to make crops economically productive to effectively improve the community's economic status (e.g., the case of Changzhi Baihe). Moreover, regarding the homestay projects in Rinari, resident R1 mentioned that:

"The government departments did not cooperate and communicate. First, the Tourism Bureau and the AIPA are doing their best to support our homestay business and generously provide various project funds. On the other hand, the county government's building management department had relentlessly demolished the economic lifeline we depend on. A few years ago, because our permanent house was made of wood, we could not be registered as hostile due to fire prevention regulations. However, we were encouraged to develop homestay business— the whole supporting measures and policies were not comprehensive and contradicted."

CG1 acknowledged that the government's lack of consideration in the PDR policy led to inadequate farming land for residents to cultivate. Regarding the households who joined the homestay project were unable to be registered, L1 thought that the central government should authorize local governments to adapt to local conditions and establish the autonomy ordinance and internal management regulations.

"Will the permanent housing community have the problem of escape and installation of fire and smoke extraction equipment? When your location is in the mountains...that is only needed in Taipei. The central government has to give us (local governments) the authority to adapt to local conditions. A country can have many regulations (self-govern regulations and internal management methods). They just need to be reasonable."

Regarding the legislation of the homestay housing as the hostel, TG1 and C1 mentioned that they had been conducting a comprehensive review since February 2020 so that the homestay projects' households can now be legally managed and registered through the official approach.

However, TG2 mentioned:

"This incident of demolition reflects the potential contradiction of space use and industrial development. According to the trilateral contract, permanent housing can only be used for living, not for industry. Is this necessary (restrictions)? In fact, livelihood and living is closely related to each other."

To address the problem of not having enough farming land for the residents of Rinari, TG1 put forward his vision for the original community.

"It is better to go back to the mountains and forests for the indigenous people—the area that we are most familiar with. We should designate it as a "natural ecological landscape area." By integrating modern technology, the original communities can have better tourism and agriculture industry development in the area. Compared to the current situation, I think that going back to the mountains to promote the industries is more suitable for the indigenous communities."

It is clear from the interview that though the demolition of housing extension seemed to be a problem in the Haocha community, it reflected the overall government policy's problems and involved other stakeholders, which was extraordinarily complex and challenging to understand. This chapter presented those critical issues and difficulties. The issues, challenges, and solutions proposed by the interviewees were listed in Table 6.7.

Table 6.7 Important Issues, difficulties, and solutions from the Interviews

Issues	Challenges	Proposed solution (stakeholder in charge)
1. Reasonable and fair enforcement of the permanent housing extension demolition	1. Indigenous people's aversion to the concept of demolition and relocation 2. The reasonableness and fairness of the law enforcement is difficult to grasp	1. Introduce and legalize the housing extension construction while ensuring the safety of housing extension (Local government) 2. Establish a friendly communication mechanism between the government and residents to avoid confrontation (Local government)
2. Legally extend the housing and obtain the land ownership	1. Difficulty in adjusting the trilateral contract 2. Conflicting interests of government land management and privatize the land ownership	1. Coordinate the amendment of the trilateral contract (Local and central government) 2. Review the existing laws and regulations (National Property Law, National Land Planning Law, Regional Planning Law) to manage land in the county and assist residents in obtaining land ownership. (Local and central government) 3. After acquiring land ownership, try to increase the capacity building rate under the regulation's limitation (Local government)
3. Returning to their original community and road repair	1.The forest conservation policy is unclear 2. Generational gap (young and old people have different views on their original communities and livelihoods)	1. Consider the livelihoods and cultures of indigenous peoples in a holistic pattern when formulating the mountain and forest conservation policy (Central government) 2. Allowing sufficient time for dialogue and consensus-building among residents in the community (Local government and community)
4. Livelihood support in the permanent housing settlement	1. Rigid regulations and policies 2. Changes of the livelihood as the time being	1. The central government should reasonably authorize local governments to handle cases flexibly to avoid rigid regulation issues (Central government) 2. Assessment of the livelihood suitability in the permanent housing settlement, eco-tourism, and agriculture industry in the original communities. A better livelihood strategy for the indigenous households is needed (Local government)

6.8 Discussion and conclusion

First, in view of the scarcity of literature regarding the comprehensive understanding of spatial characteristics and socioeconomic factors in the indigenous PDR context, this chapter pointed out the permanent housing extension was closely interrelated with the pre-and post-disaster livelihood and cultural factors of indigenous households. Given the limitation of time, budget, and knowledge of indigenous culture, the participatory scheme initiated by the NGO was undermined by the government thus generating the inappropriate permanent housing design. Therefore, the housing extension can be interpreted as the approach for the resident to adapt to the post-disaster lifestyle and livelihood requirements—the performance of the post-disaster resilience in the indigenous community.

Second, this chapter used Bourdieu's (1987) economic and cultural capital concept to understand the post-disaster livelihood development issues in the Rinari permanent housing settlement. This chapter found that the residents can be divided into four subgroups according to their economic and cultural capital. The confrontation between the groups with high economic and cultural capital and those with high economic and low cultural capital gradually intensified during the post-disaster livelihood development. The chapter also proved that the community is not homogeneous. The differences within the subgroups were dynamic and

diverse due to their background and interests.

Third, as for the demolition of permanent housing, this chapter first went through the story of the demolition process. Second, the chapter compiled the residents' requests and the view aligned with the opinions of the relevant stakeholders (government, academic, and NGO representatives) on four major issues. Overall, this chapter presented the long-term recovery issues in the indigenous PDR context.

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Chapter 7

7. Conclusion and proposed framework

Based on the finding from chapter three to chapter six, the objective of this chapter was to suggest and provide a suitable PDR framework for the indigenous groups which can comprehensively facilitate the groups' cultural, social, economic, and physical recovery. First, in the conclusion and proposed framework chapter, the previous six chapters were briefly summarized. Some important points and issues were concluded. Second, since the five research questions and objectives mentioned in chapter one had been addressed in the previous chapters, in this chapter, the last research objective—a comprehensive PDR project implementation framework in the indigenous context, was proposed.

7.1 Chapter one and two

As the process of global warming aligns with urbanization and the explosive increase of the global population, it is fair to say that human beings are very vulnerable to natural disasters—natural hazards if they happen in human society or habitat. Chapter one introduced some essential quantitative data regarding the natural disaster. The Asia region is the most disaster-prone area among the major continents. Therefore, the chapter stated that it was reasonable to focus the study on the Asia region. However, despite tremendous disasters happening yearly, the PDR projects only implemented limited, mainly concentrated on mega disastrous events such as the aftermath of tsunamis or earthquakes. Moreover, due to the complex nature of PDR projects, some recurrence happened during the implementation of the PDR projects worldwide.

This study decided to choose the 2009 Typhoon Morakot that happened in Taiwan as the case study. Several reasons were given. First, Typhoon Morakot was regarded as the unprecedented Typhoon disaster in the history of Taiwan, which also launched the sizable post-disaster relocation and construction activities. Second, amount the disaster victims, 73% of them were the indigenous groups—which only have 2% population in Taiwan. The indigenous population had been considered to have a profoundly human-nature and human-land relationship, which posed difficulty during the PDR projects (Lin and Lin, 2016). Nonetheless, the previous literature rarely mentioned the PDR project based on the indigenous context.

In chapter two, first, chapter clarified the definition of disaster, hazard, and relocation. Second, the development and history of the PDR project were also introduced. It was evident that the development of the PDR project had evolved from the ad-hoc response to preparedness, aligning with the concept of build back better and resilience. Also, the practitioners realized that the PDR project is not a linear process, which entails considering the physical and socioeconomic considerations. Thus, the chapter also looked at the critical characteristics of the PDR projects—from the built-environment perspective (physical) and

vulnerability and social capital perspective (socioeconomic). Third, the chapter identified that NGOs, government, and communities should be deemed crucial stakeholders in the PDR implementation. For instance, despite the 2009 Typhoon Morakot PDR project being a complete NGO-led program, the completion of the project still entailed the cooperation of the government and the residents. Especially from the residents' perspective, a broader literature had endorsed the importance of community participation. Community participation is beneficial for the resident to gain a sense of ownership, maximize the variety of solutions, and minimize the dangers of top-down decision-making (Lizarralde et al., 2009; Cronin and Guthrie, 2011). Forth, a widely admitted operational framework of the PDR project, proposed by Bilau et al. (2015), Vahanvati (2018), and Jamshed et al. (2018), was summarized and introduced in the chapter, which included the initiation stage, planning and implementation stage, and monitoring and livelihood restoration stage.

7.2 Chapter three and four

These two chapters provided an overall perspective of the PDR project after Typhoon Morakot. Chapter three looked at the number of relocated households, settlements, design and planning characteristics, policy decision-making, and stakeholders' behavior during PDR project based on the timeline.

Chapter three first systemically analyzed the number of relocated households and settlements after Typhoon Morakot. The analysis included the relocation patterns, the number of the relocated communities, and the relocated distance. Generally speaking, the divided and compound relocated pattern could cause the relocated communities' instability due to the livelihood conflict with the other communities. In addition, the limitation of the construction site—prioritizing the government-owned land—also caused the remoteness of the original communities to the relocated settlement, which hampered the long-term recovery of the disaster-affected households.

In the case of settlement planning and design, chapter three categorized the settlement configuration into six types. The research stated that the resident valued the compound configuration the most, given the security of privacy and community solidarity. Another critical point in the finding was that the PDR projects implemented in different jurisdictions by different NGOs could vary significantly. For instance, the World Vision and the Taitung County Government valuated the participation of the indigenous communities. The community's solidarity and the distance to the original settlement was the first concern when planning the settlement.

By using the text analysis, chapter three stated that despite the permanent housing being constructed massively, the temporary housing policy had been ignored. Also, the government overlooked the agriculture revitalization scheme despite the drastic livelihood change in the disaster-affected households. As a total NGO-led PDR project, the presence of NGOs was tremendous. Nonetheless, the domination of the NGOs limited the local community participation and the role of other stakeholders.

In chapter four, the research looked at the discrepancy between indigenous and Chinese groups in terms of vulnerability and social capital—two elements that influence disaster recovery. The physical vulnerability perspective showed distinct characteristics of the housing type distribution of the indigenous and the Chinese groups. The social vulnerability showed that pre-disaster livelihood differences could widen both groups' income and employment rates. However, both groups were considered economically vulnerable compared to the regional income. In terms of the bonding social capital, the indigenous groups showed better performance after the disaster because of the collective relocation scheme and intimate community network. The number of resources received internally and externally also outweighed the Chinese groups. The linking of social capital with NGOs depended on the pre-disaster mutual trust, the religious background, and the extent of participation. Nonetheless, despite the indigenous-oriented PDR policy, the indigenous still struggled to recover from the disaster. The reason can be related to their unique livelihood and cultural concern.

7.3 Chapter five and six

Chapter five and six looked at the micro-scale—the PDR project in the Changzhi Baihe and Rinari settlement. These two settlements were the sizable indigenous permanent housing settlements in terms of the number of relocated households. Using the PDR framework proposed by Bilau et al. (2018) and Jamshed et al. (2018), chapter five showed the NGO—government and NGO—community relationship in the indigenous PDR project. In the case of the NGO—government relationship, the research showed that though the NGOs can compensate for the role of the government and provide the necessary assistance to the community, the NGOs can sometimes dominate the government's decision-making based on their underpinning ideology. However, the result might not be preferable for the community. In terms of the NGO—community relationship, the research showed that the flexibility of NGOs and the mutual trust with the community could secure the welfare of the resident after the disaster. Nonetheless, the community might sometimes refuse help from the NGOs if their identity and culture are not respected.

In chapter six, the research looked at the long-term issues in the Rinari settlement, including the housing extension and socioeconomic restoration issues. The chapter pointed out that the permanent housing extension was closely interrelated with the pre-and post-disaster livelihood and culture. Five extension patterns were identified according to the extension situation in the Rinari settlement. Additionally, using Bourdieu's (1987) theory, the research showed that the indigenous community was not homogeneous. In the post-disaster scenario, the community might be divided into different subgroups. Lastly, the demolition incident was mentioned at the end of the chapter. By collecting the interview result from different stakeholders, the post-disaster long-term issues such as the reasonable and fair enforcement of the permanent housing extension demolition, legally extending the housing and obtaining land ownership, returning to their original community and road repair, and the livelihood support had been pointed out to be paramount from the interviewees.

7.4 Proposed framework

By using the 2009 Typhoon Morakot PDR project, some critical issues and lessons learned had been addressed. Therefore, in this section, an innovative PDR framework in the indigenous context was proposed.

Since a typical PDR project usually involves several important stakeholders (Siriwardena and Haigh, 2011). The multi-stakeholder collaboration concept was used in the proposed framework—the stakeholders played a prominent role in this framework (Lu et al., 2017; Xu et al., 2018; Lu et al., 2020). Based on the finding and critical issues throughout the dissertation, an indigenous-centered multi-stakeholder collaboration framework was proposed. Moreover, the framework also aligned with the build back better and the disaster preparedness concept—the Sendai Framework had highlighted the idea. By integrating and rearranging the concept and framework of Bilau et al. (2018), the framework was presented based on several holistic PDR stages, ranging from preparedness, initiation, planning and construction, to monitoring and livelihood restoration.

7.4.1 Preparedness stage

The Sendai Framework states that preparedness activities for future potential disasters and PDR programs should be executed (Bilau, 2018). In chapter five, the research found out that if the NGOs did not understand indigenous people's livelihood and culture before the disaster, the PDR programs would be hard to succeed. Therefore, this framework suggested that before the disaster, the Council of Indigenous Peoples (CIP)—a central government department in charge of the indigenous affairs— should outsource the research projects to the universities or the research center to conduct the livelihood, cultural, economic, and housing survey in vulnerable indigenous communities. The survey result can become the essential database of the potential PDR project's references (1[29]). Given this research also found that indigenous communities also trust the NGOs who established the mutual trust with them. Hence, during the implementation of (1), the CIP should also allow the indigenous trusted scholars and NGOs entering the indigenous community to execute some capacity-building projects (2). For instance, the community disaster preparedness projects (Kousky, et al., 2019). The disaster preparedness projects can motivate the community residents to evacuate effectively before the damage of the disaster. During the discussion, community participation in the PDR can be enhanced (Méheux, et al., 2010).

On the other hand, the central government should cooperate with the local government to investigate the possible permanent housing settlements construction land. In chapter three, the research highlighted the problem of the lack of available construction land for permanent housing settlements, given that the land did not designate in advance. Thus, the preparation of land acquisition can facilitate the relocation process. The land should be close to these indigenous communities with adequate consultation. Additionally, the evacuation and temporary housing construction plan should be prepared before the disaster (3). The proposed framework was illustrated in Figure 7.1.

[29] The number corresponded to the number marked in Figure 7.1, 7.2, 7.3, 7.4, and 7.5.

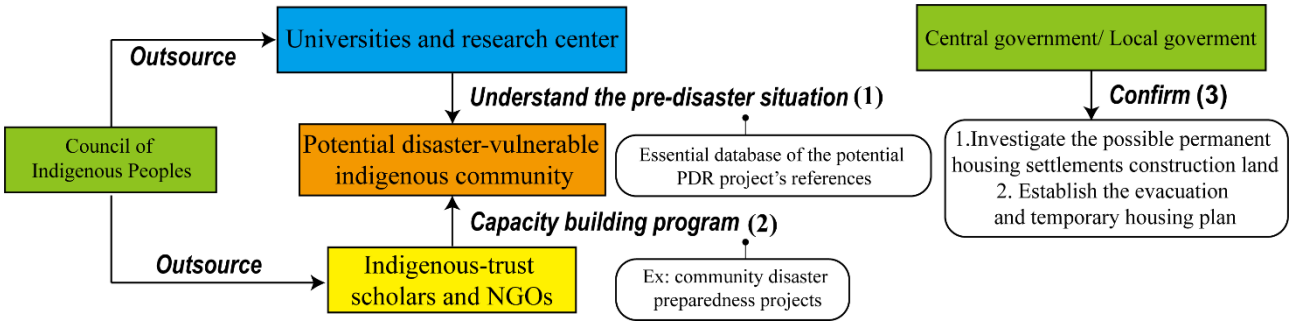

Figure 7.1 Framework of the preparedness stage

7.4.2 Initiation stage

After the disaster, even in the NGO-led PDR context, the Central Government PDR Committee (CGPDRC) should convene with the stakeholders. As underscored in chapter five, due to large-scale NGOs having vast resource, some of them dominated the post-disaster housing provision policies and greatly influenced the government's decision-making. Nonetheless, the result was not preferable for the indigenous communities. Thus, the framework proposed that the participating stakeholders should include the grassroots NGOs (GRNGO), large-scale NGOs (LSNGO), and international NGOs (INGO) to participate in the PDR initiation meeting. The research showed that different NGOs could provide different perspectives and experiences regarding indigenous PDR programs (Lu and Xu, 2014). Since indigenous people's culture and socioeconomic needs to be considered during the formation of the PDR policy in the indigenous context, indigenous experts (e.g., the universities and research center scholars) and disaster-affected indigenous communities' representatives should also be involved in decision-making. According to chapter five, the paramount issues need to be discussed during the initiation stage, including 1. post-disaster housing provision strategy, 2. delineation of the dangerous areas, 3. site selection and NGOs distribution, 4. permanent housing beneficiaries recognition, and 5. the permanent housing type decision (4). The pan-stakeholder discussion can assure that the issues mentioned above will not undermine the solidarity and right of indigenous groups. For instance, Fiji case showed that some of the tasks could be done by the community if their ability qualified (Méheux et al., 2010). Meanwhile, the CGPDRC should establish a supervision system to ensure that certain NGOs do not dominate the decision-making.

Moreover, before the planning and construction stage, the ministry of interior—a construction supervision department—should reevaluate and revise the current building code if the regulations are not suitable for the local indigenous community to use the traditional material to construct or rebuild their housing. For instance, in chapter five, the resident had once proposed using traditional slate material to construct the permanent houses. However, it received denied from the government. Hence, indigenous and construction-related experts (e.g., scholars, CIP) can assist the revision process by considering indigenous people's building culture (5). The proposed framework was illustrated in Figure 7.2.

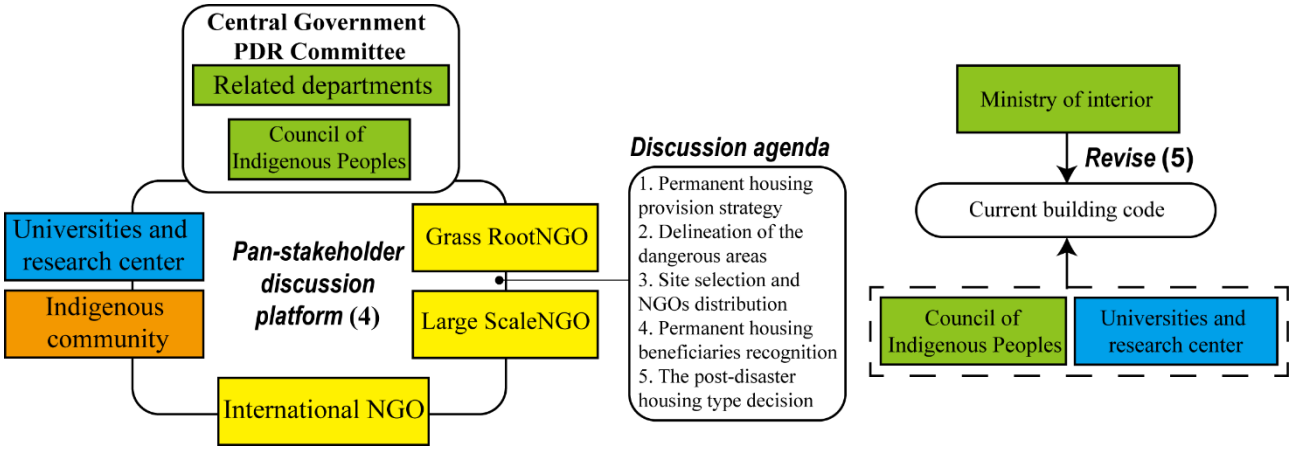

Figure 7.2 Framework of the initiation stage

7.4.3 Planning and construction stage

In the planning and construction stages, the research advocated forming inter-indigenous communities network (IICN; 6) and inter-NGOs network (INN; 7). In chapter five, the research showed that different disaster-affected communities and NGOs did not interact and exchange information with each other. The knowhow could be further assimilated to various stakeholders and resources and be shared if some cooperative networks were established. Usually, horizontal communication can be ignored in nationwide disaster events due to the chaotic situation. Seamless information exchange among communities can achieve a more indigenous-centered planning and design strategy. Similarly, NGOs tend to implement PDR programs separately due to their different ideology and religious background. The INN can help NGOs share good practice experiences, maximize the design and construction solutions, and alleviate competitiveness among NGOs (Wood, 2004).

