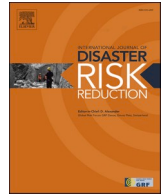




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Uprooted by tsunami: A social vulnerability framework on long-term reconstruction after the Great East Japan earthquake

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ABSTRACT

As climate change accelerates and the frequency and intensity of natural hazards increase, the world is threatened by slow and sudden environmental changes. Under these circumstances, people are displaced and forced to move, often to places unwanted. This study attempts to understand how the mechanism of social vulnerability shaped the movement of people by exploring what uproots them, in this case, using the municipalities in Miyagi Prefecture, a site affected by the Great East Japan Earthquake and Tsunami. The process of reconstruction following the disaster consists of mega buffer-zoning and moving communities to higher ground, called *Shudan-Iten* or *Takadai Iten* projects involving out-of-town temporary housing. The social vulnerability framework was used to analyse how post-disaster responses of the municipalities and long-term reconstruction plans for build-back-better affected the movement of people. Research findings show that its impact on residents was profound because of the magnitude of the disaster. Recovery plans emphasised risk reduction and time-consuming projects that led to environmental migration, communities' displacement, and the dismantling of social ties. Thus, the social vulnerability at the stages of evacuation, temporary housing, policy and planning, group relocation, and rural lifestyle and beliefs are all interconnected in shaping the outcome of the disaster. The study uses exploratory methods and multiple data sources for analysis, comprising interviews with municipality officials and residents, participant observation and direct observation. Secondary archival records were also used in the analysis, including briefing sessions, public census, results of questionnaires, official recovery policy documents, newspaper articles and official records of public meetings.

1. Introduction

On March 11, 2011, Japan's northeast region was severely affected by a 9.0 magnitude earthquake followed by a 10 to 15 m-high tsunami. The disaster forced more than 400,000 people to evacuate their homes, thus exceeding the number of evacuees from the worst of some of Japan's earlier earthquake disasters, namely the Hanshin-Awaji and Chuetsu Earthquakes.¹ The Great East Japan Earthquake and Tsunami reconstruction process consisted of mega buffer-zoning and moving communities to higher ground, called *Shudan-Iten* or *Takadai-Iten* projects. In the coastal region of Miyagi Prefecture, one of the three most affected by the disaster, 195 projects were initiated in 13 of the 15 municipalities. In Miyagi Prefecture's Disaster Resettlement Framework, begun in December 2011, more than 15,000 public housing units were planned to be built in 174 districts in 21 municipalities from 2011 to 2015. However, by 2014, only

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¹ Hanshin Awaji Earthquake (1995) 307,022 evacuees and Chuetsu Earthquake (2004) 76,615 evacuees [56].

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1351 units were completed (Miyagi Prefecture Government, 2014). The displacement continued for more than five years, including in the coastal municipalities where affected residential areas fell under the buffer zones and were forced to wait for new residential communities. In 2017, 20,000 people were still displaced in Miyagi Prefecture.² In this prefecture alone, the proportion of out-migration reached 33.3% [1]. As a result, the coastal municipalities are speculated to become increasingly ageing communities [2]. Fig. 1 below illustrates the position of the affected prefectures and the ratio of the population changes in each affected municipality in Miyagi Prefecture. The different shades represent the percentage of decreased and increased population. It shows that while the overall municipalities exhibit population decrease, the coastal cities have a higher rate of population decrease. However, the capital city of Sendai and inland cities nearby coastal cities show an increase in population.

This phenomenon of population movement caused by sudden environmental change is frequently termed ‘environmental migration’ [3–5]. However, documenting environmental migrants in scenarios of either sudden or gradual changes in the environment is problematic because of the complex measures involved [6,7]. In the case of the Great East Japan Earthquake and Tsunami, applying the notion of environmental migration can be both an opportunity and a challenge because of the unique system of Japanese residence registration within and out ‘migrant’ data and lists of ‘evacuee’ data. Thus, it is problematic to identify the movement of people as ‘displacement.’ Previous studies examining the case termed the process ‘environmental migration’, discussing the differences in destination patterns and influencing factors of migration before and after the disaster [1,8]. Moreover, the population changes in Fig. 1 result from the change of address registration at the municipal level. Therefore, these movements can be speculated as natural disaster-induced environmental migration.

Despite the complication over terminology, the literature generated has contributed to deepening the understanding of migration after natural hazards, using the Great East Japan Earthquake and Tsunami case as the empirical basis for developing conceptual frameworks and methods of analysis. For instance, migration decisions and associated factors after the Great East Japan Earthquake and Tsunami disaster were examined using the extensive collection of individual and households data [9,10,11]. The results revealed that the exodus migration decision was influenced by the lack of employment opportunities, the severity of the damage, and the loss of human networks at origin [9,10,12]. Similarly, employment opportunities and property ownership influenced the decision to stay, even after the disaster [11]. Furthermore, in some cases, fear of losing human networks is a significant factor in relocation decisions rather than solely material capital [10]. A similar study on the migrant community in Japan also suggests that the decision to migrate is complex and happens more at a collective level rather than just at the level of the individual [13].

The factors that influenced disaster-induced migration at the collective level revealed that migration was determined by the extent of the damage caused by the natural hazard and the social vulnerability of people affected [1,14,15]. Unfortunately, socially-created vulnerabilities are often ignored in the studies due to difficulties with identification and quantification. Social vulnerability is usually described using individual characteristics (e.g. age, race, health, income, type of dwelling unit, employment). Social vulnerability is frequently defined as the product of political, economic and social inequalities and the combination of pressures that make some groups susceptible to risk and out-running the capability to cope [16,17]. However, in addition to the characteristics of people, it has been argued that examination should include spatial inequalities, such as “the level of urbanisation, growth rates, and economic vitality, that contribute to the social vulnerability of places” [14]; p. 243). The concept of vulnerability has been roundly criticised as a western discourse, downgrading and labelling the underdeveloped world as a dangerous and chaotic place that needed to be improved by the West’s standards [18]. However, recent studies on climate emergency and disaster risk demonstrate that social vulnerability exists in every segment of society worldwide [1,4,15,19].