Additionally, the indigenous survey result conducted before the disaster in the preparedness stage should be fully utilized as the design guidelines for the NGOs (8). During the design process, the IICN should be consulted by the INN. The proposal should consider the local climate, site, culture, indigenous skills, and vernacular material and design (e.g., in this research, residents stated that the compound configuration was beneficial for the settlement design). If necessary, the design should allow future alternation for the indigenous households, which is especially important in the livelihood restoration stage (Tucker et al., 2014). In the construction process, the self-build project (e.g., the temporary working scheme mentioned in chapter four and five) should be encouraged and ratified by the government CGPDRC (9), as the local construction participation can boost the ownership of the resident to the new settlements as well as some possible socioeconomic reliefs (Lizarralde et al., 2009; Bilau et al., 2018). Since many NGOs might be involved in the PDR project, to ensure the implementation quality and fairness, a CGPDRC supervision mechanism should continue in this stage (10). The proposed framework was illustrated in Figure 7.3.

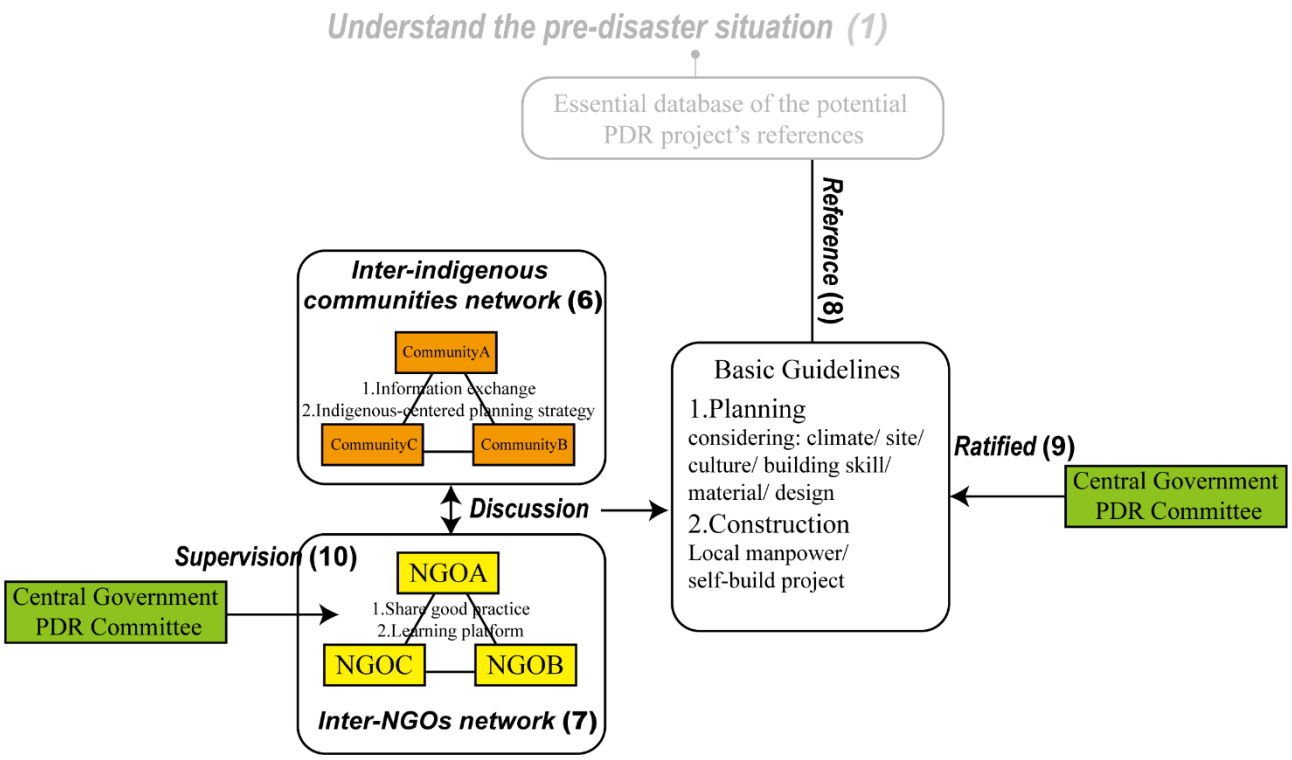

Figure 7.3 Framwork of the planning and construction stage

7.4.4 Monitoring and livelihood restoration stage

As for the monitoring and livelihood restoration stage, it can be divided into two parts. First, as discussed in chapter six, many housing extensions surged ten years after the disaster. Therefore, proper monitoring and adjustment are essential from the government site. Moreover, as also highlighted in chapter six, the trilateral contract needed to be revised—the government should release the settlement's land to the indigenous household with careful overall consideration (11). Second, to align with the new building code revision in the initiation stage, the resident should discuss and construct the housing extension under the government, NGOs, and architects' supervision to ensure living safety. According to chapter six, the safety concern and the building code violation prompted the government to enforce the demolishment of the housing extension. Therefore, the government's effective monitoring process should be implemented in the indigenous permanent housing settlements to ensure living safety (12).

Second, in chapter six, the long-term livelihood issues were pointed out. Given their lower education background, indigenous communities had difficulty forming the marketing strategy by themselves. As Hendrix et al. (2019) stated, indigenous policies should shift from a *"contracting"* to "*permanent compacting"* status. The livelihood restoration programs, such as the livelihood restoration center and the agriculture subsidy programs, should be implemented by CIP and NGOs in the long term (13). The long-term partnership of NGOs (including GRNGO, LSNGO, and INGO) and indigenous communities are important. Additionally, the CIP should be fully aware that the indigenous communities' marginalization was rooted in the history and structural factors (Huang, 2018). As chapter four pointed out, the indigenous groups' disaster recovery trajectory was inferior to the Chinese groups. This kind of institutional inequality

should also be kept in mind when executing any livelihood restoration project in the indigenous communities. For instance, the government should consider the weak human capital and livelihood issues in the indigenous communities, conduct the equity impact assessment and social impact assessment (Imperiale and Vanclay, 2016; Jaung and Bae, 2012).

Moreover, as research had shown that indigenous communities have self-determination and self-governance capabilities (Hendrix et al., 2019; Wilson, et al., 2018), community-driven livelihood restoration programs should be encouraged. No disturbance should be made to their culture and identity (Mannakkara and Wilkinson, 2015). To enhance the participatory livelihood restoration strategies, more time is needed in the indigenous communities to formulate a consensus. The proposed framework was illustrated in Figure 7.4. The relationship between research findings and the proposed framework was listed in Table 7.1. Moreover, the overall framework image, combining preparedness stage, initiation stage, planning and construction stage, and monitoring and livelihood restoration stage, were presented in Figure 7.5.

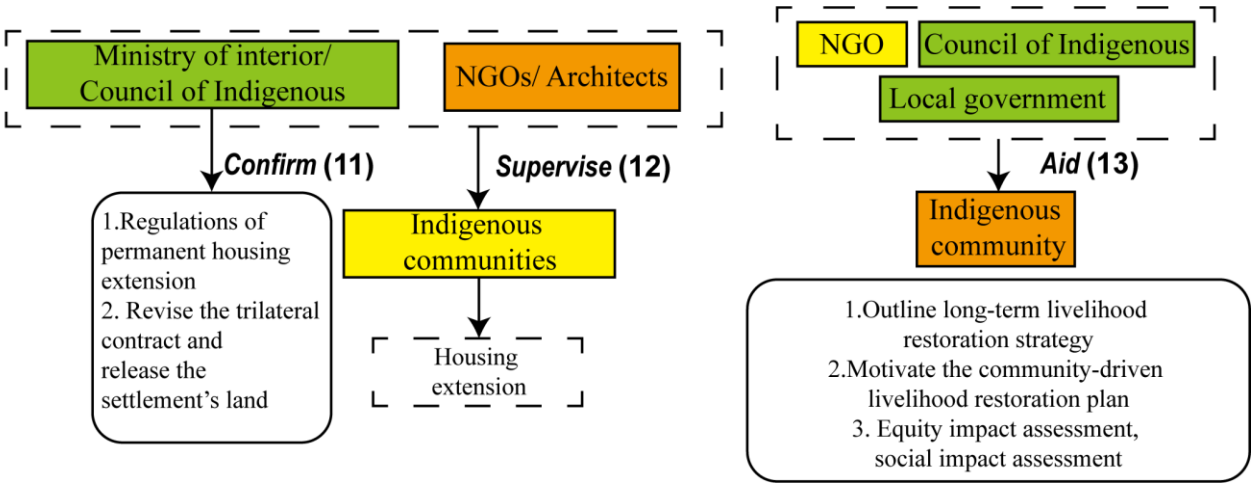

Figure 7.4 Framework of the monitoring and livelihood restoration stage

Table 7.1 Relationship between research findings and proposed framework

Code	Content	Reason	Chapter
(1)	CIP should outsource the research projects to the universities or the research center to conduct the livelihood, cultural, economic, and housing surveys in vulnerable indigenous communities.	If the NGOs did not understand indigenous people's livelihood and culture before the disaster, the PDR programs would be hard to succeed.	CH5
(2)	CIP should allow the indigenous trusted scholars and NGOs entering the indigenous community to execute some capacity-building projects.	Indigenous communities only trust the NGOs who established mutual trust with them.	CH5
(3)	The preparation of land acquisition can facilitate the relocation process. T he evacuation and temporary housing construction plan should be prepared before the disaster.	Given that the land was not designated in advance, there was a lack of available construction land for permanent housing.	CH3
(4)	Participating stakeholders in PDR initiation meetings should include the grassroots NGOs (GRNGO), large-scale NGOs (LSNGO), international NGOs (INGO), indigenous experts, and indigenous communities.	Large-scale NGOs could dominate the post-disaster housing provision policies and greatly influence the government's decision-making.	CH5
(5)	Indigenous and construction-related experts (e.g., scholars, CIP) can assist the Ministry of Interior in revising the building code by taking into account indigenous people's building culture	The resident had once proposed using traditional slate material to construct the permanent houses. However, they received denial from the government.	CH5
(6),(7)	Forming inter-indigenous communities network (IICN) and inter-NGOs network (INN)	Different disaster-affected communities and NGOs did not interact and exchange information.	CH5
(8)	The indigenous survey result conducted before the disaster in the preparedness stage should be fully utilized as the design guidelines for the NGOs.	If the NGOs did not understand indigenous people's livelihood and culture before the disaster, the PDR programs would be hard to succeed.	CH5
(9)	The self-build project should be encouraged and ratified by the government CGPDRC	The local construction participation can boost the ownership of the resident in the new settlements as well as some possible socioeconomic relief	CH4,CH5
(10)	A CGPDRC supervision mechanism should be implemented.	Many NGOs might be involved in the PDR project, which might cause unfairness.	CH3,CH5
(11)	Proper monitoring and adjustment are essential from the government site.	Many housing extensions surged ten years after the disaster. The trilateral contract needed to be revised.	CH6
(12)	The government's effective monitoring process should be implemented in the indigenous permanent housing settlements to ensure living safety.	Safety issues occurred after the housing extension.	CH6
(13)	Given their lower education background, indigenous communities had difficulty forming the marketing strategy by themselves.	The livelihood restoration programs should be implemented by CIP and NGOs in the long term.	CH6

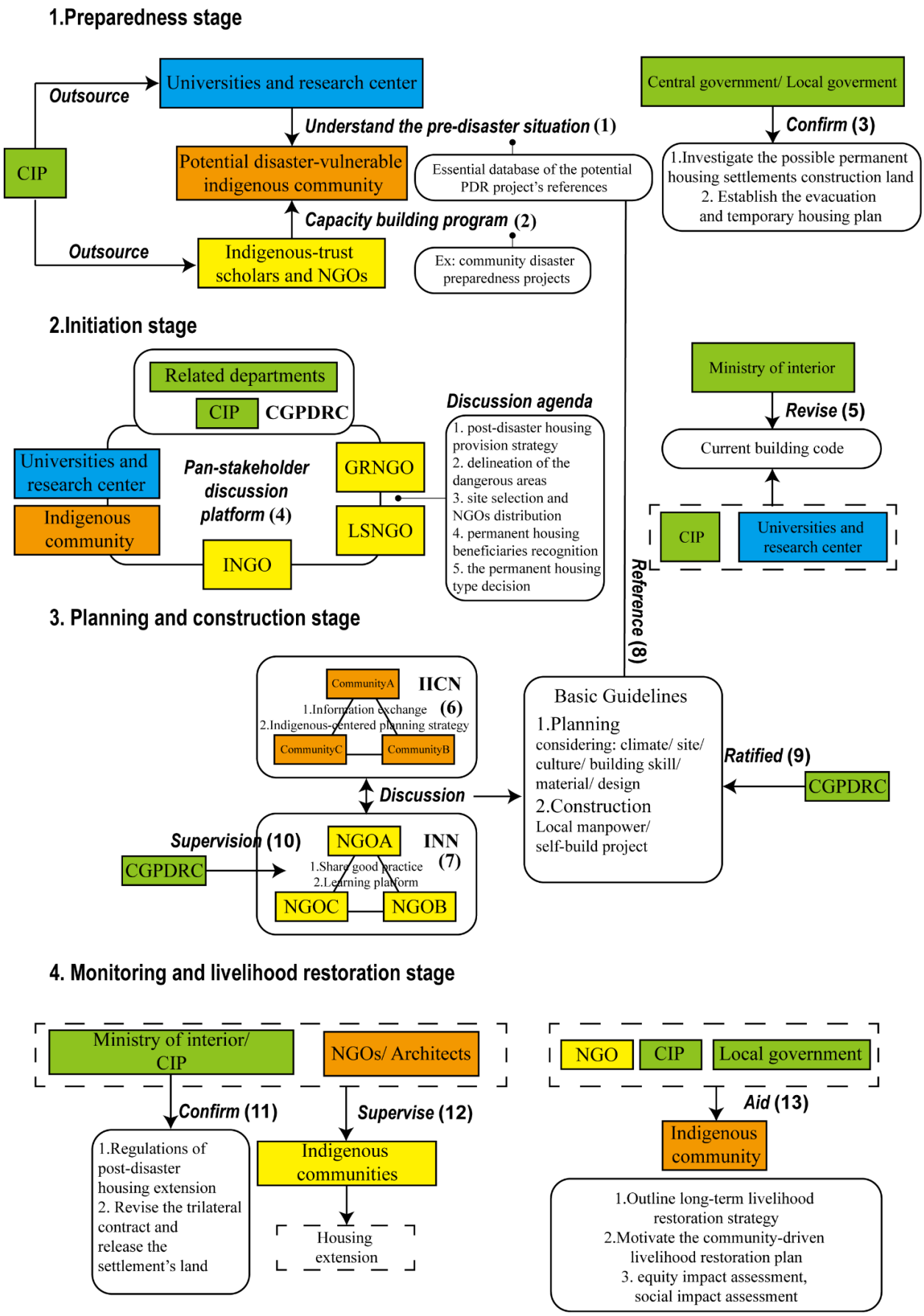

Figure 7.5 Integrated cooperation framework

Coordination is the basis of collaboration. A lack of adequate regulations and multiple stakeholders can induce coordination disorder issues (Yanay et al., 2011). Compared with the previously proposed PDR framework (Lu and Xu, 2014; Bilau et al., 2018), this framework mainly focused on the NGO-led PDR project in the indigenous context. This framework had several features. First, the step-wised pattern is easy for the stakeholder to follow and implement. Second, the essential tasks were highlighted with numbering. Third, the framework targeted the indigenous community PDR project, which integrated resilience and built back better concepts.

Moreover, one of the contributions of this framework was that it could connect and improve the current disaster risk reduction policy of Taiwan—Disaster Prevention and Response Act (Ministry of interior, 2019). For instance, the suggestions in the preparedness stage can link to chapter three (disaster rescue plan), chapter four (disaster prevention plan), and chapter five (disaster response plan). Meanwhile, the suggestions of the initiation stage, planning and construction stage, and monitoring and livelihood restoration stage can enhance and solidify the policies in chapter six (post-disaster reconstruction plan). Especially, according to the current policy framework, there are no regulations and suggestions regarding the permanent housing design, settlement planning, and livelihood restoration plan.

7.5 Research limitation, contribution, and prospects

At the end of the dissertation, some research limitations, contribtuion, and future prospects need to be stated.

7.5.1 Research limitation

First, the Typhoon Morakot PDR project in Taiwan was selected due to the case study methodology. Thus, the research finding might not correspond to the PDR project of indigenous context that happened in other localities. In terms of the type of PDR project, as Jha et al. (2010) stated, PDR project can be conducted under five different patterns. Nonetheless, this research was only able to analyze the NGO-led PDR projects.

Second, similar to the above-mentioned reason, the proposed framework needs to be customized to fit into different PDR contexts, given that this framework only targeted the case study of the 2009 Typhoon Morakot PDR projects. Therefore, the research findings and proposed framework highly reflected the Taiwanese context and thus might be different from the other PDR projects.

Third, due to the limited research period, the findings could not cover the aftermath of the disaster or the disaster recovery issues after March 2021—the last field trip to the sites. However, as Koshiyama (2021) stated, the longer terms of research scope might be necessary. The long-term demographical change and social background can influence the disaster recovery awareness of the communities.

Forth, given the questionnaire was derived from NCDR. The intention and design of the questionnaire were completely suitable for this research, thus reducing the content validity of the questionnaire survey result.

Five, regarding recent disaster risk reduction research trend, the importance of the utilizing the tradition knowledge, especially the indigenous knowledge, has been gradually focusing by several researchers (Huang, 2018; Taiban et al., 2020; Trogrlić et al., 2021). Nonetheless, given the scope of the research, the indigenous knowledge was not widely discussed throughout the dissertation except in chapter six.

7.5.2 Research contribution

Several research contributions needed to be highlighted. First, Davis (2007) stated that the PDR project is also a multidimensional issue with complexity. Using the macro and micro perspectives, the dissertation covered both the built-environmental and socioeconomic issues of the PDR project on the nationwide scale and indigenous context. Therefore, the result can be considered comprehensive. Given some of the difficulties during the implementation of the PDR project have some similarities (Arefian, 2018), the lesson learned from this research can also be used in other case studies.

Second, though the indigenous population is prone to natural disasters, few research has discussed the PDR project based on the indigenous context. By mainly focusing on the indigenous communities' PDR project in the micro perspective, the research made significant scholarly contributions in the related fields. Given that the indigenous people are the most vulnerable group after the disaster, more PDR projects in the indigenous context would happen in the future.

Third, based on the research findings from chapter three to chapter six, a PDR proposed framework considered the essence of the Sendai Framework, build back better, and community-centered participation in the indigenous context. The framework provided a guideline for future related PDR projects and enriched and improved the current disaster risk reduction policy framework in Taiwan. In view of the intensifying of the disasters and the climate change, it is inevitable to face more and more disasters. Thus, a well-designed and established PDR framework is imperative. This research had significantly contributed to the design of such framework.

7.5.3 Research prospect

Some comparison studies can be done based on the findings of this research from the perspective of built-environment, socioeconomic, and framework suggestions.

First, regarding the built environment perspective, there is still a lack of PDR-related research targeting the disaster-affected communities' relocated patterns, permanent housing settlement configuration, and permanent housing design issues. Thus, more of this kind of research should be conducted for the future inter-case study comparison.

Second, to the author's best knowledge, the questionnaire conducted by the NCDR was the only inter-ethnical comparision post-disaster recovery survey—the ethnic groups' discrepancy has not yet received

enough focus in the research community. Thus, the related research should be further conducted in the near future.

Third, the author suggested that a similar implementation framework based on the PDR project of indigenous contexts in different localities should be proposed and compared. A more active discussion of case studies among international communities is necessary to bridge the Sendai Framework with the local practitioners.

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8. Appendices

Appendix 1: Interview summaries

Appendix 1 presented the essential interview summaries of various stakeholders (Translated to English from Chinese; the name of the interviewees were shown anonymously)

Academic representative interview

Interviewee: L. F. (Director of NTU Urban and Rural Foundation)

Time of interview: 2021/3/3

Place of interview: NTU Urban and Rural Foundation (Taipei City)

Housing demolition

1. From the beginning of 2020, Mr. Lee had been receiving official documents from the county government, and other people from the tribe had also received them, so they were all a little more nervous. However, since Mr. Lee is a representative of the village, as well as has a good relationship with the government sector, he was not afraid. Even the loan for the construction of the extensional structure was also borrowed from the Indigenous People's Office—the mortgage guarantor was the Indigenous People's Office. Nonetheless, now the extension was demolished by the county government. Hence, this incident looks a bit ironic.
2. In terms of procedure, the county government received a report continuously and therefore could not do anything about it. However, the county government did not want to deal with it, so it was entrusted the township office to handle it. The township office then entrusted the village head to check the number of extension buildings. Eventually, the village head reported the three households, two of which later demolished themselves. The reason for reporting those three households was that 1. they all built up to three stories and 2. the house been extended exceeded the road boundary line. The issue also led to the community's long-standing factional problems. These reported three households are considered to be well-developed in the community. Some of them are even members of the youth association, so it has become a confrontation between the younger and older generations.
3. Before the demolition, a coordination meeting was held, hoping that the problem would not be solved through demolition. However, the community coordination failed, and the meeting ended in vain. The demolition was initially scheduled for 2020 August 15th, but it was not demolished due to some lobbying in the process. However, it was still demolished in mid-October 2020.

The solution to the problem

The Ministry of Interior can go through the process again to see if the total volume control (public facilities, roads, etc.) is deemed low use and can apply for an increase in the shelter rate and plot ratio based on the current increase in housing extensions.