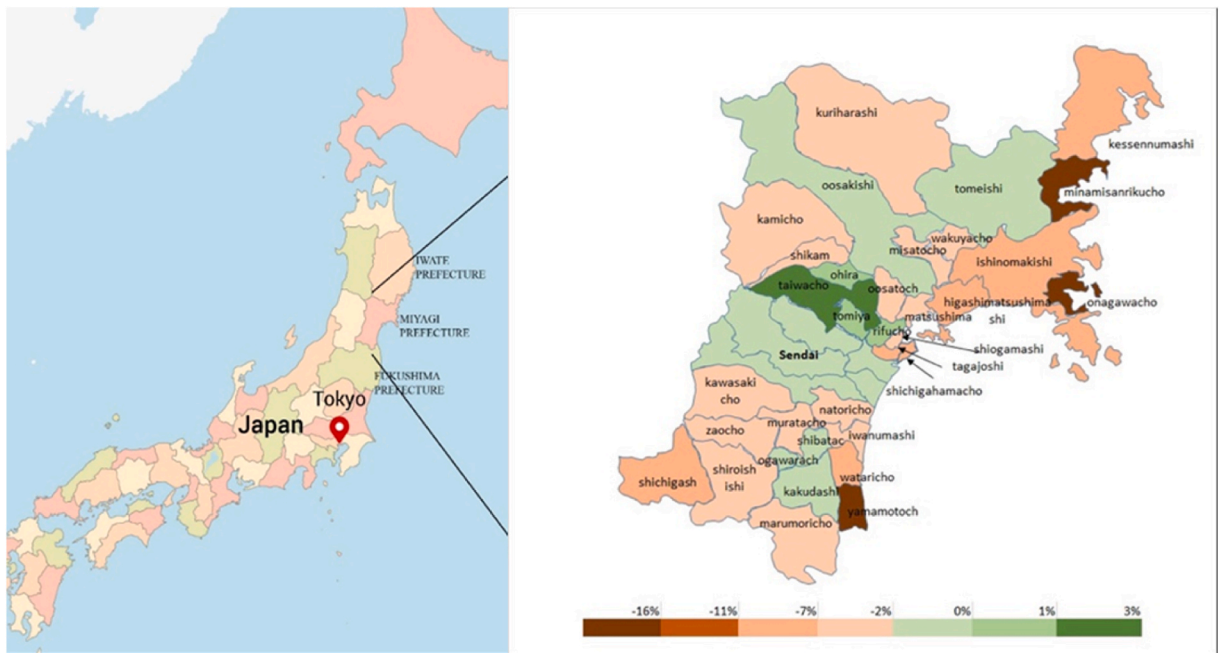
An important but underexplored aspect, particularly in Japan, is understanding how place-based social vulnerability contributes to migration after disasters strike. The Great East Japan Earthquake and Tsunami disaster unearthed vulnerabilities in the socio-political system that led to delays in the recovery due to local governments’ limited political space in the disaster governance system [20]. Pre-existing trajectories, such as inappropriate urban development, poor tsunami countermeasures and the belief systems of older people, exacerbated the loss of life [21]. The ‘build back better’ slogan reflects the reconstruction paradox in the Japanese case because the large-scale recovery program added to population decrease by hampering in-migration and driving residents out of affected municipalities [22]. Even though a rich collection of academic knowledge and contributions to disaster-induced environmental migration a decade after the disaster, understanding place-based social vulnerabilities in Japan and how they contributed to forcing people out of the affected municipalities is still lacking.

This study addresses this lack of knowledge. It analyses the reconstruction policies and responses of the local governments in the Miyagi Prefecture following the Great East Japan Earthquake and Tsunami through the lens of social vulnerability to understand the progression to the vulnerability that might have induced environmental migration in the affected municipalities. In this study, social vulnerability refers to the limitations of local municipalities and residents to shape plans for the recovery of their place of origin. The paper, firstly, introduces the problem, then presents a conceptual framework and methodology, followed by an outline of findings, a related discussion, and a conclusion. In the following section, the meaning of social vulnerability in the case of Japan is explained, and the application of the framework in linking the post-disaster reconstruction and disaster-induced environmental migration is described.

2. Understanding social vulnerability in Japan and applying a conceptual framework

The Japanese administrative system has a three-tier structure: national, prefectural and municipal. The prefectural level includes

² Displaced persons’ figures obtained from (Reconstruction Agency, 2017).



Source: Created by the author using data from the Geospatial Information Authority of Japan and the 2010-2011 Population Census.

Fig. 1. Percentage of Population change between 2010 and 2011 by Tsunami in Miyagi Prefecture (Estimated).

Source: Created by the author using data from the Geospatial Information Authority of Japan and the 2010-2011 Population Census.

the ‘To’, Tokyo metropolis, ‘Do’, Hokkaido region, ‘Fu’, Osaka and Kyoto, ‘Ken’ 43 administrative divisions. The basic municipal level includes ‘Shi, Ku, Cho, and Son’, meaning the city, special district, town and village, respectively [23]. The most basic economic and social units are ‘buraku’ or ‘shuraku’, clusters of settlements in rural settings which have no legal status under the modern Japanese system of governance [24]. Further, by 2006, rural Japanese municipalities were being merged, including Miyagi Prefecture. The purpose of the mergers was to increase the prefectural size and decrease the deficits of local governments that were financially dependent on the national government [25].

Within the disaster governance system, according to the *Disaster Countermeasures Basic Act 1961* (Japan), Japanese municipal governments are responsible for responding to and mitigating the effect of emergencies and promoting recovery after disasters [26]. The national, regional, and local governments will coordinate disaster prevention measures. Nonetheless, local governments bear most of the responsibility in mitigating local disasters [27]. Devolving disaster prevention responsibilities to local governments was regarded as a process of administrative decentralization [28]. The *Disaster Countermeasures Basic Act of 1961* s. 5.50 (Japan) describes local municipalities’ responsibility for disaster prevention: making the emergency announcement, providing evacuation information, and reporting to the prefectural government [26]. Based on the 1961 Law, local governments have absolute authority and decision-making powers to initiate and administrate disaster prevention measures.

However, other standing orders and laws also apply. One such is the *Disaster Relief Act of 1947* (Japan), relating to shelters, temporary housing building and management, and relief work after the disaster. Article of the *Disaster Relief Act 1947* s.22 (Japan) states that the governor of the regional government (prefectural government) is responsible for relief work. Following the *Decentralization Act of 1999* (Japan), the national government legally entrusted the administration of relief work to the regional government. Accordingly, the amendment to Article 30 of the *Disaster Relief Act 1947* (Japan) positioned the local government to assist the regional government relief work [29]. Based on this legal, institutional framework, local governments, regional governments, and the national government have overlapping roles and responsibilities. Moreover, because of the economic conditions of the small municipalities and the current financial distribution system, local governments need to rely on assistance from the national government, especially for financial assistance. Under all circumstances, local governments are obliged to execute administrative functions related to relief, resettlement, and reconstruction and respond to residents’ demands in disaster-affected regions [28].

The Basic Recovery Policy for the Great East Japan Earthquake and Tsunami disaster was established on July 29, 2011, and the earliest municipality’s recovery plan was established in September 2011. The municipalities were not obligated to develop recovery plans, and it is voluntary. However, in Japan, it is a custom for municipalities to design and plan recovery plans [30]. The recovery plans were established at the municipality level as an administrative process, but the actual plans may differ at the district level [31]. The basic concepts of which included: targets, implementation strategies, budget allocations, recovery from the nuclear disaster, and assistance framework. The term of reconstruction was ten years. In addition, the multi-stakeholder approach was introduced and stressed the role of the national government as the provider of finance. Furthermore, it underlined the prefectural government as the

mediator for macro-level recovery while recognising the municipalities as a significant stakeholder. In the 7th section of the policy, a reconstruction agency was proposed to promote fast recovery and coordination.