Land ownership

At the consultation meeting, residents proposed a land swap model, where the land of the new Hao-Cha would be exchanged with that of Rinari, but a major problem was whether the old Hao-Cha would be affected.

The confrontation between the elderly and the young generations

The confrontation between the elderly and the young people in the tribal meetings was a vivid experience for

the interviewee, as he participated in several tribal activities. However, since the construction of the slate house requires the traditional knowledge of the elderly, the elderly would definitely participate (referred to the slate house preservation project). At the same time, the young people thought that the resources were in the hands of another faction, so the second phase of the slate house construction had little participation from the young people. Therefore, the slate house construction project was delayed.

Problems of the Rinari

1. Farming: It is a kind of spiritual comfort for the old generation. They will not sell the red quinoa (traditional crop) for money. However, the community economy might switch to a tourism-driven one after the old generation vanish.
2. Cemeteries: Both the older and younger generations agree that cemeteries must be handled separately, and both generations consider it essential.

Academic representative interview

Interviewee: H. S. (Professor of National Taiwan University)

Time of Interview：2021/2/25

Place of Interview: National Taiwan University (Taipei City)

The reasonableness of housing extension demolition

The interviewee thought the law enforcement was too hasty and unnecessary. There should have had a certain degree of discussion, such as the transfer of use or solution proposed by Mr. Lee. However, the county government felt that the demolition was the only solution. At the same time, the government did not deal with other places (other extended communities). The interviewee thought the Rinari had been targeted. The interviewee also thought it was very natural to have housing extension to complement the lack of function or livelihood issues of the households. The county government should put more effort into legalizing the housing extension under the safety consideration.

Land ownership

It is unnecessary to tie the provision of land together with the trilateral contract, and there are still problems within that contract. Eventually, many issues (contract) become the problems of NGOs and disaster victims so that the government can dodge the responsibility. In the Japanese experience, the focus is on the land, not the houses. The land is acquired first, and then the government buys the land at a reasonable price. Therefore, there is no problem with restricted land without compensation. Now the people of Rinari are unable to dispose the land of old Hao-Cha, and the land of the permanent house is also unavailable. This is a mistake that makes the residents feel like disaster victims forever. The land issue is very complicated, the local governments used the acquirement method, so there are very rigid restrictions (state property law). The local government is sometimes pitiful because it becomes the owner of the land after the reconstruction. On the other hand, the residents have different views; some can afford to buy the land and hope to privatize it, some cannot.

For other disaster victims, it may be applicable (the land policy). However, for the Hao-Cha community, it may not be helpful. At present, each family has different opinions, some want to go back, but some want to stay. Therefore, how can you solve the difference in the position of different people in the community?—unless there are living opportunities in the old Hao-Cha, how can they go back? We have to give them 3-5 years to deal with.

Fairness

Regardless of whether they return to their hometown or not, permanent housing should be provided to them in order not to cause panic.

The regulation

Sometimes it is difficult to make everything into a disaster prevention law, which would create contradictions.

Therefore, laws such as the Cultural Resources Act help and complement (the flaw), which require some to go through the legislature and some not. However, the types of disasters are different, and the needs and responses are different.

Academic representative interview

Interviewee: T. S. (Professor of National Sun Yat-sen University)

Time of interview: 2021/2/15

Place of Interview: Pingtung Starbucks (Ziyou Road Store)

The land in the old Hao-cha used to be about 1,000 times the size of the current Rinari, and all the residents were friends or relatives of the interviewees.

The number of disputes increased after moving to Rinari

The interviewees said that they (the interviewee is also the Haocha resident) could see the sunrise in the old Hao-cha facing Dawu Mountain, and the place where the sunrise was from the ancestral spirits, so they were more open-minded. However, now they have moved to Rinari, they can no longer see the sunrise. Therefore, many people have become narrow-minded and often argue over the extension area, parking spaces, and lawns. The older generation who had lived in the old Haocha are just laughing at the current tribal disputes, which is different from the younger generation.

Permanent House Controversy (regarding the housing demolition by the government, CH6)

2020/10/15: The permanent house was demolished.

2020/10/24: the resident in Hao-cha went to the Legislative Yuan to present the case and then went to the Supervisory Yuan to find commissioners.

2020/December: A public hearing was held to tell the story of the permanent housing dispute.

2021/January: Each government department wrote back (the response regarding the issues) and gave the residents a reply.

2021/2/25: A presentation by the commissioners was held at the indigenous cultural park, with the participation of the general public and academics.

The interviewees hoped that the whole process would not be useless but would be meaningful and supported by data and evidence. Many people (preferably foreign scholars) will pay attention to it, which will be more helpful.

Respondents' views on the demolition

1. The interviewee thought that there should be a set of standards for demolition and equal treatment, and the current way is more like fretting and warning the residents. He also thought that the government's attitude was a bit negative.

2. Although Lee's extension was demolished, he continued to do business and extended the housing horizontally, which can be considered resilience.

3. The interviewee thought that the restaurant on the opposite has safety concerns and should be demolished, so the standard of housing demolition is hard to understand.

The Hao-cha people can be said to be a microcosm of the minority people facing the government machine, from the old Hao-cha at the beginning, to the new Hao-cha, to the Rinari. Whether it is the state power, climate change, or the demolition incident, the most important thing is what can be learned from it.

Architect representative interview

Interviewee: W. D. (Graduated from National Cheng Kung University, Class of '72; Architect)

Time of interview：2019/4/8

Place of Interview: Deyang Wu architect office

Deyang Wu is a member of the Chiayi Architect Association and was invited by a friend to take on the Jialan permanent house project.

Design of the permanent house

1. The interviewee felt that a three-story building should be built, leaving some space for future extension on the front yard, while the back yard can still be used as storage space.
2. The red roof was the architect's idea, related to the Red Cross.
3. The distance between buildings depended on the size of the land lot, so the distance between buildings cannot be decided arbitrarily by Wu.
4. In the design stage, Wu and the indigenous people did not communicate much. As a result, the kitchen and room sizes were designed according to the architects' wishes or experience, without (impossible to) considering the indigenous people's opinions.
5. Wu chose RC materials for permanent housing because the light steel structure used by World Vision is less resistant to wind and rain.

Continue to track the usage of the permanent house

There was no long-term tracking, and the interviewee thought that in the future when thinking about this type of project (PDR project), the government should do the long-term tracking.

Differences between post-disaster and general construction project

In addition, the quality of construction was poorer (compared to the ordinary construction project). The primary consideration was the possibility of the building being built. The aesthetics and design were simpler (compared to the ordinary construction project).

legalization of the housing extension

Architects still had doubts about the legality of housing extension. It was unlikely to be unconditionally legal in situ. These unauthorized structures must be rearranged, such as establishing fire prevention zones, fire alleys, or restrictions on extension materials to increase safety. These additions were more likely to be legalized in situ with those conditions and improvements.

Suggestions to the government for pre-disaster preparedness

Wu believed that it was not necessary to set up a disaster prevention bureau but to start from prevention.

Suggestions for the aftermath of the disaster

The government should conduct a comprehensive review of the post-disaster resettlement policy, the designation of danger/safety zone, and the recognition of permanent housing eligibility to improve the implementation of the PDR project.

Land rights

Although people's desires will expand infinitely, there should be room for discussion on whether to protect their (residents') land rights in the future during the PDR project implementation.

Architect representative interview

Interviewee: H. M. (The cooperative architect with World Vision who designed and constructed Rinari settlement; belonged to Hsieh YinJun Architect office)

Time of interview: 2018/08/25

Place of interview: Rinari settlement

World Vision did not follow the committee's three ABC household types

After communication and negotiation, the Pingtung County Government agreed with World Vision's proposal and abandoned the three permanent housing types. Therefore, the Morakot Post-disaster Reconstruction Committee was dissatisfied with World Vision and Hsieh's team and called a meeting with all NGOs and construction support teams. The committee accused NGOs (especially World Vision) of not following the committee's approach.

Communication with NGOs

World Vision worked with Hsieh's team, holding meetings with several major community leaders and essential people in Haocha, Majia, and Dashe. These community representatives went back to their respective tribes after the discussions to hold tribal meetings to discuss the planning and design.

Trust in the central government, local government, and World Vision

1. Central government: The interviewee thought the regulations were cumbersome and inflexible, e.g., the regulations of the three ABC permanent housing types restrict the opportunity of design, and what the government should do is simplify the regulations and integrate the resources. In addition, the government was too attached to the Tzu-Chi team, treating it as a model and therefore ignoring the role of other NGOs and construction teams. However, Hong stated that the design should adapt to local conditions. The construction team originally wanted to promote participatory design, but due to time pressure, they ended up letting the construction team in, although some residents were involved. Furthermore, since there is no actual contact between residents and central governments, residents' trust in central governments was relatively low.
2. Local government: Hong stated that the county government was more humane and not bound by too many constraints. In addition, the county government initially thought that 100 hectares of land could be used (for permanent housing construction). However, after deducting the hillside land and unsuitable areas, only 30 hectares were left, which means the local government had not fully understood the situation.
3. World Vision: The residents' opinions were heard and adopted, so the residents maintained a good relationship with World Vision.

Change of satisfaction level

In the beginning, people were not used to it (Rinari settlement), but after slow adaptation, they got more and more comfortable with the new environment and became more satisfied. In addition, there were some active

cleaning activities in Haocha, but fewer in Maja and Dashe.

The emergence of temporary housing

In the case of Jialan, since they already had their own land in Zhenxing and the Morakot post-disaster reconstruction regulation had not yet been officially implemented, it was possible for temporary housing to appear under such circumstances. On the contrary, in Haocha, Majia, and Dashe, there was no discussion on where to relocate due to unclear property rights. Therefore, temporary housing construction was not considered.

Hsieh's concept of permanent housing construction

We hope that the residents will be the main body of the construction project. We will provide them with a home to live in, and at the same time, allow them to develop their properties instead of just relocating them.

Building quality

The light partitions of World Vision proposed permanent housing structure had sound insulation problems, and the slabs were relatively thin, which can generate much noise in use.

Configuration

The design of the Rinari settlement was based on how many households wanted duplexes, pitched roofs, and slow roofs, but to improve the efficiency of space use, the single houses were placed on the side.

Government representative interview

Interviewee: C. J. (Congress member of Legislator Yuan)

Interview time：2021/03/10

Place of Interview: Jiabin Chung office (Taipei City)

The impact of "demolition" and "relocation" on the indigenous groups

"Demolition" is a ubiquitous thing. As long as there is illegal construction, it will definitely be accompanied by demolition. The situation is common in Chinese settlements, but it will cause much fear to the indigenous, who think that "demolition" is a prelude to "relocation." We would allow it (housing extension) in some cases, but it is unacceptable to use the housing extension for profit.

"Relocation" is a permanent pain in the hearts of the indigenous people. In the past, the Japanese wanted them to move down to the bottom of the mountains, which is 700 meters in height. During the National Government era, they wanted indigenous people to move down to manage the tribal communities and resources effectively. The policy resulted in many indigenous enclaves in Changzhi Neipu and Majia in Pingtung County and competition for land with the Hakka groups.

Land ownership and the problems arising from it

Chung stated that the core problem is that land ownership did not go to the residents.

The government's commitment for the relocation was to meet the needs of life, so if residents make a profit on it, it will be a problem.

If the land for disaster preparedness is transferred into permanent housing construction land, another piece of land would have to be found. However, finding the balance between individual needs and national resources management would be challenging.

The problem of the trilateral contract

According to the trilateral contract, the government said that if residents go back to their pre-disaster settlement, the government will confiscate the permanent house. Chung thought it was unnecessary and that the NGO should give up their rights and obligations, thus changing the contract to a bilateral contract. However, at present, the Executive Yuan is not capable to abolish the trilateral contract

The central government is responsible for conducting regular surveys of the land use. Given the special law for Typhoon Morakot no longer exists, the government needed legal authorization to restrict residents' return to their pre-disaster settlement.

Maintenance of the infrastructure

The government must first plan its policy on mountain and forest management before deciding whether to maintain a certain level of infrastructure or lifeline. Everyone can put forward their own needs. When your small sedan can drive home smoothly, how do you manage the tourists and improve the quality of service?

How can you bear the influx of tourists?

The conflict between economic benefits and traditional culture

There is a conflict between economic benefits and the preservation of traditional culture, which needs to be weighed together. There should be policies for higher-level planning, disaster preparedness, land maintenance, mountain economy, and public facilities. Once this issue is activated, many things need to be considered. This is something that citizens can participate in as a whole. In the past, urban planning could be determined by the government unilaterally, but now it is impossible. Nowadays, meetings and hearings must be held, so it takes longer to discuss and develop a policy in detail.

The sequence of problem solving

Chung said that the issue of a trilateral contract and reasonable payment of permanent housing could be solved first. In contrast, the infrastructure and pre-disaster settlements' return issues can be solved later.

Regulations need to be adapted to local conditions

There were many things that the central government had to authorize, and the local government had to manage, and these had to be managed by a fair and reliable third party. Many tribal childcare centers do not have the conditions to satisfy the legal standard, so the county government wanted us to set up internal management methods. The state has to give us the space to make the best use of local conditions, and the local government has to participate in the management and advice. A country can have multiple systems, so can a county. As long as it is reasonable, there is no problem.

Government representative interview

Interviewee: J. Q. (Head of Jinfeng Township, Taitung County)

Time of interview：2021/03/21

Place of interview: Jialan Community

The problem of land ownership

The government was afraid that the houses would be sold after the land rights were given (to the residents), but Chiang said that since the residents had houses ownership, the land ownership should also give to the residents. The demolition of housing extensions also reflected the contradiction between the use of space and industrial development. However, Chiang stated that livelihood and life were inseparable, so the residents should be allowed to use the living space to develop economic activities. The Typhoon Morkot PDR project for the government was just “resettlement” but not “redevelopment.” Therefore, the central government should adjust the land use policy of the PDR project. The local government should use regulations or administrative orders to solve the problem of land ownership.

Moreover, taxes can be collected from the residents if the land ownership is given, but the central government's decree restricts this. Since the Typhoon Morakot Post-Disaster Reconstruction Special Regulation has been repealed, there should be no problem for the government to give the land to the residents as long as they pay the cost of the land.

Government PDR projects were only half done

At that time, there were many public projects planned in the permanent housing settlements, which were supposed to be done by the central and county governments. However, in the end, why did they all have to be done by the village offices? Recently, the township government cannot develop and construct the community facility because of policy constraints.

The balance between livelihood and housing

There were still people in the community (Jialan settlements) who opened restaurants and used the space they live in to make money. However, no one has reported it, and the (Taitung) county government did not really care about this issue.

Knowing but not doing anything

We (the community) applied for the national compensation because of the government's passive inaction. For example, before Morakot, several households were already washed away because of Typhoon Haitang, but the government used a stone cage as the river bank. At that time, we questioned the county government that they should have placed monitoring equipment to keep track of changes in the water level and established various rescue facilities following the disaster prevention and relief law. However, the county government's policy was wrong and there was no monitoring.

Site selection for permanent housing settlements

Although it was essential to find a place to live as soon as possible, the victims were calmly exploring the possibility of staying in or leaving the Jialan community. Afterward, the community decide to rebuild the settlement in situ.

Selection of building materials for permanent housing

The community went to see the permanent house in Rinari. Chiang told the residents that building materials for the permanent house should be carefully considered. The lifespan of the RC structure is 50 years, which was a better choice than the light steel structure.

NGO involvement

The reason why Tzu Chi did not participate (in the construction of the Jialan settlement) was purely because of the task allocation issues. The World Vision was very active and had already dialogue with the county government. The east side was a duplex style, and the west side was a single building. Compared to Rinari, Jialan is much better. However, three other households (from Jinlun and Bin Mao villages) were forced to move in, so these three families could not participate in politics (select the village head of Jialan), which is a pity.

Industrial Development

At present, there are ten production and marketing classes in the Jialan community. In the future, the community needs to increase the production value and establish a matchmaking platform in the township office to help match companies willing to buy.

Government representative interview

Interviewee: T. W. (Deputy director of administration of indigenous people affairs; AIPA)

Time of interview：2021/03/17

Place of interview: Pingtung County Government

The provision of business loans

The government can only provide loans for start-ups businesses to purchase business equipment and develop applicants' businesses, so applicants cannot use it to build a house (extensions). The government will be more cautious in examining the loans in the future (after the demolition incident). In addition, banks will examine the loan allocation. There was some misinformation that the AIPA would lend money to families to build illegal structures.

Opinions on the demolition of illegal structures and protests

The county government managed the land. Thereforee, we had to deal with such a huge building extension because of our responsibilities. However, the government did not need to be so iron-fisted and create confrontation between the government and the people. Tsai also understood Mr. Lee's thoughts. Although the AIPA should think from the perspective of the indigenous people, but from the perspective of the county government, if not dealt with will encourage illegal construction, what should be the countermeasure? The government also repeatedly advised Mr. Lee before the demolition, hoping that the government would not end up taking action.

Disaster preparedness vs. resettlement

Tsai stated that post-disaster reconstruction planning should be done in advance by preparing land for disaster preparedness (e.g., the parking lot in Rinari) that can be used immediately if necessary, while permanent housing is land for resettlement where disaster victims can live permanently and peacefully.

Views on land ownership

From the perspective of the resettlement policy, Tsai stated that it was unreasonable for residents to get land ownership. However, if public opinion pushes forward in the future and the government has the sincerity to deal with it, the land can certainly be privatized. Some residents think that if they get the land ownership, they can build more, take out a loan, and sell. However, the current disaster prevention law now stipulates that permanent housing cannot be foreclosed even if the resident does not repay the loan.

Views on future housing extensions

Extensions were allowed to grow taller but not fatter. However, whether the current permanent housing structure could support the extended third floor was suspectable. Moreover, after ten years, the government needed to know whether the steel structure had aged and could not extend any structure on it. If there were safety problems, the housing must be knocked down and rebuilt. Although, according to the regulation, the rebuilding of permanent housing was certainly no problem because residents have ownership of the house,

PCG was now trying to amend the law to increase the plot ratio so that the building could be built larger in the future. In addition, there was an autonomy ordinance to control the building landscape and maintain a neat and uniform permanent housing landscape, which is more harmonious overall.

Return to the original settlements and trilateral contract

During the 10th anniversary of Typhoon Morakot, the residents asked for a comprehensive investigation to of the original settlements and wished for the lift up of the ban on returning to their original settlements. However, the central government did not pay attention to it, and only after the demolition incident did the central government start to deal with the people's requests. The trilateral contract stipulated that if residents wanted to return to their pre-disaster settlement, they must give up their permanent homes. If the central government allowed the residents to keep their homes in the original and new settlements, it would not be difficult to amend the trilateral contract. Nonetheless, it would be challenged to persuade the eligible residents as permanent housing beneficiaries but did not move down.

Livelihood development

Majia had no problem with arable land because of its proximity to their original settlement, while the Daeshe and Haocha had more problems. Now there are three tribes in Rinari. If only two or one moved to Rinari, the arable land should be adequate. The government at that time was very respectful and responsive to residents' opinions.

The government had found Changchi Baihe residents the land of Taiwan Sugar company in about 10 minute drive distance and spent 20 million NTD for counseling and support. However, later the residents started not paying rent and not planting crops. At first, they tried to plant sweet corn or red quinoa but finally decided to cultivate red dragon fruit. PCG provided three million NTD of patented seeds, transporters, lawnmowers, filtering machines, and other equipment.

NGO representative interview

Interviewee: C. L. (In Tzu Chi, she was mainly responsible for coordinating with various post-disaster reconstruction affairs)

Time of the interview: 2019/4/6

Place of interview: Tzu Chi Pingtung brench office

Tzu Chi's view of the disaster

Tzu Chi believes that the disaster is related to the fact that the indigenous people did not allow the mountains to rest and therefore wanted them to move down from the mountains.

Tzu Chi's main beliefs and values for reconstruction

"To cultivate compassion in suffering; to test wisdom in variables; to stimulate resilience in hardship; to learn patience in tedium; to appreciate merit in complexity; to pursue progress in ideals; to be grateful to one another; to be peaceful and uncontested in society; to nurture the earth for a long time; and to eliminate disasters in the world" - " Ten Paths of the Heart ", from which the interviewee stated this is the main belief and value of Tzu Chi in post-disaster reconstruction.

In addition to the "Ten Paths of the Heart," Tzu Chi also emphasized the keyword "quick" to give the disaster victims a place to stay and settle down as soon as possible. In the case of the permanent housing in the Daai settlement, it took only 88 days from the beginning to complete the project.

Tzu Chi's approach to the permanent house and overall design

The main design of the exterior was a “washed finish” similar to the style of "Jingsi Hall." All five schools after Typhoon Morakot in Pingtung were built with this design.

Tzu Chi's request to the government

1. The applications for the three types of permanent housing must be scrutinized strictly, and people who own homes (in the original community) must not apply for permanent housing.
2. the permanent housing must be built directly because the experience of the Ji-ji earthquake had shown that it was challenging to revoke the land if there was temporary housing on the land.
3. The land should belong to the city government, and the permanent house on the ground belong to the people.