The policy stressed several points that had implications for reconstruction and spatial planning (*Chiikizukuri*). Firstly, the policy included statements such as 'New Tohoku' and 'Creation of the new era of Tohoku', implying that the reconstruction was meant to change aspects of the Tohoku region. This region includes six prefectures in the northeast region of Japan, three of which are the severely affected Iwate Prefecture, Miyagi Prefecture and Fukushima Prefecture (Fig. 1). According to the Policy, the spatial planning of Tohoku employs three dimensions: structure, industry, and the energy sector. The Tohoku region suffered from a decrease in population even before the earthquake and tsunami disaster. Therefore, policymakers were conscious of population shrinkage in coastal areas and were cautious of overspending. Incentives were given to attract corporate investment and venture capital to attract the younger generation. In addition, self-sustained and renewable energy was proposed to solve needs in the energy sector.

Such reforms were not new to the region. It repeats a history of disaster capitalism, as Kline [32] explains, where reconstruction is overshadowed by promoting national economic growth and energy security. After the Sanriku Earthquake of 1933, the Showa Reconstruction Plan demonstrated a similar approach, where industrialisation and economic growth overshadowed disaster reconstruction [33,34]. The reconstruction plan was aimed to diversify beyond the production of rice and fisheries [35]. As part of the reconstruction, two electric power companies were established, Tohoku Kogyo Company and Tohoku Shinko Electric Power Company. In the first 11 years after the Sanriku Earthquake, small power plants were set up in various places. Subsequently, small power companies were integrated into Tokyo Dento, now TEPCO. After the Second World War, the Headquarters for Economic Stability was established to aid reconstruction. As coal and steel production proceeded, the government planned to develop a large-scale power plant to prevent power shortages. Since then, Tohoku has focused on energy development as a hub for power generation. Hydroelectric and nuclear power plants were installed, local people were provided, government grants and public facilities, and dependent on nuclear power and government subsidies [34,35]. Fig. 2 below reflects these developments and relationships.

Source Created by the author based on the framework by Thiri [1].

The significance of the study is in using the social vulnerability framework to analyse the development-oriented long-term reconstruction process affecting the out-migration of residents following a disaster. Even though previous studies identified linkages between pre-existing social vulnerability and migration [1], as Bankoff [18] argues, we cannot ignore other factors relating to national and regional governments that played a role in shaping the outcomes. This study focuses on the structural factors influencing the population rather than on the drivers of the movement of individuals, as decision-making in emergency responses is complex. The study uses multiple sources of evidence to establish the events, including direct observation, participant observation, document assessment, analysis of archival records, and interviews. With this approach, different stakeholder perspectives, of residents, municipality officers, and policymakers in reconstruction, are included, to produce a holistic picture of the link between disaster management and environmental migration, and to reduce bias. Participant observation allowed the author to communicate with residents, and within casual encounter, allowed respondents to express their opinions. A second contribution of the study is the incorporation of findings into the debate over the installation of buffer zones in coastal regions after a tsunami disaster.

3. Methodology

This research applies the case study method using 1) documentation review, 2) archival records, 3) direct observation, 4) participant observation, and 5) interviews as data for analysis [36]. Documentation review included assessing policies and plans, newspaper articles, and government and non-government organisations reports. Moreover, the archival records were collected from the municipalities' websites and included briefing sessions, public census data, and questionnaire data. The data from interviews, participant observation, and direct observation were used as multiple data sources for analysis. The analysis also included secondary sources from the municipalities, including official recovery policy documents, plans, newspapers, and official records of public meetings. Based on this documentation, the issues and challenges in the resettlement of resident stakeholders leading to environmental migration are analysed.

More specifically, data collection included the following components:

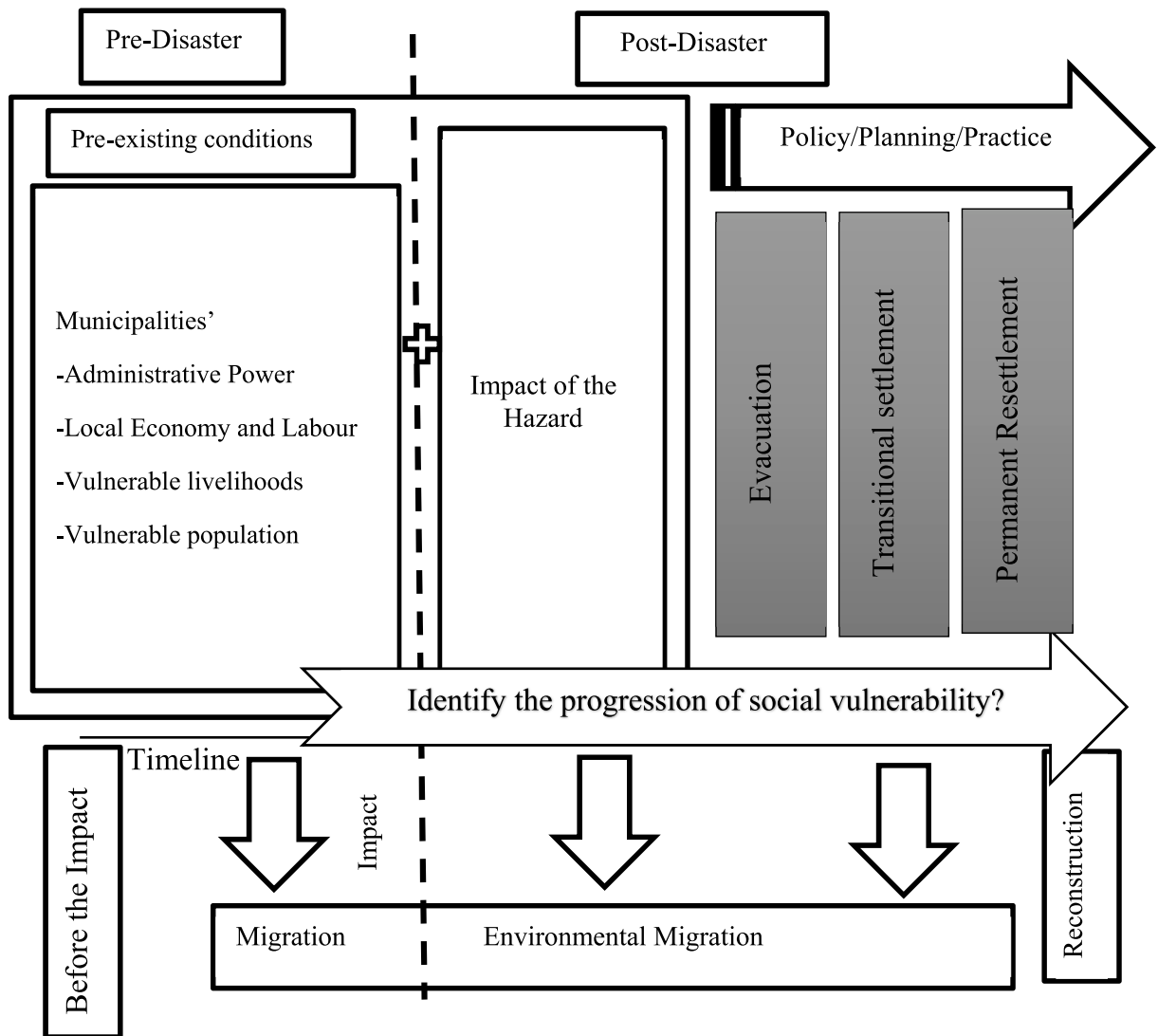
- Interviews were conducted with the Assistant Manager Livelihood Support Department Counsellor and Chief of Recovery Department in Onagawa town, and the Chief of Evacuee Support Division from the Health and Social Welfare Department in Minamisanriku town.
- Participant observation and direct observation of residents was conducted at the Shichigahama Temporary Housing facility from November 14 to 17, 2014, including a group discussion in the volunteers' program. The five primary respondents, residents of Shichigahama Town, were directly affected by the tsunami.
- Informal interviews were conducted with residents, and observations were made at the housing districts and affected areas in Shichigahama Town, Ishinomaki City, Minamisanriku Town, and Onagawa Town.

The framework within which the above data was conceptualised and analysed is set out in Table 1 below.

As the framework indicates, the study explored the post-disaster reconstruction process and focused on four major phases: 1) evacuation, 2) temporary housing, 3) policymaking and planning, and 4) housing recovery.

4. Applying the social vulnerability and environmental migration framework to long-term reconstruction

As a setting for the framework, first, Minamisanriku Town is described to understand a holistic view of population movement in a



Source Created by the author based on the framework by Thiri (2017)

Fig. 2. Conceptual framework.

Table 1
Framework of Analysis of the reconstruction process.

Process of resettlement	Category of analysis	Data sources
1. Evacuation	Time	National Government Basic Reconstruction Policy
2. Temporary housing	Capacity of residents	Miyagi Prefecture Basic Reconstruction Policy
3. Policymaking and planning	Capacity of municipalities	Reconstruction Plans of 15 municipalities
4. Housing recovery	Migration	Data collected from fieldwork
		Secondary data (records of resident meetings and results of questionnaire surveys conducted by the municipalities.)

Source Author

coastal town affected by the Great East Japan Earthquake and Tsunami. It is presented the effects of the tsunami on migration laying out the effort of residents and municipal government in the reconstruction process.

4.1. The experiences of residents from temporary housing to resettlement: the case of Minamisanriku Town

Minamisanriku is located northeast of Miyagi Prefecture, facing the Pacific Ocean. It was created in 2005 by the merger of

Shizugawa Town and Utatsu Town in the so-called 'Great Heisei Merger' (*Heiseidaigappei*). In the Great East Japan Earthquake, the tsunami struck the town centre, where almost 70% of the houses were destroyed. The town hall, police station, fire station, and public hospital were severely damaged. Many staff members, who remained at the disaster prevention measures office calling for evacuation until the end, were killed. The death toll in Minamisanriku was 566; the number of missing persons was 310 (as of December 28, 2011) [37].

At the initial evacuation phase, the people displaced from Minamisanriku Town were allocated to Akita Prefecture and Osaki City, Tomei city, and Sendai City, at 43 emergency shelters classified as 'out-of-town', 'in-town', and 'out-of-prefecture'. The shelters in Akita Prefecture were a temporary one-month refuge. There were 56 group evacuations, with displaced residents allocated to temporary housing in 58 different locations from May to September 2011. *Minashi* temporary housing were located out of town, where a quarter of the displaced population was allocated. Tomei City allocated displaced people to two parts of the city. Of the 82 households living in Tomei City temporarily, only 21 returned to Minamisanriku; the remainder continued to live in Tomei City.³

The record of a public forum, conducted at Shichigahama City Hall on November 26, 2011, included the statement of a cabinet committee and reconstruction committee member as follows:

In the case of Minamisanriku City, the cost for *Takadai-Iten* is 1200 billion yen; therefore, under the previously existing law, Minamisanriku must fund one-quarter of the cost, which is 300 billion yen. Minamisanriku city's yearly general account is 70 billion yen. Out of 70 billion yen, the town can only spend up to 1 billion on reconstruction. It indicates that the town will take 300 years to pay for the cost. Including this example, many cases require adjustment to the existing law. For these reasons, even though it takes time, there have been many legal revisions. For example, in the previously-mentioned case of *Takadai-Iten*, it was determined at the Diet that the national government shall cover all the costs [38]; p.19).⁴⁵

This statement was made three months after the Basic Reconstruction Policy was developed and eight months after the disaster. The statement shows the burden of the local municipalities to implement the relocation as planned out, and a high-level financial dependency on the national government.

By 2015, Minamisanriku Town could not provide housing for all displaced people, the recovery was slow, and other cities had a better living environment. Not only did those evacuating to Tomei City choose not to return, so too did those living in Minamisanriku, even though the city offered support to residents undecided about where to live. In June 2015, 738 housing developments were still to be built as part of the *Takadai Iten* group relocation. Approximately 600 households self-relocated. Further, the decision among residents changed over time. The city planned to build 1000 public housing projects, but the number of residents moving into these projects subsequently decreased to 900, then to 770 and in June 2015 to 738, due primarily to the slow pace of housing construction. Of the eight planned relocation housing locations, only three sites were finished and designated for 100 households. Two further housing complexes were to be built by 2016 and 2017, with the effect that displaced residents waited over six years for permanent housing. Only 25% of displaced persons had rebuilt their houses, including those who moved to Tomei City. Tomei City built 60 public houses, of which 24 were left vacant, and subsequently offered displaced residents to Minamisanriku. This pattern was repeated in Onagawa Town. All *Minashi* Housing was out of town, and most of the displaced persons evacuated to other municipalities eventually moved there. As a response, the municipality put more effort into communicating with residents and providing necessary assistance by creating get-together events and counselling for those who want to return.⁶

Minamisanriku was one of the hardest-hit towns and one that lost most of its population to migration. Because of a lack of available land and budget for temporary housing, residents moved to other areas in Miyagi Prefecture. In 2012, 885 households took refuge in temporary housing. Out of the total evacuee households, 19% were forced to find shelter outside Miyagi Prefecture (Fig. 3). The data presented are based on the official registration system; thus, those evacuees who did not report to the local government are not reflected in the figures.

Among the households who moved within the Miyagi Prefecture, only 9% moved to Minamisanriku. Most evacuees had to move to other cities in Miyagi, such as Tomei City (50%) and Sendai City (22%), where prefabricated temporary housings and rental apartments (*Minashi* housings) were available (Fig. 4). The data for households evacuated to other prefectures are presented in Fig. 5, showing that most households moved to other prefectures in the Tohoku and Kanto regions.

Minamisanriku Town has four districts: Tokura, Iriya, Shizugawa, and Utatsu. Iriya district was the least affected by the tsunami, being far from the bay. The other three districts were severely affected. Fig. 6 below shows the change in population for the four districts from 2010 to 2017. The Iriya District, with the least devastation, increased in population. The Tokura and Shizugawa districts had the highest out-migration. The Utatsu district had the lowest. In one case, a village in the Utatsu district, Minamisanriku, survived without outside support. The residents initiated several recovery projects themselves, including a road connecting the harbour with the rear of the mountain near the relocation site contributing to an easy commute between housing and places of employment. The project was financed and supported by volunteers and NGOs and was completed in October 2011 [39]. The community initiated many self-help projects during the initial evacuation period; strong leadership and community spirit may have played a role in helping residents remain at their place of origin.