Site selection and construction of Changzhi Baihe

Tzu-Chi's superiors felt that the location of Rinari had the risk of landslides, so they chose between the Hai Feng Farm and the Changzhi Broadcasting Station (Changzhi Baihe).

In the construction process, because of the many denominations, 36 churches would have to be built if each denomination needed a church, but this was not possible with limited resources.

Difficulties Tzu Chi encountered in the process of construction

In order to complete the permanent house as soon as possible, although staff from both Kaohsiung and Pingtung could be transferred to support each other, there were some difficulties in terms of manpower because both places were strained. In addition, Tzu Chi is a Buddhist organization, and there was much opposition from the residents due to their Christian religion.

Tzu Chi's assistance to foreign countries

Tzu Chi had been assisting in the reconstruction of Taiwan and overseas for many years, so Tzu Chi also had overseas aid teams in foreign countries. In the past, some overseas countries had been very successful in implementing reconstruction projects, such as in the Philippines, where local companies' donations and resources were more than adequate.

NGO representative interview

Interviewee: C. K. (Former director of PDR department, World Vision)

Time of interview: 2021/3/5

Place of interview: New Taipei Banqiao High-Speed Rail Station

Views on the government's demolition of Mr. Lee's extension

Chuan stated that Mr. Lee's extension was likely to be demolished (in October 2021) because three households were notified that they would be demolished, and two of them had already demolished themselves. Lee had misjudged the situation. Many Rukai pastors did not respond to this event because the church felt there was not enough legitimacy (regarding the protest again the demolition and government). Chuan stated that the government had been dealing with the issue. For example, the Pingtung County Government discussed how to legalize the existing housing extension. However, they needed time to solve the issues.

The issue of trilateral contracts and land ownership

Chuan stated that it was better not to give residents land ownership. There were many cases in the past where indigenous people sold their land cheaply or used it as a mortgage for real estate, which created many problems in the future.On the other hand, the advantage of having land ownership was that the land could be directly converted into an *"indigenous reserve land"* afterward, protecting indigenous people's right to land use.

Planning for permanent housing by NGOs

Chuan stated that the Taitung County government, which is dominated by the indigenous population, had a more flexible mindset and was more concerned about the indigenous issues. Therefore, World Vision worked with Taitung County Government much more compared to other local governments.

However, in the case of Pingtung County, the local government insisted that the same among of PDR projected should be allocated to each NGO to ensure fairness.

The PDR projects of Kaohsiung were all handed over to Tzu Chi. The local government believed it would be easier to implement the relocation and construction if all households could concentrate in the Da Ai settlements. However, some people did not want to give up their motherland, so they found some lands nearby and sought assistance from the World Vision (which were not tallied in the total permanent housing stock, given those were the informal projects).

NGOs become a good lubricant between government and residents

In the past 50 years, World Vision had been sponsoring indigenous children and has gained the residents' trust, so it is easier to promote the PDR projects and become a good lubricant between the government and the residents. The staff of World Vision needed to know about the relief project and be acquainted with the

administrative work. For example, World Vision's response to participatory design and solution for ineligible households as permeant housing beneficiaries. The NGOs should be flexible to assist and complement the government's role during the PDR.

Disaster Relief Alliance

The alliance was established by Red Cross and provided opportunities for middle and small-scale NGOs to serve in disaster areas, share experiences, exchange ideas, and also recruit experts and scholars to the disaster areas. In the future, it is essential to consider how NGOs can cooperate with each other instead of competing and confronting each other. In addition, resources should be localized to help those who really need help. If there is a need for expertise, we will commission NCDR experts and scholars to go to the tribes to investigate the potential disaster risk in the communities. In addition, these NGOs that are promoting disaster prevention communities may be the leading players in post-disaster reconstruction in the future because they already have a trusting relationship with the local residents. Even if they do not lead the reconstruction in the future, the NGOs should promptly play the role of coordinator so that the NGO residents and the government can communicate smoothly.

The construction of a permanent house in the Rinari settlement

There was a proposal to use stone slabs to build the permanent house, but it would take about three years and need excavation to find the stone slabs.

Regarding the construction of housing extension

World Vision's design had left the land for residents to build houses extension. However, the county government had said that the housing extension should not be taller than the permanent houses or bigger than the original buildings. Therefore, the third-floor extension was not allowed.

Rinari community interview

Interviewee: C. Z. (Representative of Wutai Township, incumbent)

Time of interview：2018/08/27

Location of interview: Rinari settlelemnt

Chen Zaihui lived with his wife and three children (about 30 years old, two sons, and one daughter).

Residents' perceptions of public sector enforcement and assistance

Although some of them (the Rinari residents) were not satisfied, they were grateful.

Communication with NGOs

World Vision made the decision after thorough communication with the residents and repeatedly asking for their opinions.

Relationship between the residents and the Hao-Cha Relocation Village Committee

Chen stated that they and World Vision had many detailed discussions, whether about the building or other parts. For example, as for the issue of farmland and cemetery, many people had participated and discussed it. In addition, Chen also admitted that it was mainly due to the time pressure that many reconstruction issues could not be discussed in depth.

Level of trust in government and NGOs

1. Central government: Suspected. For example, although the Dawu tribe (another disaster-affected village) was not affected by the disaster at that time, they were eligible to move down to Rinari and allocated permanent housing. However, they were afraid that the government would expropriate their pre-disaster houses, so they did not move down (which seemed to be deceived by the government).
2. local government: Basically many things the county government had managed, but like farmland and cemeteries, the county government was still looking for a solution.
3. World Vision: Trust.

Problems with farmland and cemeteries

In terms of using the farming land in Old Haocha, Chen said they were thinking of ways to solve the problem of transportation, for example, sending people to the old Hao-Cha by roadway.

The permanent housing allocation process

1. The tribal head chose the location of the house first.
2. The few single-type houses on the side were less competitive because few people wanted them.
3. In the case of duplexes, two families (mostly siblings) would be arranged together and allowed to exchange the location with other families.

Housing extension

1. Chen said that if there were hunting families in the past, they would have such a large freezer storage space in their homes, which was somehow related to their living habits, and many of them had such a freezer in their homes.
2. The front yard extension of Chan's house was mainly for meeting purposes, with an office-like space; the addition at the back was mainly for the kitchen.

Future Development

The future population growth means the flow out of the people from Rinari. However, Rinari residents always feel that they are together.

Rinari community interview

Interviewee: L. M. (Retired elementary school teacher)

Time of interview：2018/08/26

Place of interview: Rinari settlement

Family Composition

A daughter and her husband. The family next door was her husband's brother.

Communication with NGOs

The interviewees did not know much about the construction, and many things were conveyed to them (the residents) through the community leaders. However, she was not clear about the three ABC permanent housing types.

The relationship between the residents and the Hao-cha relocation Committee

Lan sometimes went to the committee for discussion, but the interviewees had no strong opinions.

Trustworthiness

1. to the central government: Some people still have many grievances about the relocation, which remain unsolved. Therefore, the interviewee had joined the protest in Taipei. Nevertheless, unfortunately, it was difficult for some people to reach a consensus on the village's relocation.
2. to the local government: The interviewee was unsure if the local government would demolish their illegal housing extension, but the residents could only face it. However, the demand for extensions was huge.
3. to World Vision: She trusted World Vision, but she was an amateur in architecture, so there was not much discussion (during the interview).

Change in satisfaction

With the increase in the number of housing extensions, the sense of identity, adaptation to the environment, and satisfaction levels have increased. However, still, she was not satisfied with the farmland and cemetery arrangement by the government.

Housing extension

The main reason respondents wanted to build more extensions on the east side was that the wind and rain would pour in from the east.

Daycare for the elderly and the economy

The interviewee mentioned that the economic part was the most difficult to solve. She has been working as a volunteer in a daycare center for the elderly in the community for many years, mainly to help collect handicrafts made by the elderly to sell.

The plight of the elderly

The elderly were living on a pension of NTD 7,500. Nowadays, they could only buy the product on the market, which is a significant burden, so the quality of life quality in Rinari was not very good.

Building Quality

The building itself was not a big problem. Lan said that the water leakage problem happened in the first year of completion. Because the housing was built of wood, the façade of the housing was not strong enough and had some cracks.

Rinari community interview

Interviewee: T. M.

Time of interview: 2021/03/18

Place of interview：Rinari settlement

The interviewee was a former contracted officer of the county government, mainly responsible for the slate houses preservation project.

Slate House Preservation

Although the Cultural Resources Act allows for some subsidies for repairing slate houses, many things are restricted, including repairing and remodeling houses.

Views on the demolition event

The interviewee felt that the government had aimed at Mr. Lee's house. There were two major requirements for demolition: 1) constituting an immediate public security problem and 2) interfering with the use of others, which Lee's house was not applicable. However, if the prosecutors were tribal people, it could be attributed to the faction issue.

He also thought that the government was playing a two-sided approach. On the one hand, the government tried its best to guide permanent housing households to the hostel industry and develop tourism. However, on the other hand, it is constantly suppressing and using demolition of housing extension to scare people from building more (for the industry development), which he found unacceptable.

Privatization of state-owned land

Tsai stated that if residents owned property rights, they would feel more at ease and would not have to worry about the day when the government would revoke it.

Returning to the old Hao-Cha

We (Rinari residents) can think about how to develop the tourism industry for the old tribes in the future, such as limiting the number of visitors to the mountains, establishing a one-stop service (using the Cultural Capital Act to collect entrance fees to provide food, and beverage, accommodation, etc.), and setting up a tribal fund to support the tribes to make it better. There are also many options for development, but the strategy and plan must be correct.

Changzhi Baihe community interview

Interviewee：B. J. (tribal leader)

Time of interview：2018.8.28/2021.3.10

Place of interview: Changzhi Baihe settlement

The interviewee lived with his wife, and two daughters. He also had an older son who lives outside with the interviewee's granddaughter most of the time.

Do NGOs respect the residents' opinions?

Tzu Chi had its way of doing things. As a result, many things may not be following the residents' ideas.

The relationship between the residents and the village relocation committee

In order to prevent the situation of multiple leaders, the chief of the village was asked to be the commander-in-chief and to be the spokesperson and coordinator.

Trust in central and local government

The interviewee stated that the government had heard a lot of opinions and feedback on many issues and that both Tzu Chi and the government had been slowly making corrections.

Tzu-Chi

The interviewees were not comfortable with the government-induced architectural project of the Changzhi Baihe. Overall, it was not their culture. However, the interviewee was still grateful and did not say that Tzu Chi or the government were bad.

The interviewees also said that they would not be able to buy such a big house (referred to permanent housing) in the city, so they (the residents) should be thankful for this extra house and could not ask for anything more.

Difficulties and Improvements in Tourism Development

Changzhi Baihe was not the original territory of the indigenous people, so no one would come to the community for sightseeing.

The farmland

Although the farming land was large enough (in Changzhi Baihe), the distance was far for the elderly.

No cemetery for burying relatives

In the beginning, there was no place to bury the community members. However, after the negotiation, a cemetery park was built in the original community of Ali village.

Change in satisfaction of the relocation

The interviewees said that many people did not adapt to the new environment at the beginning. Nonetheless, their sense of identity has also increased as time being. However, many people did not have enough income and took the original community as a forward base to develop their own business.

Future planning of the old tribe

1. Try to restore the slate houses and develop eco-tourism in Ali.
2. The current house on the mountain (on the cliff) could be developed into another attraction in the form of a disaster museum.

Interviewee's suggestions for post-disaster reconstruction

In post-disaster reconstruction, the government had to seriously consider their (the residents) future livelihood. Therefore, it was essential to emphasize the linkage between new and old settlements, such as developing indigenous-related agricultural products and helping the indigenous economy.

Changzhi Baihe community interview

Interviewee: B. M. (Changzhi Baihe community representative)

Time of interview：2021/3/10

Place of interview: Changzhi Baihe settlement

Interviewee's stance and views on the housing demolition incident

The interviewees thought that the Rinari case was business use, unlike the Changzhi Baihe, a living space use, so it is more likely to be demolished. He thought people still had to follow certain rules while constructing the housing extension.

The government's current proposal and consensus on housing extension is "grow taller, not fatter," which can be discussed in more detail, as the current regulations are still not perfect. If some details can be discussed in the future, residents will be better able to comply.

There has been no in-depth discussion on the recognition and legality of the housing extension. However, the Rinari demolition incident had provided an opportunity to discuss the fairness and reasonableness of the matter.

Insufficient living space for households

The interviewee said that living space planning was too mean during the design stage, and many households had to build additional rooms. In addition, households did not agree on the size of the extension and often reported each other (as the illegal extension). It was also observed that the original kitchen was moved to the backside to increase the space for use. The permanent housing design did not consider storage space for the indigenous people, so the resident piled up their stock on the second floor.

Many residents expressed their wish to build additional barns in front of their houses, which were part of the Rukai culture, and needed to dry crops and store them separately. However, the request had not yet been responded to by the government.

Public space issues

1. Recently, the community planned to use NTD 30 million from the "Foresight Project" to build a long-term care center at the back of the community, but there was no construction company willing to implement it due to the project's cost, so the project has been delayed.
2. The indoor activity space was not enough, and the outdoor activity space was also restricted to the weather conditions (wind and rain problems). The church space was not very suitable.
3. There was not enough space for community offices.

Problems in the development of the tourism industry

1. There was not enough housing space, so it is unlikely to promote hospitality industries.

2. The only possibility was to use the resources of the original village to promote tourism, unlike Rinari, which had the conditions to develop tourism on-site.

Problems of agricultural development

1. The interviewee felt that the government did not have a comprehensive policy to support the promotion of the agricultural industry, such as growing red dragon fruit with high production value. However, the market supply was ample, so it is impossible to maintain reasonable prices and stable income.
2. The community had leased three pieces of land from the Taiwan Sugar company. However, because of the unstable income from farming, the community cannot maintain livelihood and rent, and Lot 1 and 2 had been returned to the Taiwan Sugar company, while Lot 3 was shared by six people.
3. With the withdrawal of the government, the lack of counseling has led to poor agricultural development.
4. The interviewees said that the Rukai people miss their original community and keep farming, so they are currently farming on the Changzhi Baihe community and on a small piece of land in front of their house.
5. Some people in the community are currently using water pipes for irrigation, but the drawback is that the water bill is too high (6,000-7,000 NTD/month), and the chlorinated water is not suitable for plants.
6. The government encourages the residents to return to their hometowns for farming and tourism development. However, because they hold the property right of their housing in their hometown, they cannot stay overnight in their houses and spend too much money on transportation.

Jialan community Interview

Interviewee: L. W. (Age 55, Paiwan, Jialan village leader)

Time of interview: 2019/3/10

Place of interview: West Jialan settlement

Family composition

Interviewee, his mother (tribal chief), his wife (Paiwan princess), and three children

The quality of living in the past

The interviewee said that the quality of life in the temporary houses was good. However, the shortcomings were that the structure was not strong enough and the problem of sound insulation.

Reasons for deciding to use reinforced concrete structure (RC) instead of Hsieh's (Hsieh Yin Jun) light steel structure system

After living in a temporary house, the interviewee felt that the structure was not strong enough and called the villagers to discuss what kind of structure should be used to build the permanent house, and finally decided to use the RC structure.

Problems of the permanent house

1. The east side of the permanent house required a 90-degree turn to enter the door. Therefore, the coffin would not be able to enter.
2. The house had a water leakage problem, and the windows did not fit entirely into the window frames.
3. The height of the rain shelter was not high enough, so the interviewee felt oppressive and hot.

Public Space

The interviewee described that other tribes had a lot of churches and playgrounds (than his community). However, the interviewee felt that this has a lot to do with limited funds and the lack of land in the Jialan community.

Livelihood issues

The community's population was about 1,500 people, and the agricultural output and economic efficiency were low. On the other hand, the professional military was better paid, so most people chose to join the military.

The construction of permanent house extensions

1. The interviewee had built a front yard extension, moved the kitchen to the back of the permanent house, and built a suite on the second floor with a partition.

The interviewee explained that the residents thought that the outdoor area was the living room and a place to receive guests in Paiwan culture.

Disaster Prevention and Rescue

Recently, they (community residents) implemented the flood radio system. So when they knew that the water level was rising, the observers could immediately broadcast it over the radio instead of going to the village office. In addition, they had been going to other communities to share their disaster prevention experiences.

Planning configuration of the east and west bases

The interviewee said the configuration of the Jialan west was better than Jialan east due to the single housing unit planning, while the east side had to build duplexes because there was no land available for the permanent houses. Also, the government had great difficulty in acquiring construction land.

Jialan community Interview

Interviewee: S. X. (61 years old, retired primary school director)

Time of interview: 2019/3/1

Place of interview： West Jialan settlement

Opinions on the temporary house

The interviewee's mother and sister had lived in a temporary house, but he did not. In terms of satisfaction, the interviewee stated that a temporary house was just a transitional period. Those who change from small to big (size of the house) would feel satisfied, while those who change from big to small would feel dissatisfied. The interviewee's original home had 240m^2 (approx.), so he was not satisfied. However, in the short term, temporary housing was still helpful. Nonetheless, the government had to treat all households equally (one size for all), so it could not fully satisfy the requirements of each household.

Comparison of the quality of living in permanent housing and temporary housing

Respondents were grateful to World Vision (who built the temporary housing in the Jialan community) and the permanent housing policy but still felt that the quality of permanent housing was better than the temporary one.

Problems of permanent housing

The design did not take into account the convenience of living, such as the placement of farm equipment and the lack of living space, so each household had an extension. After Typhoon Morakot, the resident personally reflected (the problem of permanent housing) to President Ma Ying-jeou and gave him some opinions. The reason why the interviewee's request was not fully implemented was unknown. However, he also said that many people would actually build work huts on top of the hills (near the community), and many people were still used to living in work huts on the hills.

Post-disaster resettlement and reconstruction agenda

The respondent agreed with the policy of leaving the village but not the county policy because some elderly people do not like to leave their hometown. During the evacuation period, he had also assisted in the resettlement and management of the victims at Jie Da Elementary School (where served as the initial evacuation center for Jialan residents). He also had applied to the Rotary Club for 55 ten-person tents, and he was responsible for the external affairs while his wife was responsible for the internal affairs.

The Xinxing Junior High School principal, Mr. Herman Cheng, and Ms. Heung-Jun Kuo, helped transmit information (opinion from the residents) to the government, which led to the construction of the new temporary house.

Choice of building materials

The community considered that safety was important, so when choosing whether to use RC or light steel construction for the permanent house, they felt that RC was better.

Public space of the community

The tribal leader wanted to do the cultural transmission and build the main spiritual house, so the government had to work on it (legal procedure).

Quality of living in permanent housing

The respondent was satisfied with the quality of cooking, bathing, sleeping, privacy, and space in the permanent housing.

Life story

The interviewee worked with the Council of Indigenous Peoples chairman in Taipei for about four years, and he retired as the director of the elementary school.

Permanent House extension

The interviewee used bamboo as the primary material for the extensive construction. He also planted some indigenous plantations in the surrounding area.

Jialan Community Interview

Interviewee: C. M. (50 years old, Paiwan)

Time of interview: 2019/3/10

Place of interview: East Jialan settlement

Her husband, a retired professional soldier, was not in the tribe, so the interviewee handled most of the community affairs

Interviewee's family composition

At the time of (permanent housing) application, four family members, including the mother-in-law, passed away before moving in. Hence, the interviewee, the interviewee's husband, and one daughter were living together.

Allocation of temporary house and resources

There were some problems in the allocation of resources. Not all of them lived in a temporary house, which caused the dispute among villagers.

Suggestions for permanent housing

Interviewees suggested RC is the preferable material for permanent housing because typhoons often come therefore the light steel structures should be avoided.

Problems faced by permanent housing residents

1. The residents of permanent housing in the east and the west(part of the community) were more or less opposed to each other.
2. In (elementary) school, teachers would divide the children into affected and non-affected households, resulting in comparisons between students.
3. Interviewees think that resources should be properly distributed. Some people get too many resources that they did not really need.

The quality of the permanent house in the Jialan community

1. Water towers were installed in all the permanent houses on the east side, and the water from the towers cannot be drained from time to time.
2. There were water leaks in the interviewee's house, especially in the places where two pipes cross.

Modifications and additions to the permanent house

1. Sometimes things (e.g., coffins, according to the Paiwan tradition, the coffin need to be moved into the house for a while) can't be moved in, so the interviewee removed the handrail of the stairs or knocked down the windows to make a big door to let things in.
2. The interviewee added blinds to the strong wind and rain. Because of the burning wind in Taitung, the

interviewee often has to turn on the air conditioner in summer.

3. Because the kitchen fumes could not be exhausted, the interviewee would like to build a kitchen in the back to cook food.

4. The front yard of the permanent house on the west side was too low, so most households would raise the roof height by about 30 cm when building a new front yard extension.

5. The interviewee participated in the discussion of housing design but was not a core person.

Permanent housing base problem

Interviewees said that there was a problem of ground sinking, about 3cm annually.

Community industries development

1. The interviewees have been working hard to promote community development in the tribe, building thatched and stone houses (traditional housing style) and doing tribal education with other community leaders.

2. The slate house in the tribal square was used for the youth club and tourism, so the lintel was higher than the ordinary slate house.