The following section presents the detailed exploration of the evacuation efforts using the cases from different municipalities in Miyagi Prefecture. It aims to understand the variation of the scales of the hazards, the efforts of various stakeholders and the capacity of

³ Data gathered from the interview with the municipality officers in *Minamisanriku* Town.

⁴ *Takadaiten* means moving neighbourhoods to the higher ground from low coastal area.

⁵ Ishiyama Keiki (cabinet committee and reconstruction committee member).

⁶ Interview with Onagawa Town officers in 2015 at Onagawa Town office.

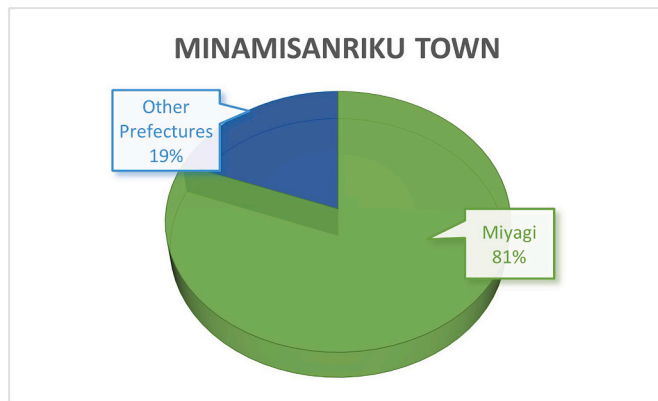


Fig. 3. Households living in temporary housings for Minamisanriku Town.
 Source: Created by the author based on Minamisanriku Town's Data (Minamisanriku, 2020) Note: Total number of households 885.

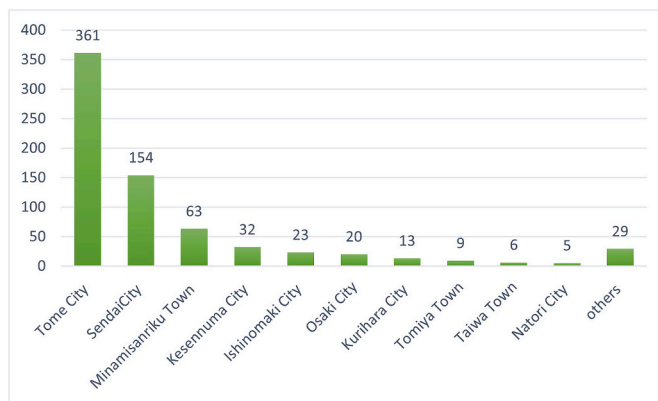


Fig. 4. Destination cities and town within Miyagi Prefecture for Minamisanriku Town.
 Source: Created by the author using data from Minamisanriku Town (Minamisanriku 2020).

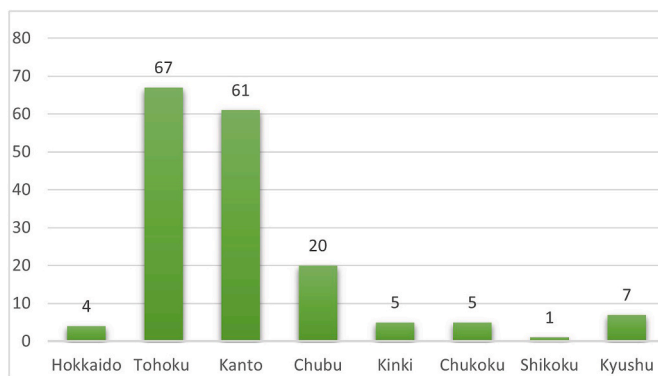


Fig. 5. Evacuees who moved out to other prefectures.
 Source: Created by the author based on Minamisanriku Town (2020).

the municipalities' government.

4.2. Evacuation during the hazard: cases from Miyagi Prefecture

A massive tsunami hit Kesennuma City in Miyagi Prefecture, which was then devastated by fire. On March 11, the tsunami hit Kesennuma Port 30 min after the earthquake and flooded the city behind the bay. It spread 2 km inland, destroying houses. The fire spread in the destroyed houses burning 100,000 square meters within 5 h after the earthquake [40]. The fire was difficult to extinguish.

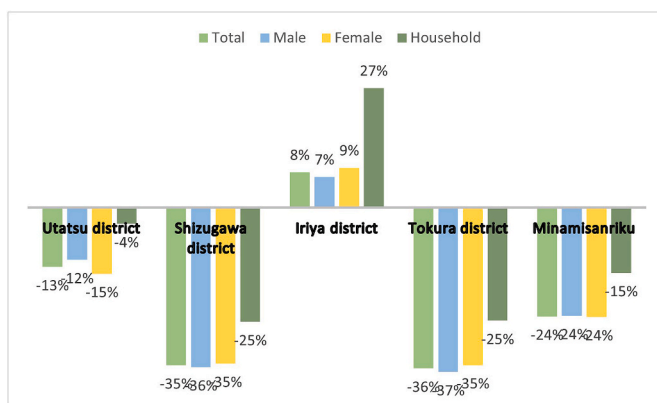


Fig. 6. Change in population in the districts of Minamisanriku 2010–2017.

Source: Created by the author based on Minamisanriku, 2020.

Roads were clogged with rubble, and the fire engine could not pass. The fire department guided the evacuation (*Shobodan* using trained volunteers. Although municipal officers and volunteers tried to evacuate devastated areas, the speed and scale of the tsunami were unforeseen. The residents also believed that the existing countermeasures and infrastructure could prevent tsunami incursions [41]. However, state-of-the-art countermeasures were not able to protect the coast. Not only was the scale of devastation unprecedented, but it also revealed that modern lifestyles intensified the damage and demonstrated that people's trust in disaster countermeasure systems were misplaced [42]. Crucially, the spread of the devastation was such that there was little time to react, evacuate, and take shelter.

In Shichigahama Town, there was not enough food and shelter right from the start, as one resident explains: "On the first day of the evacuation, we had no place to shelter. We stayed inside the car. Despite being 90 years old, it was difficult for us to find shelter and food. On the third day, we received only one rice ball. On the fourth day, we received the first meal where we had to wait in line."⁷ The tsunami flooded Shichigahama Town. It became an isolated island with only one access road to the city. The distribution of food and necessities was good in some places and not good in others.⁸ Help from the other region did not come because of limited communication coverage by the authorities. Further, areas that were not well known found that few organisations came to help.

Respondents expressed dissatisfaction in both the early phase of the emergency evaluation and the emergency shelter housing stage. As one evacuee stated: "The way local government manages shelters is rigorous when the community member manages the shelter, it is better because they understand us, and they are flexible". A further evacuee stated that: "They (the public officials) won't give us the food because there was not enough for everyone, but we needed the food".⁹ The officials' handbook for emergency management forbids the uneven distribution of goods to avoid conflict among the residents, so evacuating residents were disappointed at some shelters, where the rules were strictly applied.¹⁰ These issues of emergency evacuee management are structural weaknesses in the local units that contributed to a developing vulnerability [43].