3. The interviewees said that the temporary office initially built at the height of the east side was not used after the new office was built. As a result, they felt that the government was wasting money.

4. The church was initially planned, but the government later told people that there was no space, so the church was not built.

Interviewees' views on temporary houses and permanent houses policy

The interviewees thought that the policy of temporary housing was well-designed.

The residents of permanent housing in other areas of Taitung, such as Taniao and Dawu, came to see the permanent housing in Jialan and thought that the conditions and quality of the permanent housing in Jialan were better than theirs.

Appendix 2: Housing measurement result

The 28 households analyzed in chapter six had been presented. Each household was presented with the household's basic information, photos, and spatial measurement result. The numbering of the households was corresponded with the numbering presented in Figure 6.12. However, due to the household's opinion and privacy concerns, households No. 3, 8,13, 22, 24, 25, and 28 were not shown. Moreover, the settlement level housing extension areas of Rinari and Changzhi Baihe were presented.

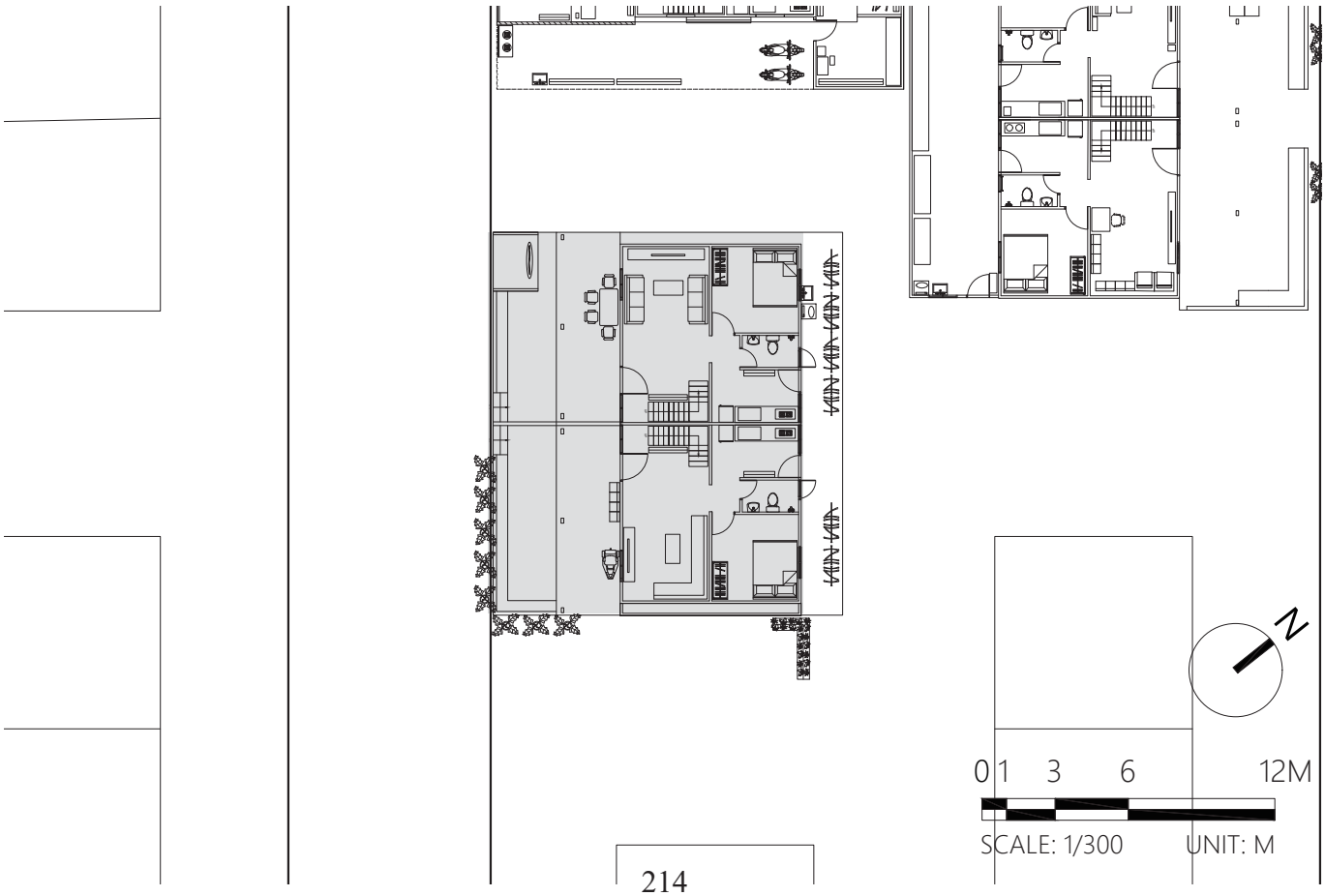
HOUSING INFORMATION

Interviewee: Mrs. Ku Chen
Sex/Age: 70 (Approx.)
Occupation: House keeper

House type: Duplex
Area (sq. m): 43.73
House ID: 1

HOUSING PHOTO

HOUSING PLAN



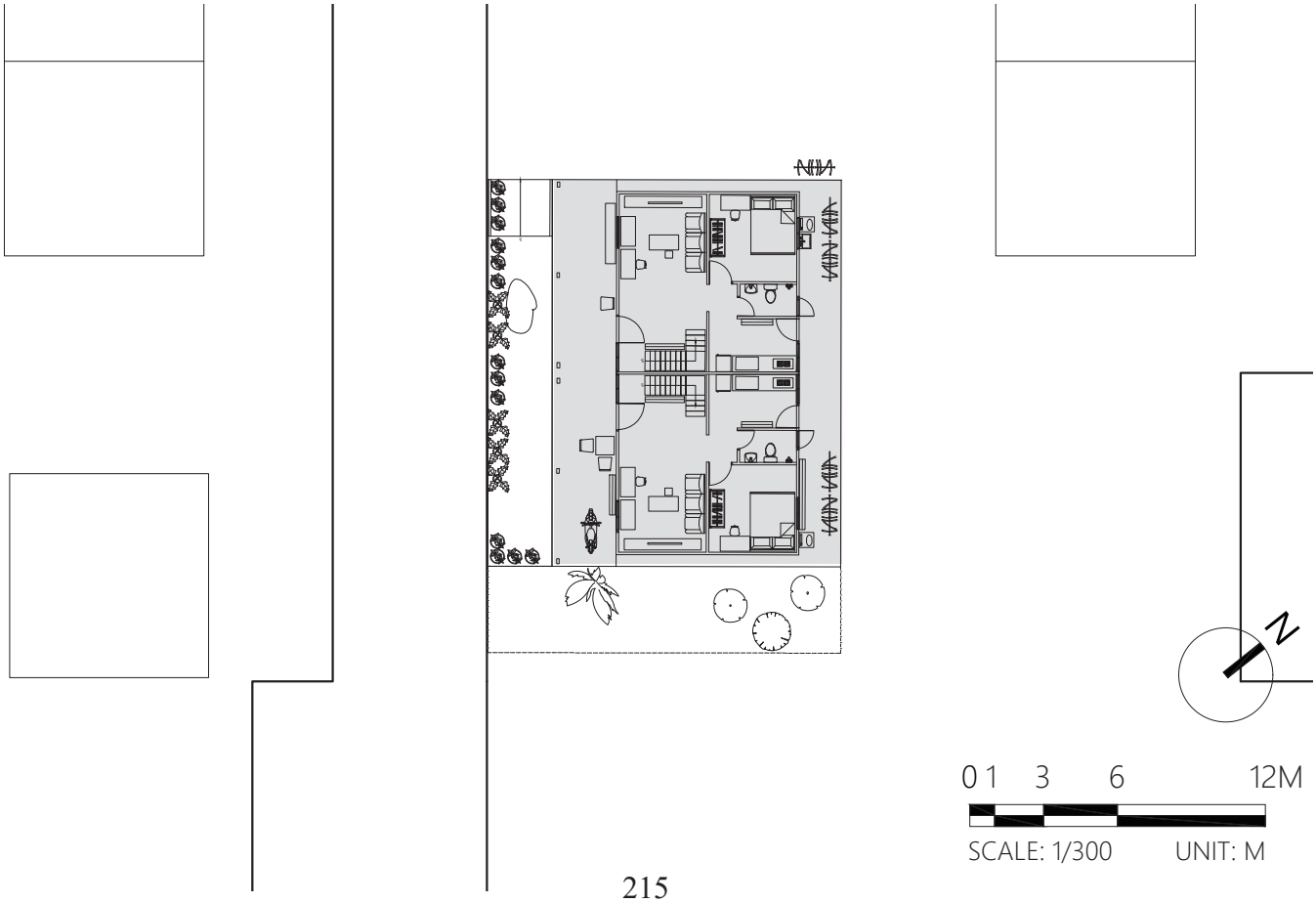
HOUSING INFORMATION

Interviewee: Mr. Jiang
Sex/Age: 40
Occupation: Factory worker

House type: Duplex
Area (sq. m): 43.88
House ID: 2

HOUSING PHOTO

HOUSING PLAN



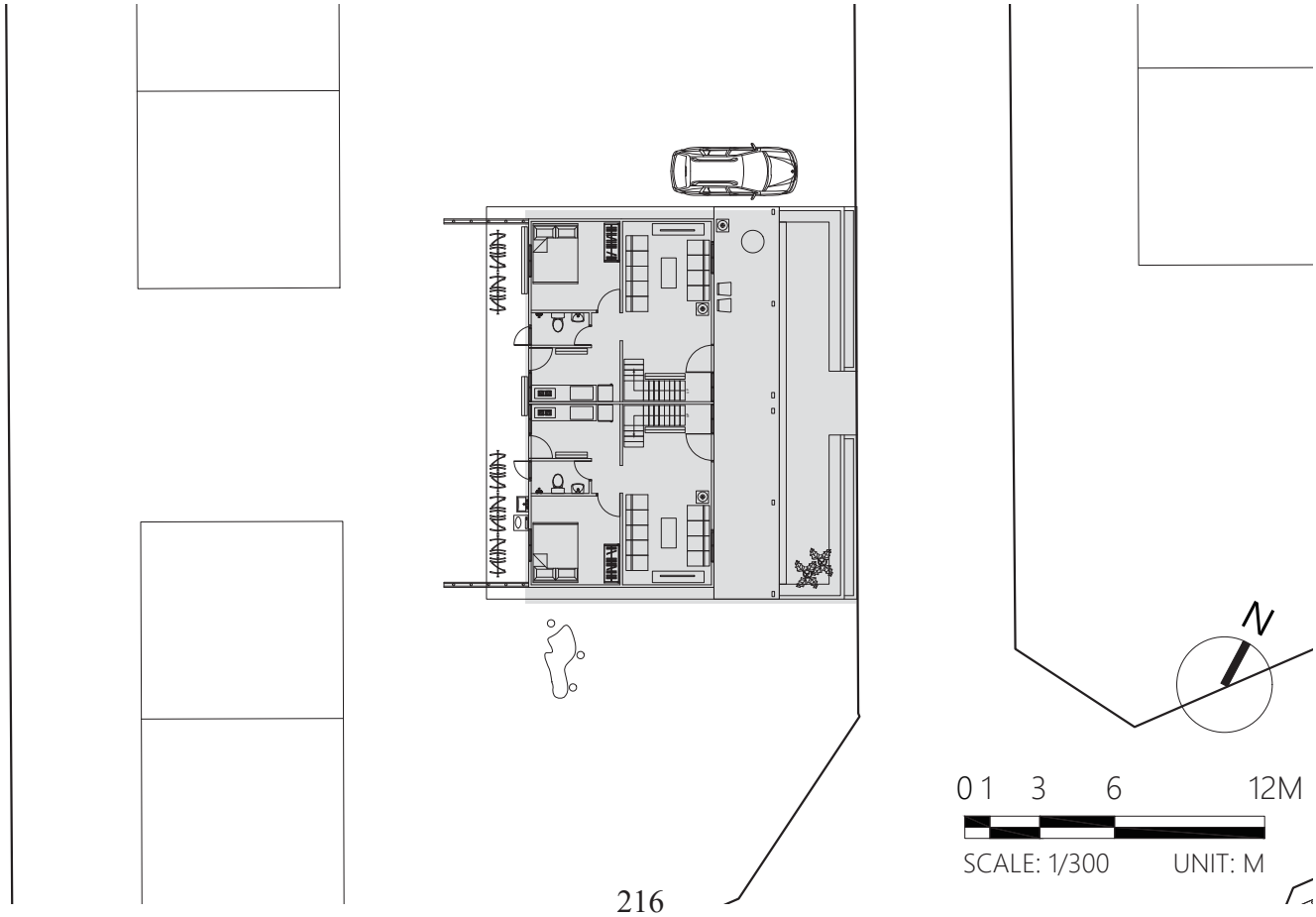
HOUSING INFORMATION

Interviewee: Mr. Young
Sex/Age: 36
Occupation: Office worker

House type: Duplex
Area (sq. m): 48.92
House ID: 4

HOUSING PHOTO

HOUSING PLAN



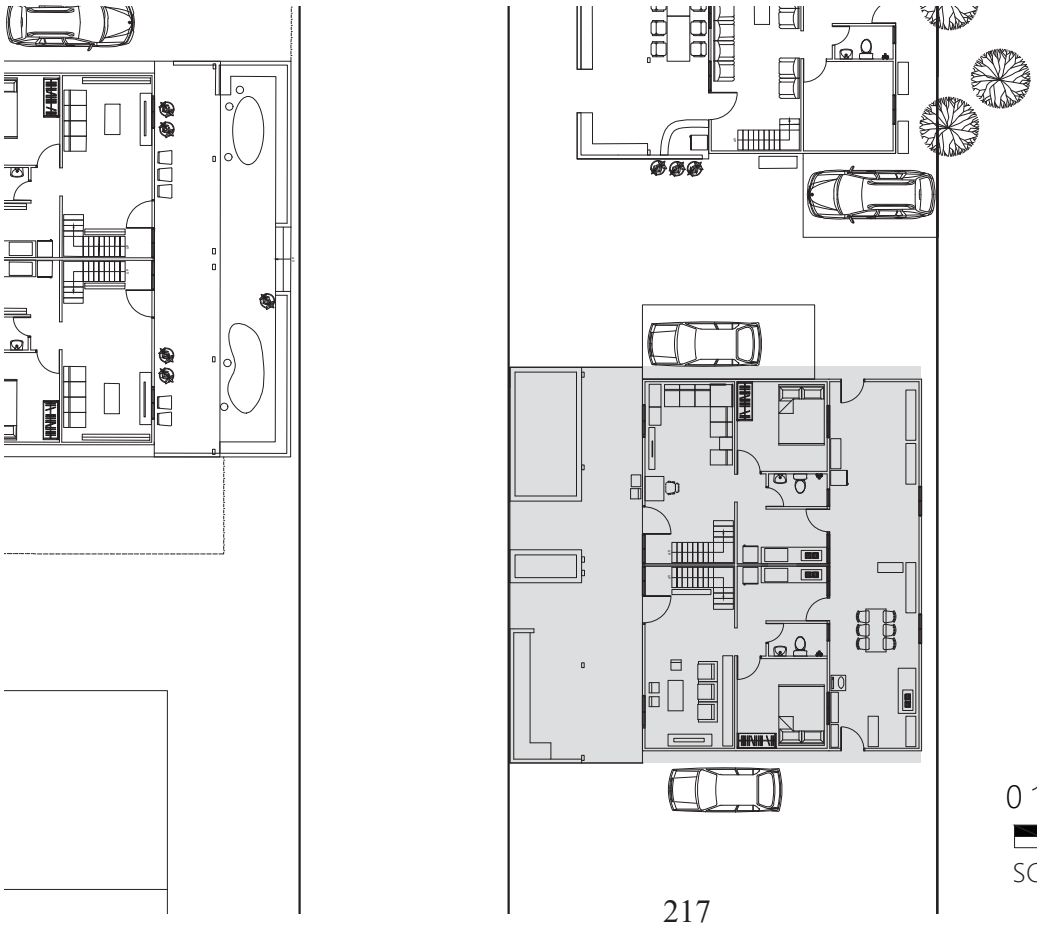
HOUSING INFORMATION

Interviewee: Mr. Chen
Sex/Age: 75
Occupation: Teacher (retired)

House type: Duplex
Area (sq. m): 98.4
House ID: 5

HOUSING PHOTO

HOUSING PLAN



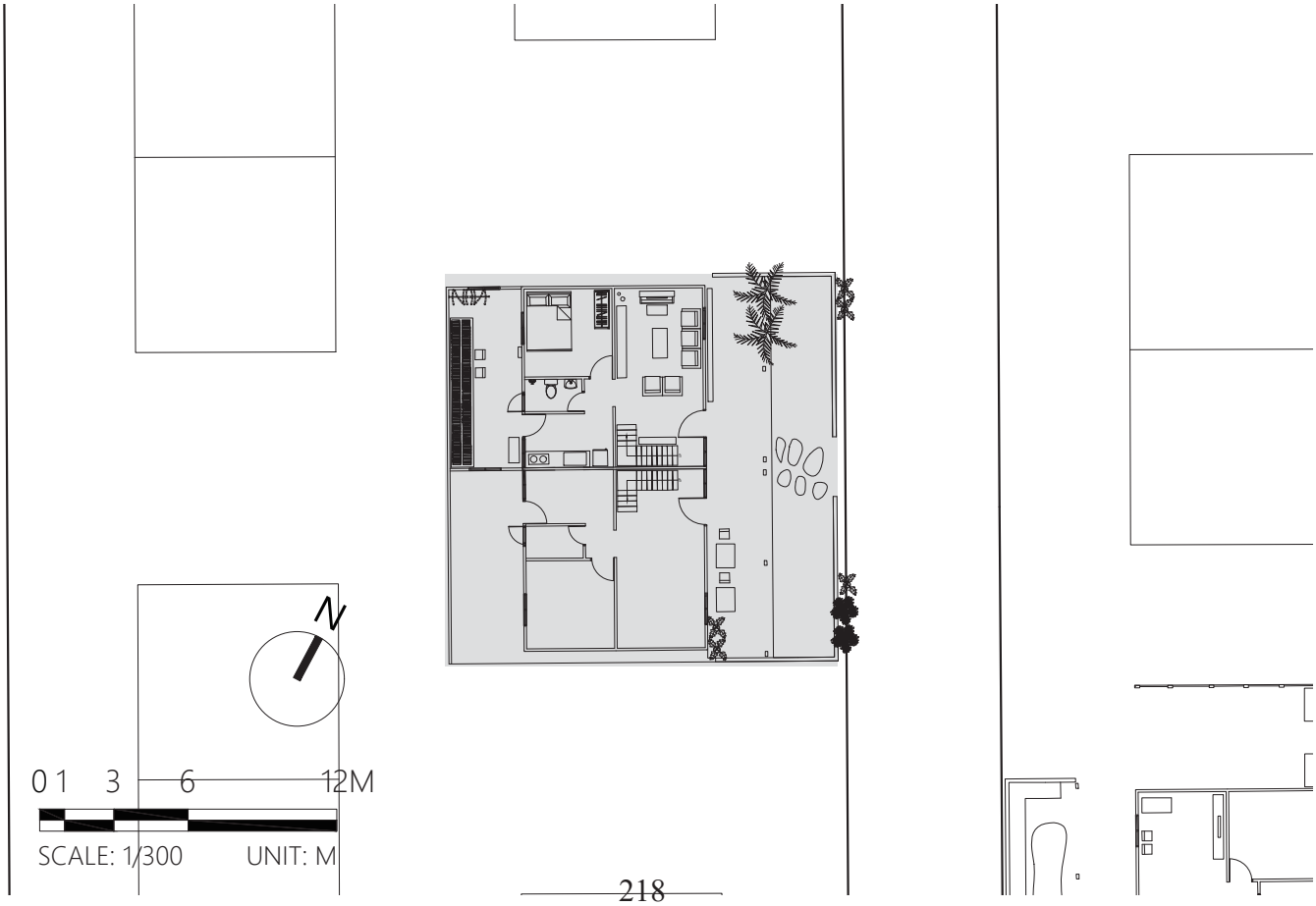
HOUSING INFORMATION

Interviewee: Mr. Chung
Sex/Age: 72
Occupation: Prist

House type: Duplex
Area (sq. m): 90.84
House ID: 6

HOUSING PHOTO

HOUSING PLAN



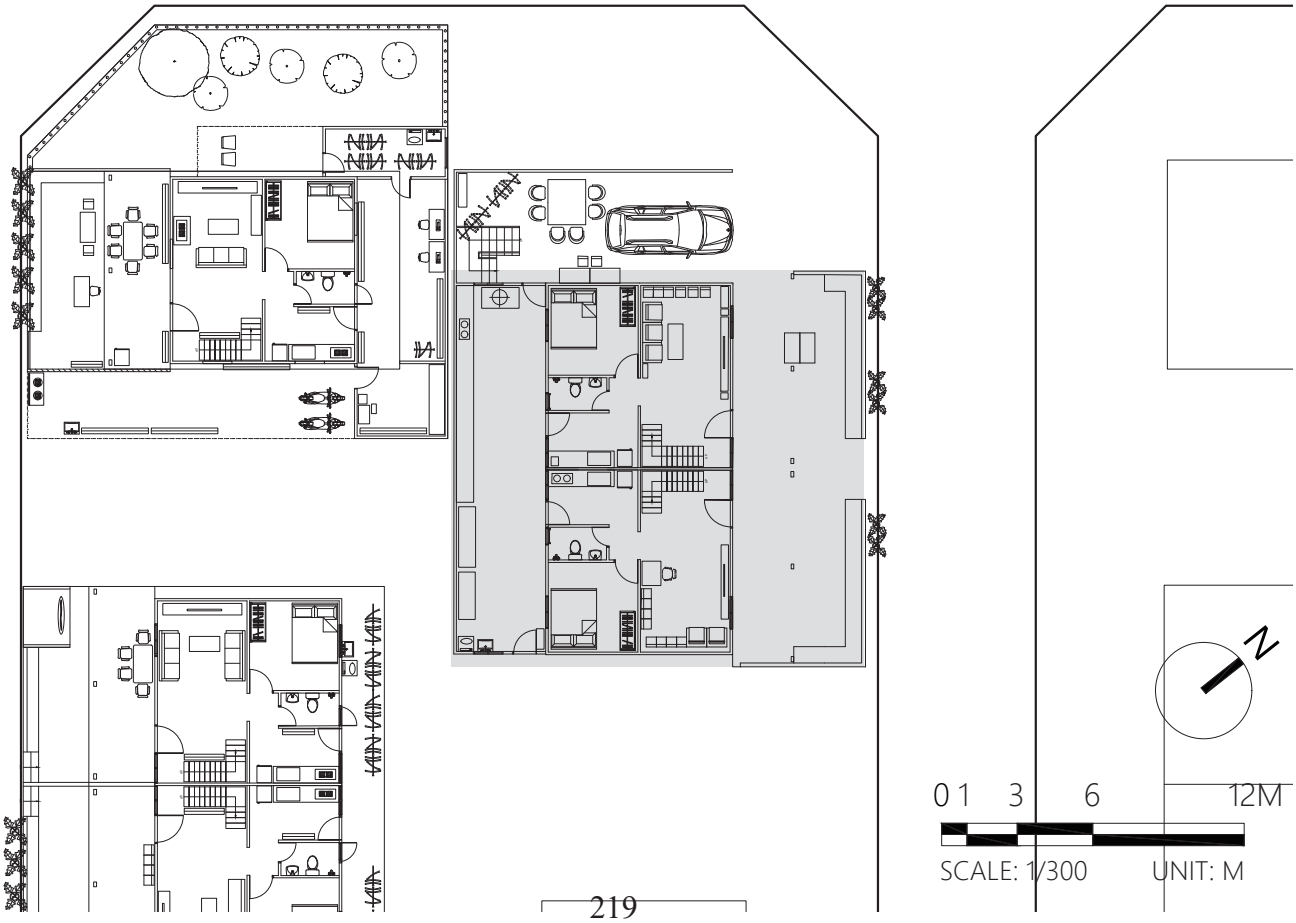
HOUSING INFORMATION

Interviewee: Mr. Hsu
Sex/Age: 40 (Approx.)
Occupation: Office worker

House type: Duplex
Area (sq. m): 88.82
House ID: 7

HOUSING PHOTO

HOUSING PLAN



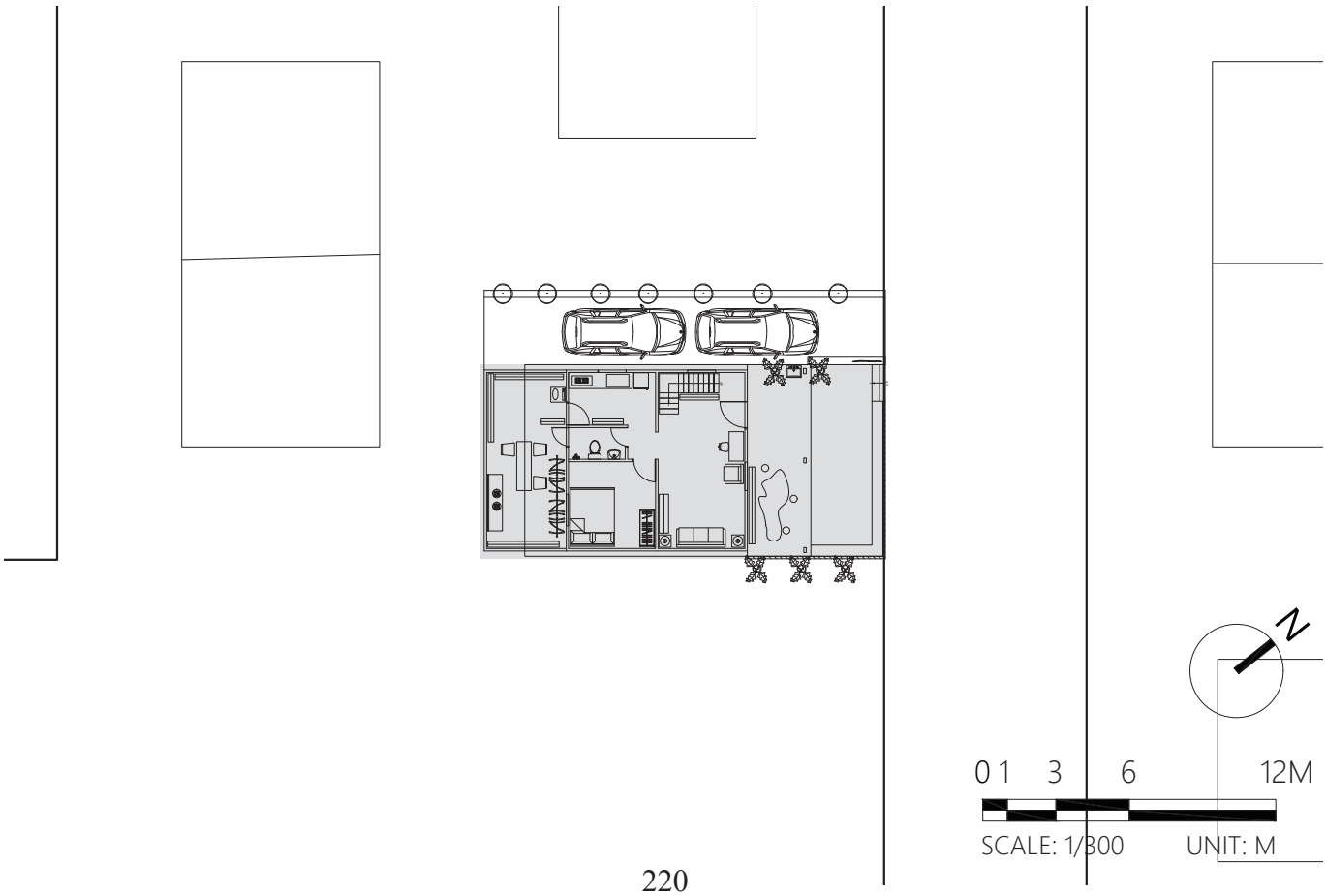
HOUSING INFORMATION

Interviewee: Mrs. Shih
Sex/Age: 48
Occupation: Coffee retailer

House type: Single
Area (sq. m): 51.35
House ID: 9

HOUSING PHOTO

HOUSING PLAN



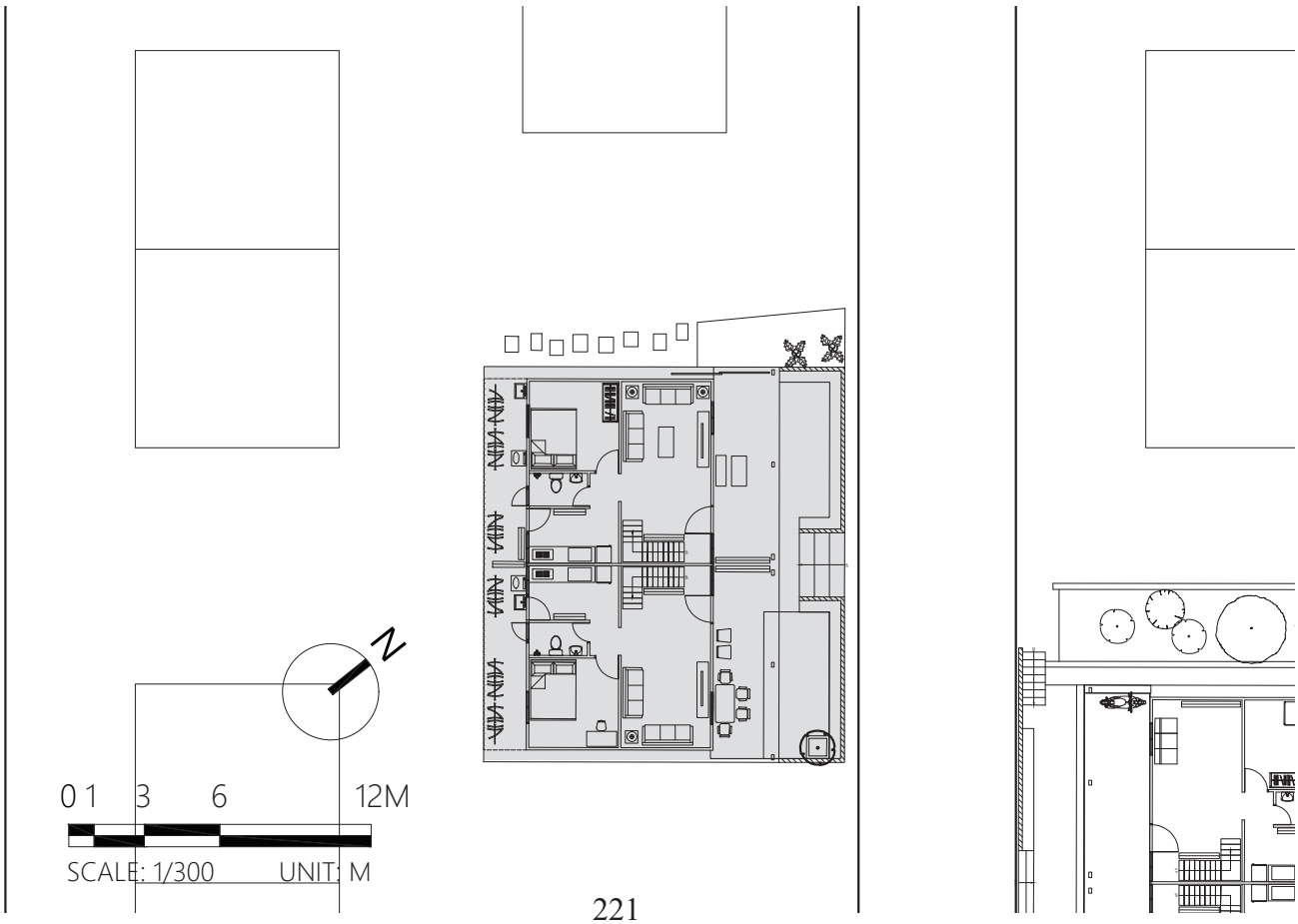
HOUSING INFORMATION

Interviewee: Mr. Chiu
Sex/Age: 60 (Approx.)
Occupation: Writer

House type: Duplex
Area (sq. m): 70.33
House ID: 10

HOUSING PHOTO

HOUSING PLAN



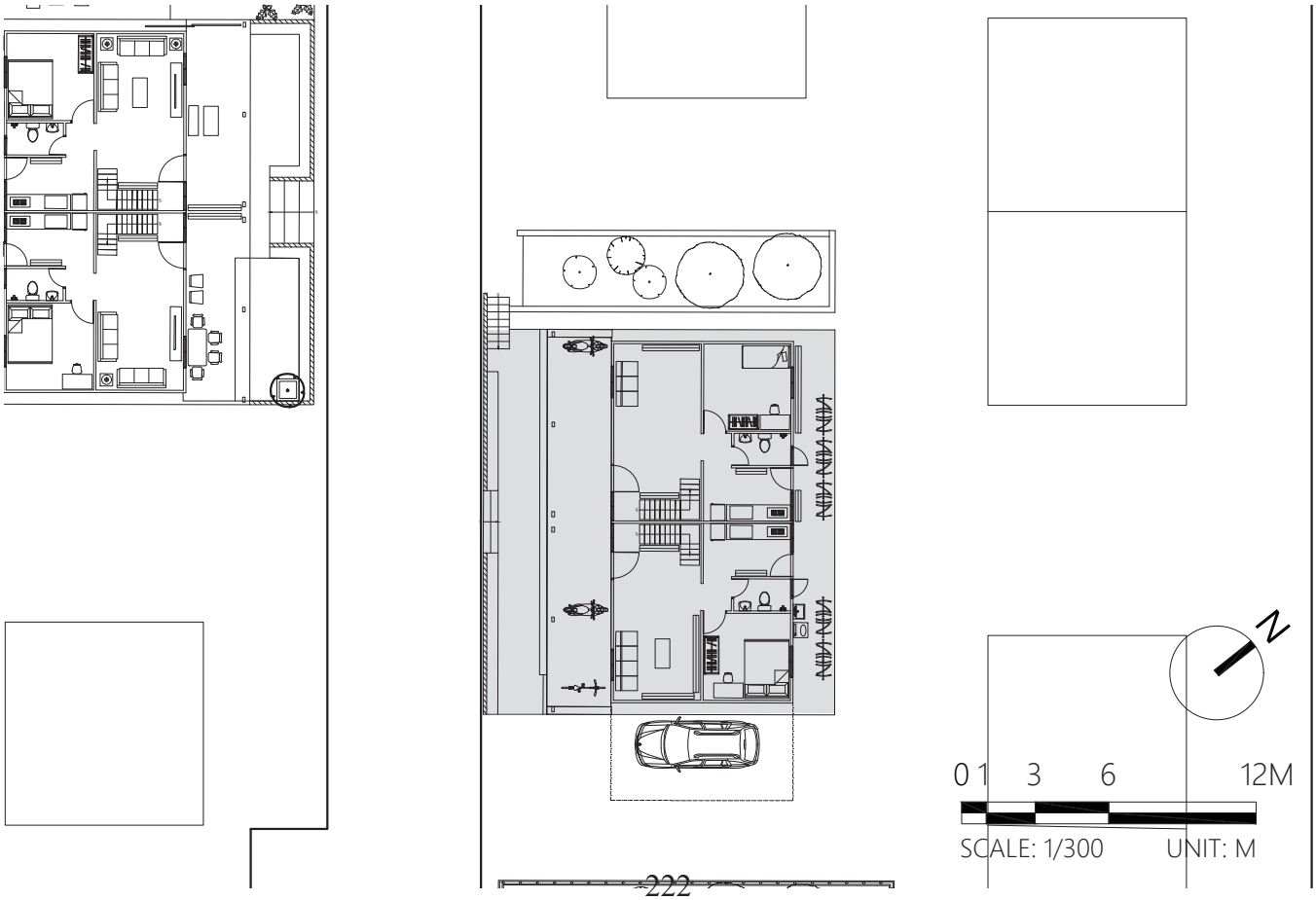
HOUSING INFORMATION

Interviewee: Mr. Kuo
Sex/Age: 60 (Approx.)
Occupation: Military (retired)

House type: Duplex
Area (sq. m): 70.48
House ID: 11

HOUSING PHOTO

HOUSING PLAN



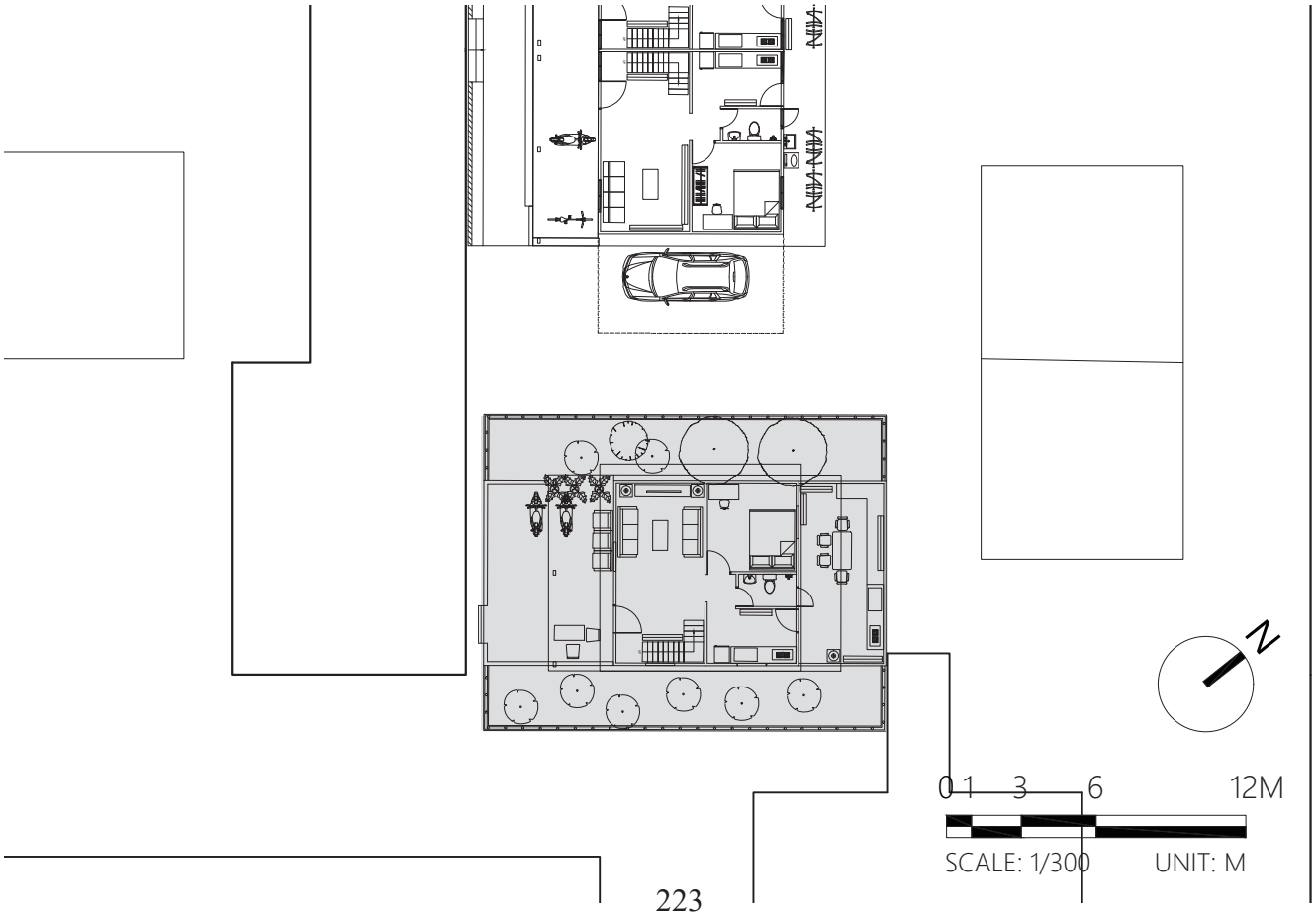
HOUSING INFORMATION

Interviewee: Mr. You
Sex/Age: 50 (Approx.)
Occupation: Community worker

House type: Single
Area (sq. m): 46.67
House ID: 12

HOUSING PHOTO

HOUSING PLAN

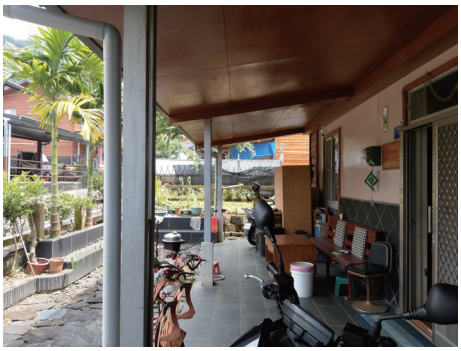


HOUSING INFORMATION

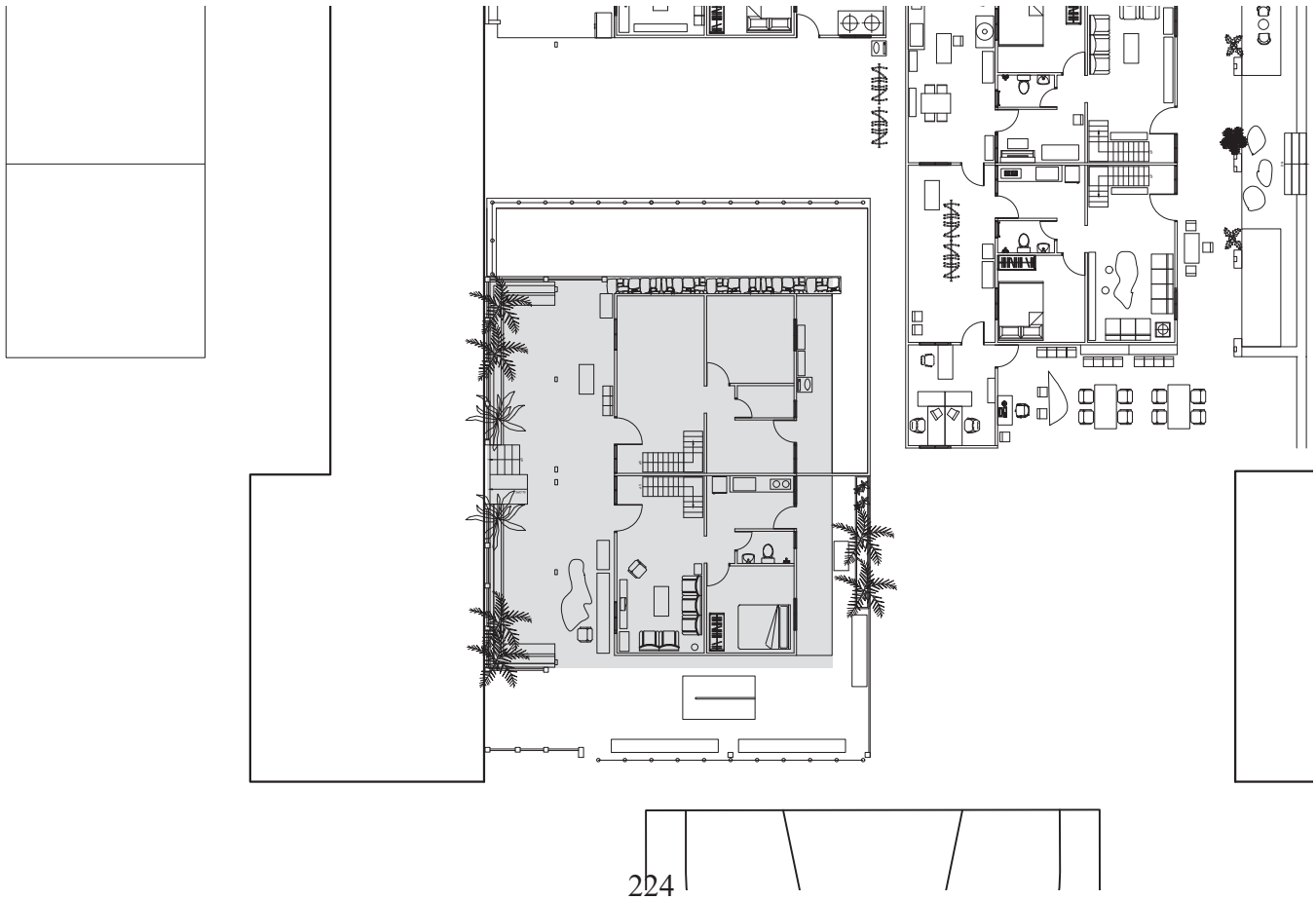
Interviewee: Mr. Chou
Sex/Age: 40
Occupation: No occupation