Providing evacuation and shelters (*Hinanjo*) is a municipal responsibility. However, municipal officers were also affected by the disaster. Although the responsibility to manage evacuation shelters was shared with evacuating residents, centre management differs from place to place. Evacuee experiences differed depending on the centre, and evacuation behaviours differed across regions. Evacuation and evacuation practice announcement are components of disaster mitigation, for which municipalities are responsible. Yet, despite the scale of the disaster, community efforts in disaster prevention and management immediately after the disaster were evident.

The following section presents the temporary housing process and the experiences of the local people living in the temporary housing, a transition housing that is also an important process that influences the decision to migrate. Furthermore, it aims to understand the types of temporary housing in Japan after 2011 the Great East Japan Earthquake and Tsunami Disaster and how it helped displaced persons recover their homes.

4.3. Temporary housing: the experience of the disaster-affected communities

The housing recovery process was varied as its components and stages differed over regions and disaster governance regimes. The best housing recovery comes when transitional housing is not required [44]. However, with the immediate need of displaced persons, examples of diverse forms of temporary housing can be found worldwide. The practice in Japan is usually a progression from emergency shelter to temporary housing, then to permanent housing. In extreme cases, emergency shelter or temporary secondary shelter can be found for a short time in hotel rooms and serviced apartments, and later in temporary and permanent housing. Transitional housing called 'temporary housing' (*Kasetsu-juutaku*) may not be appropriate in resettlement frameworks outside Japan. In

⁷ Temporary Housing resident/evacuee in Shichigahama Town in 2014.

⁸ Field Notes collected in Shichigahama Town in 2014.

⁹ Tsunami affected resident in Shichigahama and same as 5.

¹⁰ Field note taken in Shichigahama town in 2014.

Japan, the *Disaster Relief Law 1947 s.23. (Japan)* states that temporary housing shall be provided for the stability of disaster-affected people. Therefore, temporary housing is one of the crucial components of prefectural and local government in Japan, especially in earthquake and tsunami disasters.

Earthquake and tsunami devastation left survivors in need of temporary shelters across the three heavily hit prefectures. The local governments faced a harsh reality of scarcity of land for temporary housing—strict building regulations and pressures on municipality administration limited capacity to carry out responsibilities on time. Temporary housing construction was slow owing to regulations on land supply for building temporary housing and the time needed to find land that met requirements. These conditions are: firstly, the land must be flat and safe; secondly, lifelines, such as water supply, must be in place [39]. Further, provision must be made for vehicles in excess of four tons to enter the land, including ambulances, fire engines, and construction vehicles. Temporary housing regulations stipulate long, narrow one-story facilities with 5 or 6 rooms, allowing improvements. However, because of a lack of administrative capacity, there was no room to consider alternatives for temporary housing. For instance, even though two-story temporary buildings were permissible in Onagawa Town, they were not recommended elsewhere due to noise problems and added cost. Additionally, of course, temporary housing cannot be built where the area is contaminated by nuclear power waste or damaged by tsunami inundation.

The Miyagi Prefectural Government and local municipalities provided 406 prefabricated temporary housing compounds, including 22,095 housing units in November 2011. By that date, evacuees were offered over 24,700 private apartments via the apartment rental system. In the Great East Japan Earthquake case, temporary housing was not limited to prefabricated housings but included rental apartments, called *Minashi* housing, a subsidised rent payment system for public and private apartments established for disaster victims who had lost their houses. The reason behind this system is the lack of safe land available for prefabricated housing compounds at the affected site, with empty private and public apartments being offered rent-free as an alternative. Providers and recipients favoured the *Minashi Juutaku* scheme for several reasons. The estimated cost of *Minashi* temporary housing was 1,830,000 yen (approximately 20,000 USD) per unit for a two-year rental contract with immediate occupancy.¹¹ When compared to prefabricated housing compounds, they are easily accessible by public transport, notwithstanding their several disadvantages, such as reduced support from non-profit organisations and the absence of space for community events, leading to feelings of social disconnectedness. Although a long time is necessary to build prefabricated compounds that might be less accessible, their advantage is that residents have more chances to access private and public financial support and rebuild the community [45].

The advantages and disadvantages of the living arrangements in temporary housing were exemplified in Shichigahama and Ishinomaki. Electronics and basic supplies were available to people who moved into temporary housing. Those who did not do so did not receive them. In Shichigahama Town, a respondent who moved to a private apartment recalled that: “I didn’t receive assistance because I didn’t move into the temporary housing, which is not fair because my house was also destroyed.”¹² All the residents spoke about their experience in temporary housing being of a minimal standard, freezing in winter, and humid in summer and lacking privacy: “... Temporary housing has no privacy. I could hear my neighbour flushing their toilet, how they were complaining about their pension salary. I hated living there”¹³ Communication among residents of temporary housing was also difficult. “Some people are noisy, some people are quiet. Most of the time young people are quiet. Voices are unevenly heard”.¹⁴

There are some cultural norms among displaced persons and their effect on mobilising collective actions towards recovery at temporary housings. Temporary housing facilities are created to expedite civic mobilisation; however, within a culture of respect for the elderly and superiors, most residents, especially younger people, avoid raising their voices and making their needs known. These facilities were also inconvenient for families with children. Similar cases were found in other municipalities. Participation in the rebuilding community was restrained by a group of former residents in coastal areas called ‘Burakumin’ who did not interact with other residents.¹⁵

The following section explains the policy and regulation on reconstruction. This section aims to understand what are the possible influence of policy on migration after the disaster.

4.4. Understanding the policy

In the case of the Great East Japan Earthquake and Tsunami Disaster, the roles and responsibilities of the national government, the prefectural government, and municipalities are overlapping. Therefore, it is vital to examine the policy at different levels. The revision of policies is done by reviewing the reconstruction policy at multiple levels of administrative divisions and how the contents of the policy differ or are similar among municipalities.

There is a strong emphasis on risk reduction and disaster preparedness in the spatial planning component of reconstruction (*Chiikizukuri*), with risk reduction emphasised as the basic concept. Simultaneously, other post-disaster features, such as the recovery of infrastructure, livelihood support, and housing recovery plans, are built upon this core concept. The ‘Build Back Better’ approach has been carried out in many different parts of the world, especially in developing countries, where original infrastructure, industries, public facilities and housings are in poor conditions. As an initial alternative, humanitarian assistance aims to improve the initial conditions by providing better housing to withstand storms and better facilities to improve and maintain social and economic

¹¹ The rate of exchange is calculated in 2011 rate.

¹² Tsunami affected resident in Shichigahama.

¹³ Former temporary housing resident/evacuee in Ishinomaki.

¹⁴ Same person as 9.

¹⁵ Fieldnote collected from the informal interviews, participant observations in Ishinomaki City, Minamisanriku and Shichigahama Town, 2014.

activities. The concept of risk reduction in the Great East Japan Earthquake Basic Reconstruction Policy refers to tsunami risk reduction for future hazards. The implementation method of risk reduction proposed in the policy was zoning for coastal land use and separating industrial and residential areas from the coast. This preparation method for tsunami hazards requires vital projects, such as 1) moving to the higher ground or lifting the ground, and 2) relocating communities. This emphasis on risk reduction largely influenced decision-making and recovery town planning called *machizukuri* in prefectures and municipalities, especially in coastal municipalities.