House type: Duplex
Area (sq. m): 150.68
House ID: 14

HOUSING PHOTO



HOUSING PLAN



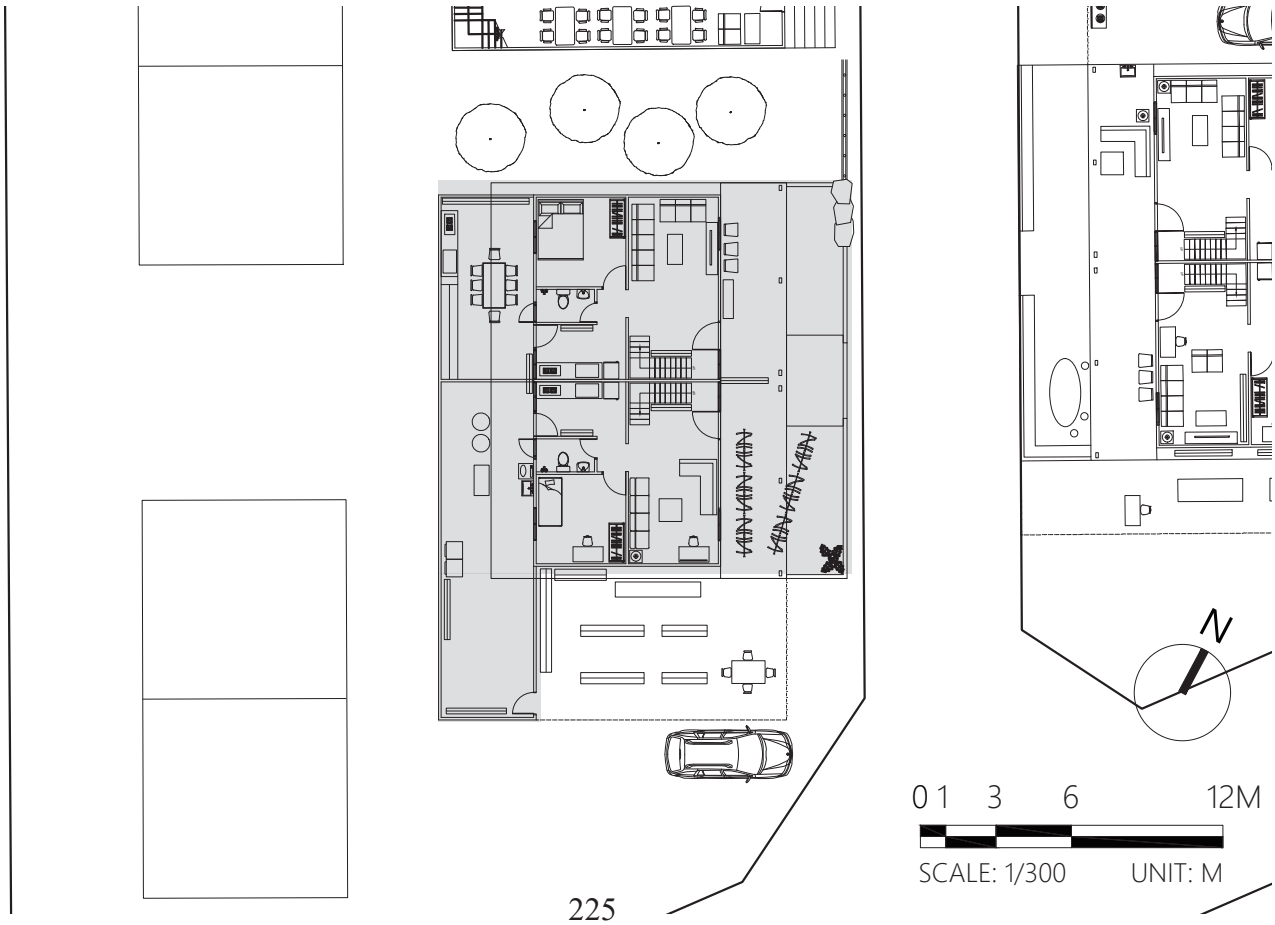
HOUSING INFORMATION

Interviewee: Mr. Jiang
Sex/Age: 50 (Approx.)
Occupation: University Professor

House type: Duplex
Area (sq. m): 164.28
House ID: 15

HOUSING PHOTO

HOUSING PLAN



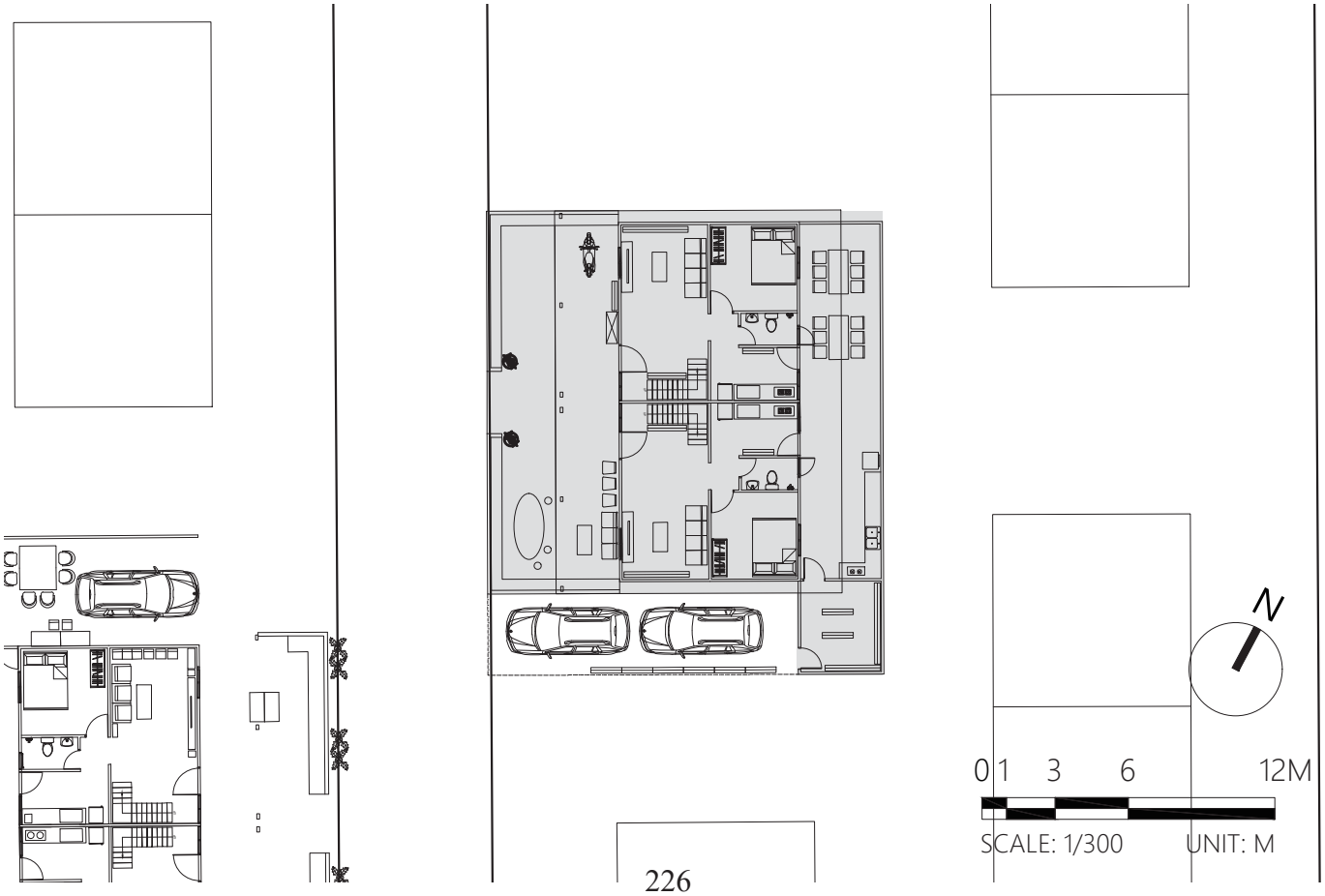
HOUSING INFORMATION

Interviewee: Mrs. Peng
Sex/Age: 58
Occupation: Office worker

House type: Duplex
Area (sq. m): 138.63
House ID: 16

HOUSING PHOTO

HOUSING PLAN



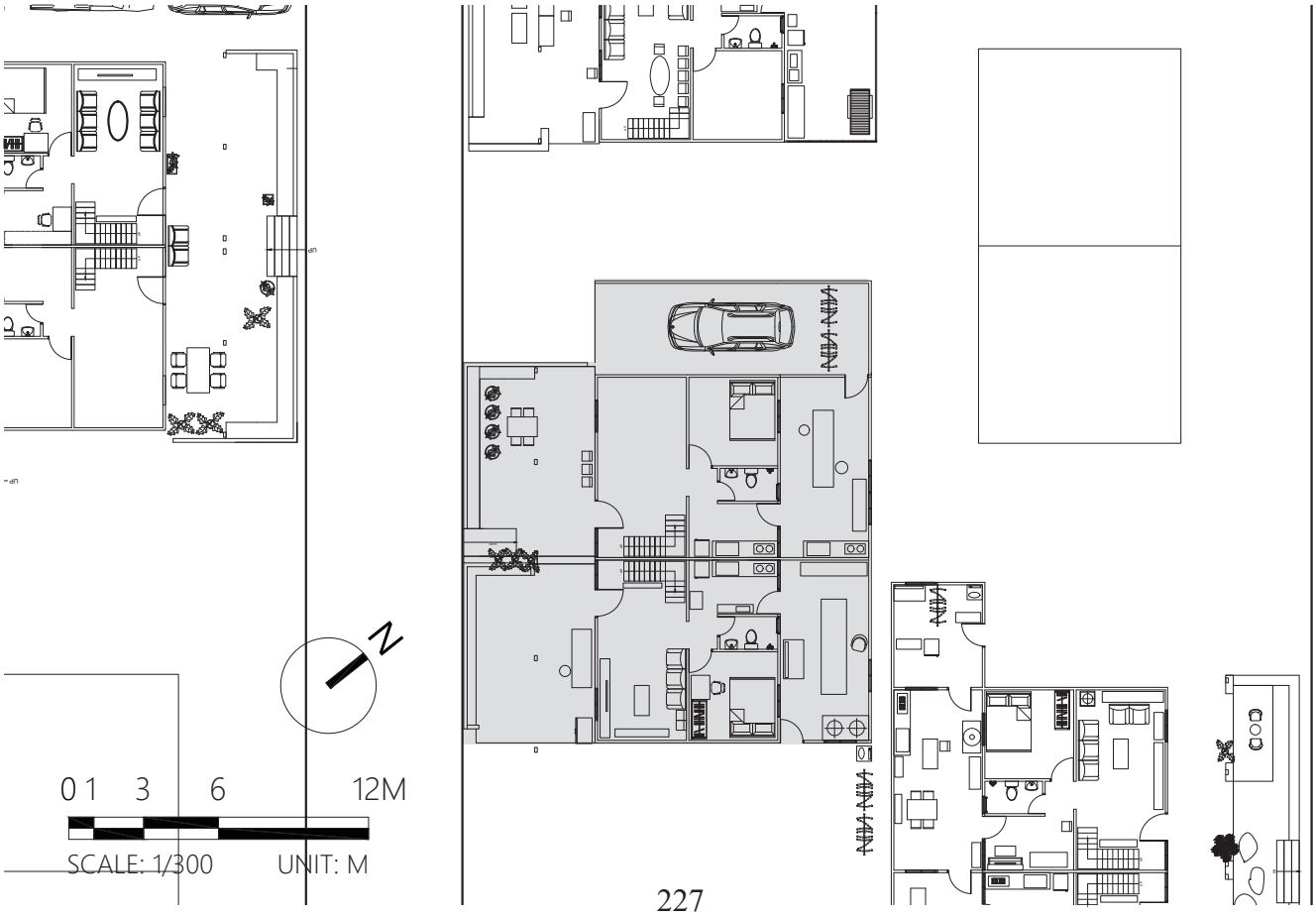
HOUSING INFORMATION

Interviewee: Mrs. Chen
Sex/Age: 60 (Approx.)
Occupation: Restaurant owner

House type: Duplex
Area (sq. m): 137.5
House ID: 17

HOUSING PHOTO

HOUSING PLAN



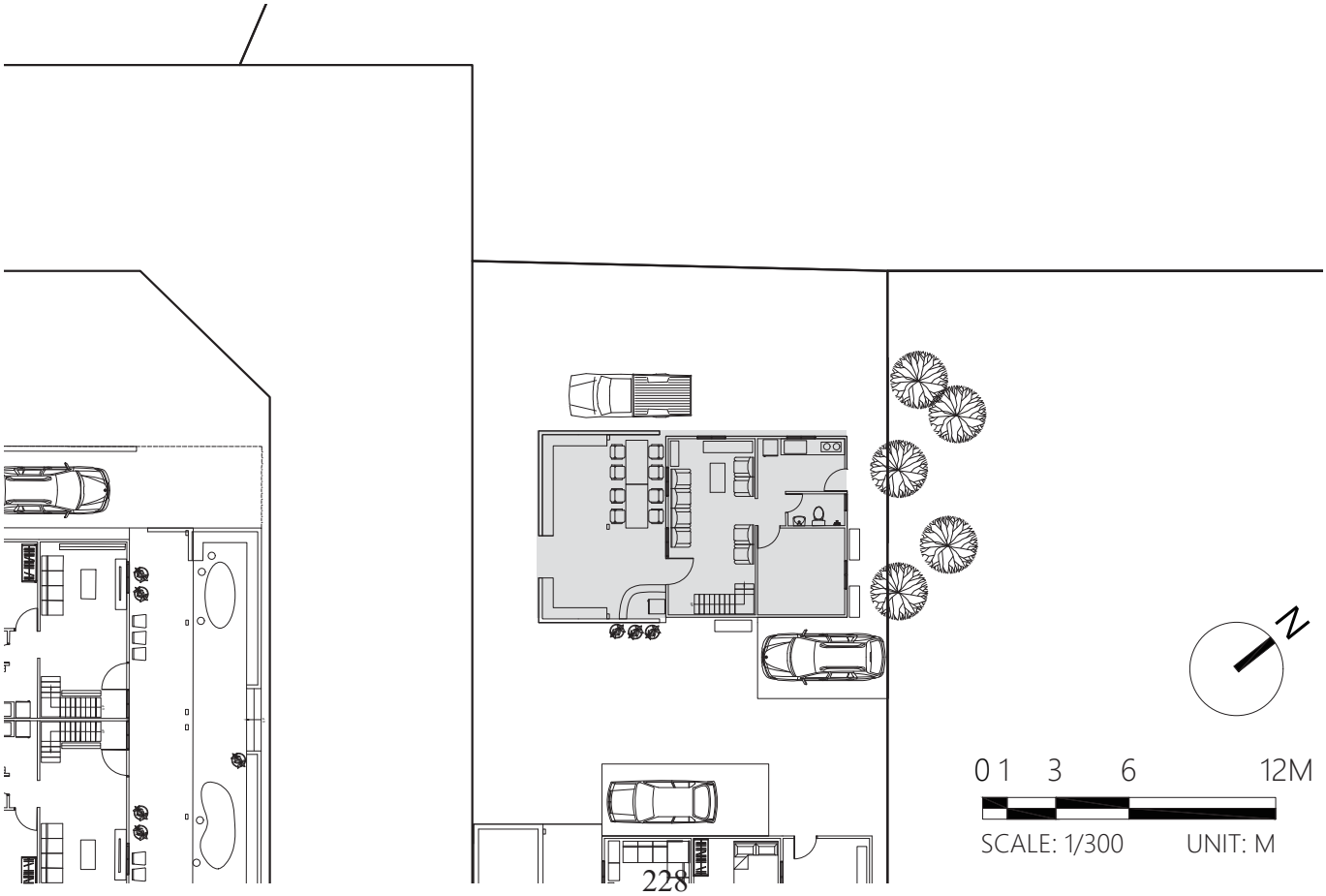
HOUSING INFORMATION

Interviewee: Mr. Jiang
Sex/Age: 33
Occupation: Restaurant owner

House type: Single
Area (sq. m): 107.5
House ID: 18

HOUSING PHOTO

HOUSING PLAN



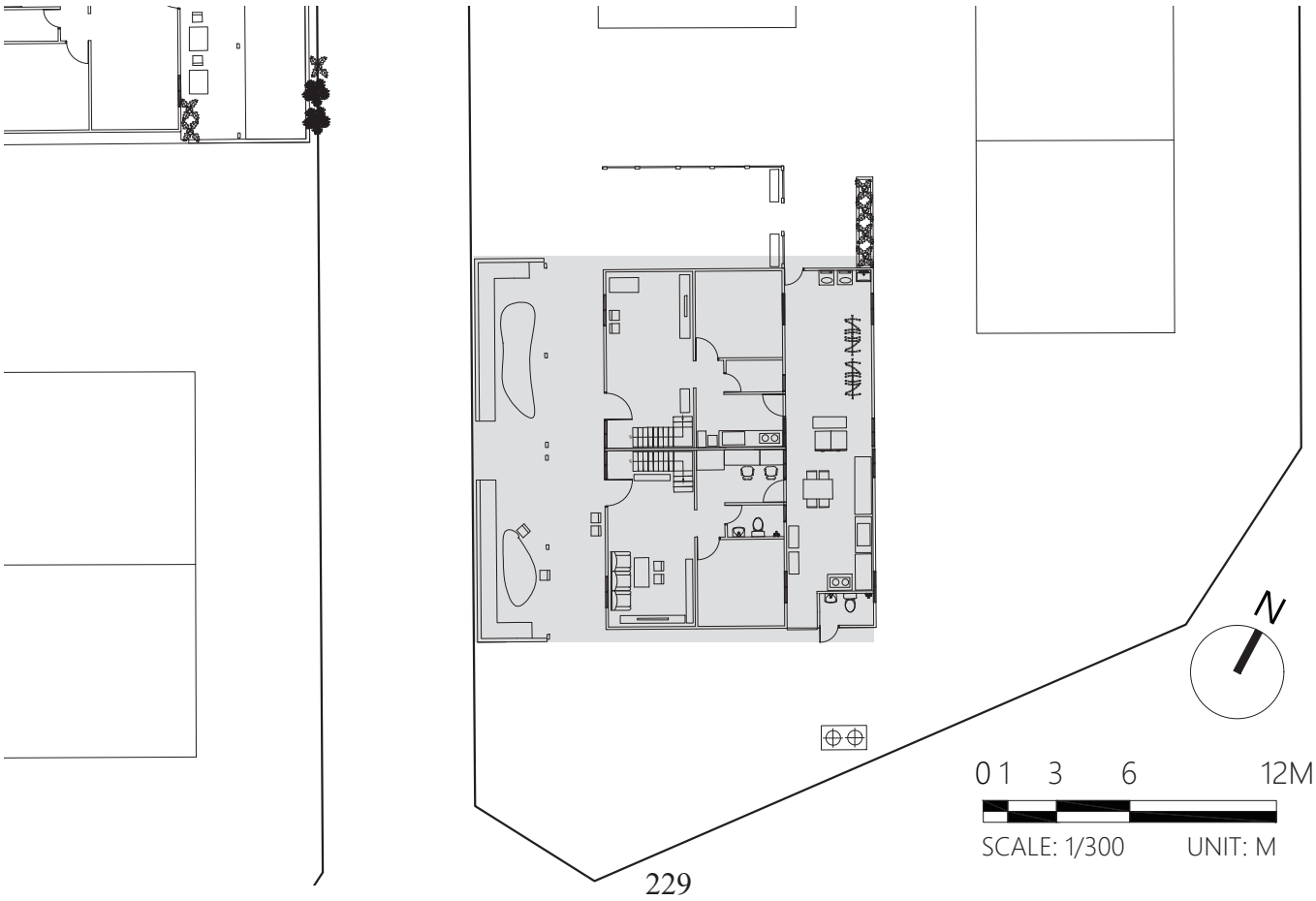
HOUSING INFORMATION

Interviewee: Mr. Du
Sex/Age: 71
Occupation: Government related (retired)