When reviewing the recovery plans of Miyagi Prefecture and the 15 municipalities in the coastal region, the central concepts of the national policy were being adopted at different application levels, as shown in Table 2 below.

Miyagi Prefecture's reconstruction policy made a clear statement that the reconstruction aimed not just at a mere recovery but also a transformation of the region. The prefecture adopted the concept of the formation of innovative communities and the idea of a 'compact city' that emphasised land-use reform as a method of risk reduction. The review of all recovery plans revealed that municipalities adopted concepts and applications from state and prefecture policy. Although each municipal government and residents were the primary decision-makers, the planning contents were standardised or generalised as a package. Applying the concept of risk reduction in pre-construction planning and design can be regarded as one of the best practices in disaster reconstruction. However, the implication of the risk reduction approach does not offer many options other than the relocation of communities to higher ground. Municipality planning also included concepts such as: 'revival of traditional livelihood' and 'co-exist with nature', implying preservation of its own identities, livelihoods (*Nariwai*), and culture (*kurashi*). However, such planning concepts were contrary to the intended reshaping or transformation where local communities wanted to preserve their traditional ways of life. For instance, it was difficult for some fishing communities to have a very high sea wall or move to higher ground where they are far from their livelihoods. Struggles arise from the opposition between risk reduction practices and 'co-existing with nature'.

The municipalities chose different options from among the given risk reduction plans, with the decision influenced by geographical factors and severity of impact. Rifu, Matsushima, and Tagajo City, did not select collective relocation. These municipalities had fewer fatalities and missing people compared to other coastal municipalities. The remaining 12 municipalities in the coastal region planned to process collective relocation plans with segregation of livelihoods and residential housing along the coast.

Due to legal revisions, the municipalities could not establish reconstruction plans consistent with the actual need [30]. The Basic Reconstruction Policy was promulgated in July 2011, assuring the lifting of burdens from local governments. However, it did not

Table 2
Uniformity in policy and plans between national, prefectural and local levels.

Region	The concept at city/town level	Risk reduction measures	Risk reduction methods
Basic Reconstruction Policy New Tohoku New <i>Chiiki zukuri</i>	Promotion of eco-town	Tsunami measures	Collective relocation Land adjustment
Miyagi Prefecture: Not recovery, but reformation	Formation of innovative communities	Disaster prevention	Collective Relocation Installation of the buffer zone
Kesennuma	Slow and smart communities	Never suffer again from the tsunami.	Sea wall Collective relocation Land adjustment
Minamisanriku	Smart city	Tsunami zero <i>machizukuri</i>	Collective relocation Land adjustment
Onagawa	Compact city/town	<i>Machizukuri</i> that is strong against disaster	Collective relocation Land adjustment
Ishinomaki	Self-sufficient/sustain energy	Safe coastal city <i>machizukuri</i>	Collective relocation Land adjustment
Higashimatsushima	Compact city	<i>Machizukuri</i> that is strong against disaster	Multiple safeguards Sea wall Collective relocation Land adjustment
Rifu	Sustainable community	Safe from disaster <i>machizukuri</i>	Multiple safeguard approach, relocation, sea wall Land adjustment
Matsushima: not a simple recovery: Recreation	Renewable energy	Safe town <i>machizukuri</i>	Evacuation procedures. Multiple safeguards
Shiogama	Self-sustained energy	Disaster prevention <i>machizukuri</i>	Sea wall Safeguard
Shichigahama	A compact community in some districts	Safe from disaster <i>machizukuri</i>	Relocation, Multiple safeguards, Land adjustment
Tagajo	Sustainable environment	Co-existence with hazards and strong against disaster	Multiple safeguards, Land adjustment, Relocation
Sendai	Venture Incubation, Energy renewable town	Risk reduction	Multiple safeguard system
Natori	Eco model town	Risk reduction <i>machizukuri</i>	Multiple safeguards, Collective relocation, Land adjustment
Iwanuma	Compact town	Re-creating city strong against disaster	Collective relocation, Multiple safeguards, Land adjustment
Watari	Renewable energy smart city	Safe from tsunami <i>machizukuri</i>	Collective relocation, Multiple safeguards
Yamamoto	Self-sustaining energy consumption	Safe and secure <i>machizukuri</i>	Relocation
	Compact town	<i>Machizukuri</i> prioritising risk reduction	Multiple safeguards, Collective relocation

Source: Author. Review of Basic Reconstruction Policy, Miyagi Prefecture Reconstruction Policy, and 15 municipalities' reconstruction plans, available at Miyagi Prefecture Archives [46]

clearly define the funding available. This became well-established later when funding from the national government increased from 75 to nearly 90%, with a *special local reconstruction allocation tax* introduced to cover all costs. However, the budget sharing among the stakeholders was not articulated in the early stages. Therefore, municipalities were not able to execute timely planning due to this ambiguity in resource financing. The *Act on Special Financial Support for Promoting Group Relocation for Disaster Mitigation 1972 s.132.7* (Japan) states that the national government must subsidise no less than three-quarters of group relocation costs. In the case of the *Hanshin-Awaji earthquake*, the reconstruction cost from 1994–1999 was 9.5 trillion yen (86 Billion USD Approx.), funded as follows: 5.1 trillion yen (46 Billion USD Approx.) by the national government and 4.4 trillion yen (40 Billion USD Approx.) by the prefectural and municipalities' local governments. From the existing law and previous examples, lifting the financial burden presented in the *Basic Reconstruction Policy* was interpreted as half the total budget funded by the state governments. The prefectural government will fund one-fourth. The municipal governments shall fund the remainder. In this case, municipalities were not capable of providing the funds to carry out the relocation.

The following section presents the mega relocation schemes, one of the consequences of the reconstruction policies discussed in this section. It aims to understand the effects of these relocation schemes on housing recovery and how they influence the decision to migrate.

4.5. Mega relocation scheme for housing recovery in small coastal towns

In the case of Japan, after the Great East Japan Earthquake and Tsunami disaster, there were four types of housing options: 1) relocation to a safer place as a group, 2) rebuild in the same place with plans to strengthen safety, 3) public housing in place of relocation or rebuild at origin, and 4), self-rebuilding in the place of relocation or at the place of origin [47]; pp. 236). Municipalities

Table 3

The completion rate of relocation and migration.