House type: Duplex
Area (sq. m): 143.12
House ID: 19

HOUSING PHOTO

HOUSING PLAN



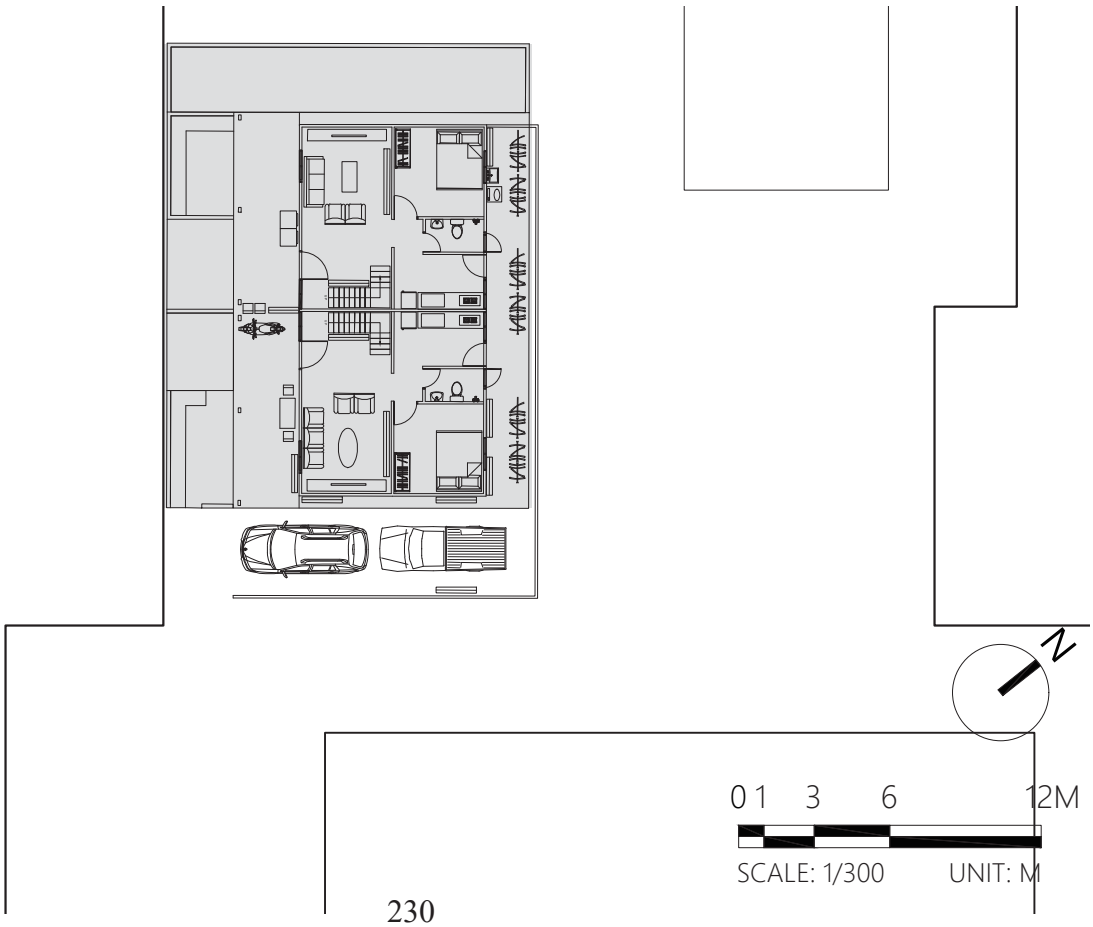
HOUSING INFORMATION

Interviewee: Mr. Chen
Sex/Age: 72
Occupation: Former village leader

House type: Duplex
Area (sq. m): 122.91
House ID: 20

HOUSING PHOTO

HOUSING PLAN



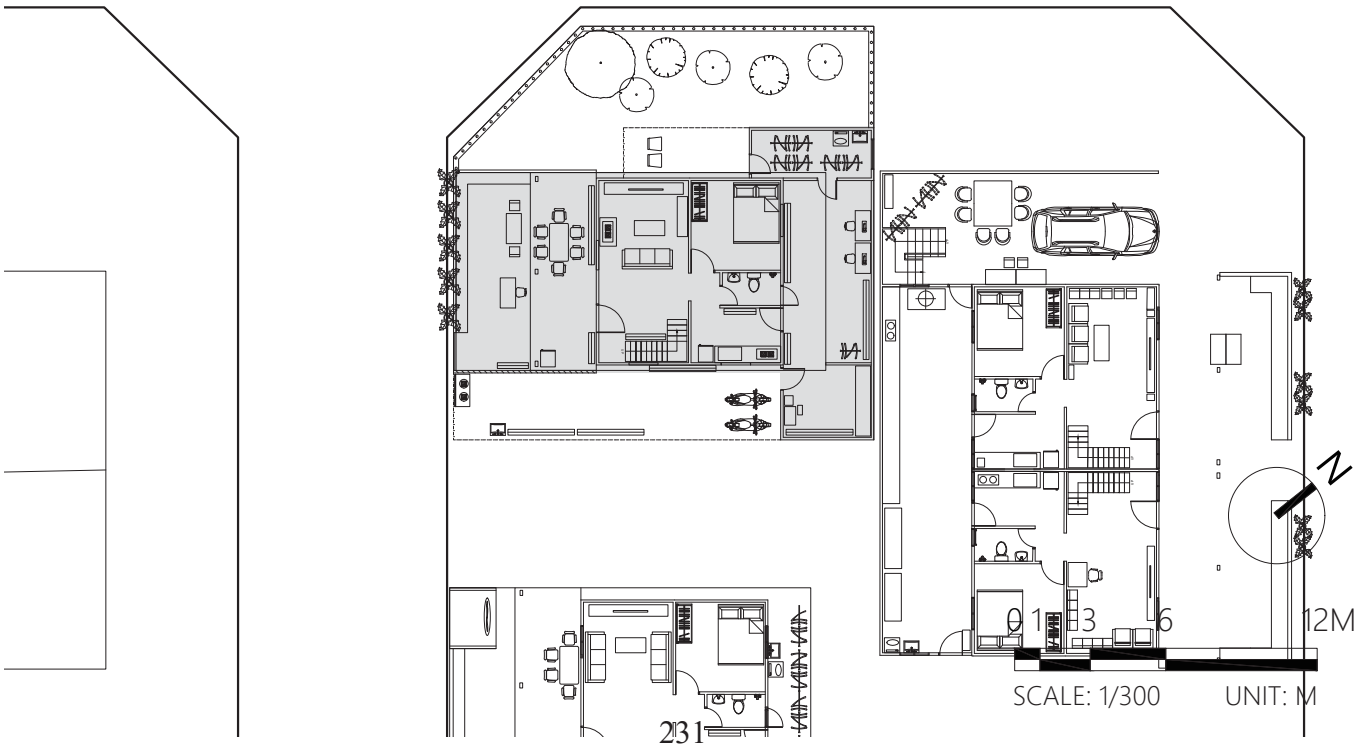
HOUSING INFORMATION

Interviewee: Mr. You
Sex/Age: 50 (Approx.)
Occupation: Restaurant owner

House type: Single
Area (sq. m): 73.92
House ID: 21

HOUSING PHOTO

HOUSING PLAN



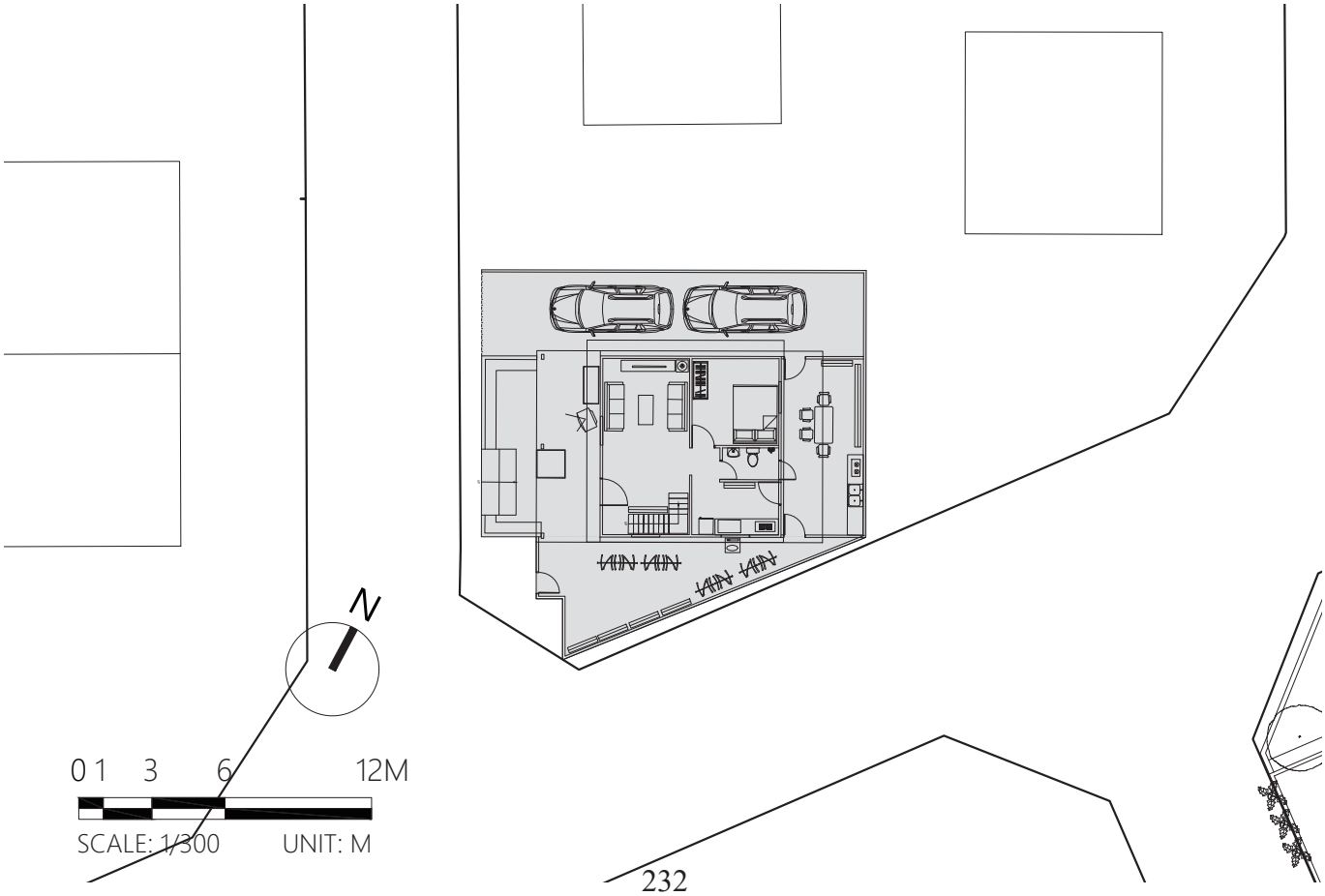
HOUSING INFORMATION

Interviewee: Mr. Lin
Sex/Age: 60 (Approx.)
Occupation: Retired

House type: Single
Area (sq. m): 130.48
House ID: 23

HOUSING PHOTO

HOUSING PLAN



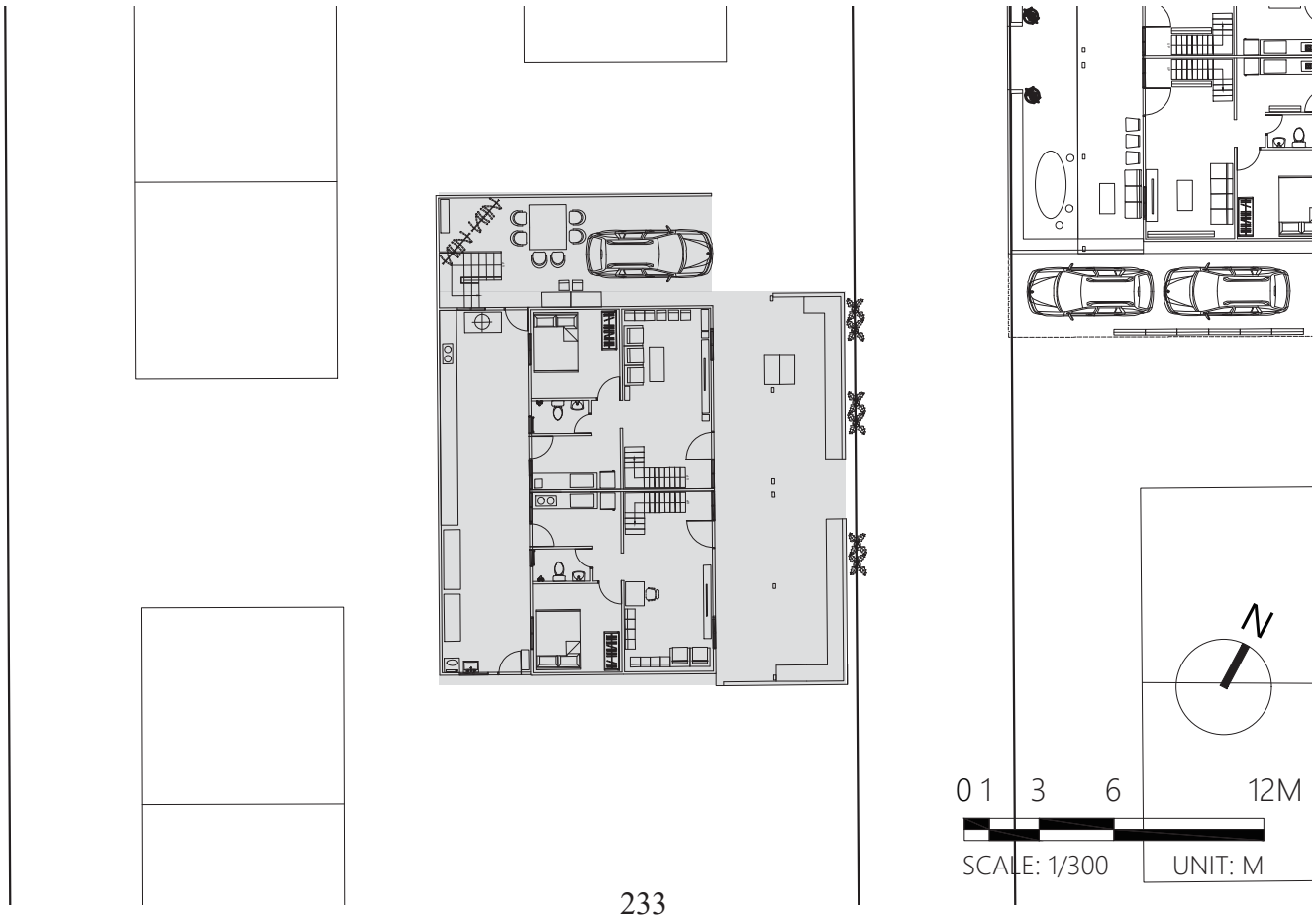
HOUSING INFORMATION

Interviewee: Mrs. Lan
Sex/Age: 68
Occupation: Teacher (retired)

House type: Duplex
Area (sq. m): 198.71
House ID: 26

HOUSING PHOTO

HOUSING PLAN



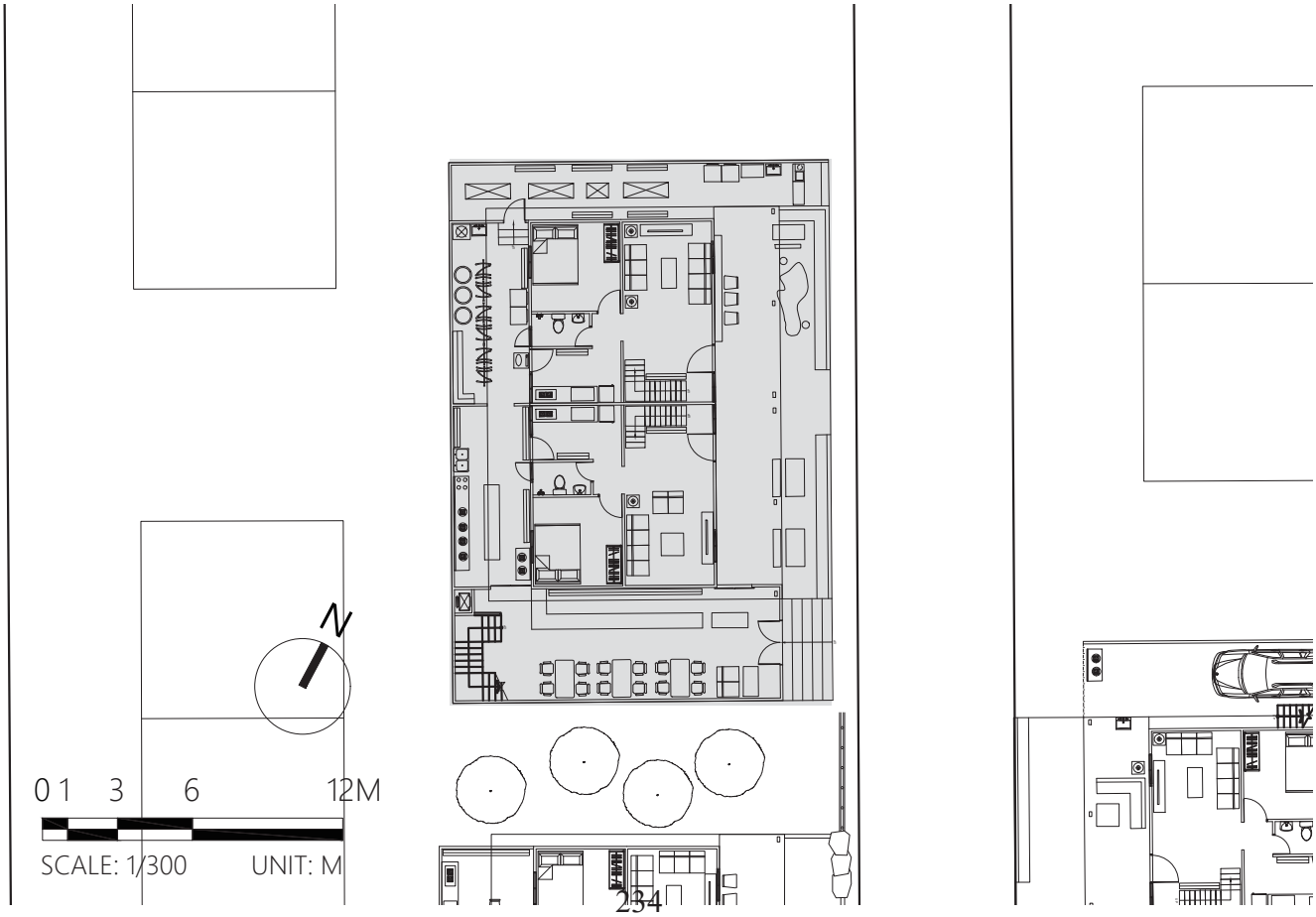
HOUSING INFORMATION

Interviewee: Mr. Lee
Sex/Age: 43
Occupation: Association leader

House type: Duplex
Area (sq. m): 319.27
House ID: 27

HOUSING PHOTO

HOUSING PLAN



Housing extension in Hao-Cha Rinari

Legend : Front Back Side extension

0 15M 45M 90M 130M

SCALE: 1/1500 UNIT: M

Housing extension in Changzhi Baihe-1

Legend : Front Back Side extension

0 10M 30M 60M 100M

SCALE: 1/1000 UNIT: M

Housing extension in Changzhi Baihe-2

Legend : Front Back Side extension

0 10M 30M 60M 100M

SCALE: 1/1000 UNIT: M