City/Town	Started	Time (year)	Group relocation (district)	Date of Completion (relocation)	Date of Completion (Public housings)	Migrated Population 2010–2013
Kesenuma	2011 Oct	10	52	2017 Aug	2017 Jul	5%
Minamisanriku	2011 Dec	10	26	2016 Jul	2016 Jul	12%
Onagawa	2011 Sep	8	21	95% In 2017	Ongoing in 2017	18%
Ishinomaki	2011 Dec	10	56	2017 Jul	Ongoing in 2017	4%
Higasimatsushima	2011 Dec	10	7	2016 Jun	Ongoing in 2017	4%
Rifu	2011 Dec	6	–	–	2013 Nov	+ (3%)
Matsushima	2011 Dec	5	–	–	2014 Oct	0%
Shiogama	2011 Dec	10	2	2015 July	2016 Sep	1%
Shichigahama	2011 Nov	10	5	2015 May	2014 Aug	4%
Tagajo	2011 Dec	10	–	–	2016 Jan	2%
Sendai	2011 Nov	5	14	2015 Mar	2015 July	+(2%)
Natori	2011 Oct	7	2	2016 Jul	Ongoing in 2017	+(2%)
Iwanuma	2011 Sep	7	2	2013 Jan	2014 Jul	1%
Watari	2011 Dec	10	5	2014 Jul	2014 Oct	3%
Yamamoto	2011 Dec	8	3	2017 Jan	2017 Apr	17%
Shiroishi	2011 Sep	7	–	–	–	1%
Kakuda	2011 Aug	5	–	–	–	1%
Tomei	2011 Dec	12	–	–	–	0%
Kurihara	2011 Dec	11	–	–	–	1%
Oosaki	2011 Oct	7	–	–	–	+(1%)
Wakuya	2012 Mar	10	–	–	–	–

^a The reports are available in the following link: <http://www.pref.miyagi.jp/soshiki/dobokusom/doboku-sintyoku-press.html>.

Source: Miyagi Prefecture Department of Civil Engineering 2017 Reports on Progress of Reconstruction.^a

planned to either relocate the communities or elevate the ground in coastal areas affected by the tsunami as a means of disaster risk reduction and prevention (see Table 3). In the fishing communities where it is difficult for them to move inland and in municipalities where the availability of higher ground is limited, the projects chosen were those that elevated the ground. In municipalities where relocation is promoted, the municipal government bought the residents' land affected by the tsunami and prepared alternative land for relocation. Should residents not be able to rebuild either in relocation or by raising the ground, the government would provide public housing at a low cost. However, this reconstruction has been delayed due to land restructuring; as the flat land to build new relocation area is limited, the topsoil of the mountains has to be scraped, and coastal area with low sea levels as to be elevated.

Onagawa Town consists of the mainland and an attached island. The island was zoned as non-residential, and recommendations were made to the residents to move to higher land in the *Takadai* inland area. The town was divided into zones A, B, and C, as shown in Fig. 7. Residents of zones B and C (Photo 1 below) and the residents from the linked island were encouraged to move to zone A. The process involved many discussions with residents, either in a group or as individuals. The public hearing was conducted several times in two parts among the residents of different districts. The first round of discussions was completed in 2012, and the second in 2013. Perhaps the most challenging situation for the municipalities was the change of decisions of the residents over time.¹⁶ From the first survey to the second within a year, residents who wished to rebuild their houses themselves decreased.

In contrast, residents who wanted to move to public housing increased, and the number of those who wanted to move out of the municipalities more than doubled (Onagawa, 2020). Moreover, residents had not decided on the place of relocation. The reasons for changing their mind included: that the recovery was taking too long; that they could not wait longer; and that when the land is sold, they will move out of Onagawa. Obstacles to relocation were land availability and creating a residential area on the hillside, which takes time.¹⁷



Source: Photograph taken by Author (2015)

Photo 1. Onagawa Town destroyed residential area, 2015. Source: Photograph taken by Author (2015).

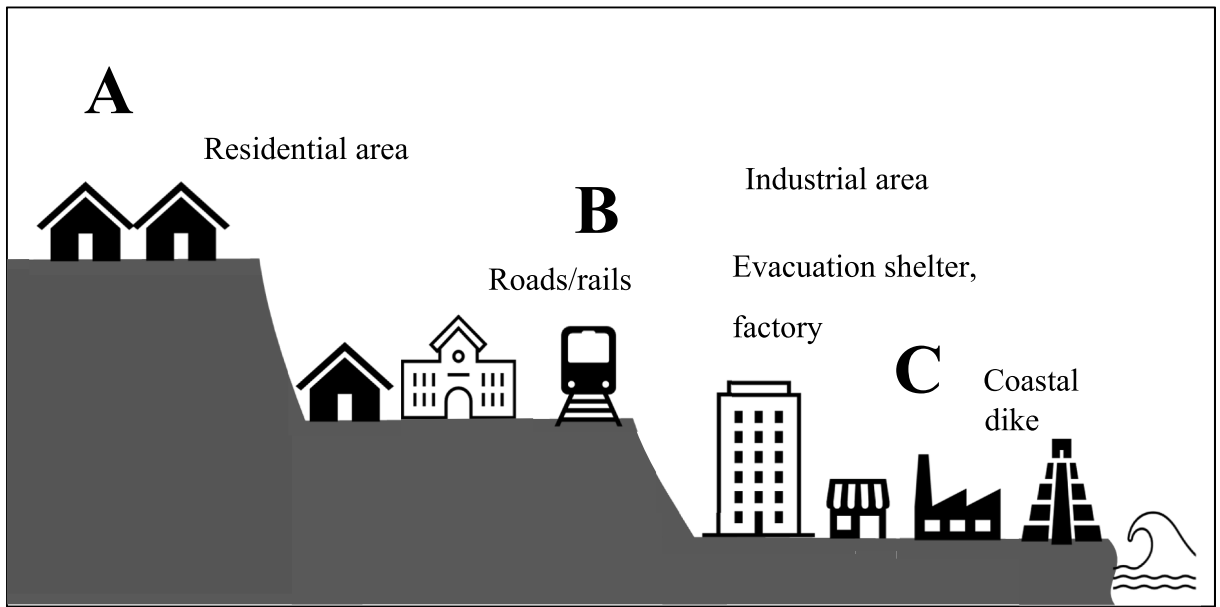
Fig. 8 below shows the decision-making framework of residents for household recovery. Labels with a dotted line indicate that decision-making occurs at the individual level, and labels with black lines mean decision-making occurs at the collective or administrative levels. When the disaster-affected home is in a buffer zone, the rebuilding of the house is restricted. When the area falls under the project of collective relocation, all residents must agree to relocate collectively or individually. Getting an agreement can take a long time, and even after consent has been reached, meetings and discussions continue. Once an agreement on the destination relocation is prepared, residents get to rebuild their houses. Those who cannot rebuild are offered public housing in the place of relocation. However, when the community members have died or have been evacuated to different shelters, collective relocation becomes challenging. If the residents decide to relocate separately and not with other residents, they could relocate individually to higher ground. However, they will have fewer benefits and supports compared to those who relocate collectively. When the community decides not to relocate collectively, individuals who cannot relocate are offered public rental housing (see Fig. 8).

Municipalities managed to establish participatory workshops to create local committees and round table discussions before plans were established. One example is Minamisanriku Town, which collected residents' opinions on risk reduction and its most favourable practice methods.¹⁸ Most residents (68%) thought that safety was the most important aspect in the *machizukuri* and wanted to move to the higher ground. However, the remaining 32% had different opinions. Although residents' views were divided, the plans to relocate were promoted as group relocations at the district level. The briefing sessions showed that government buffer-zoning plans were inflexible. While the resident opposition was taken into consideration, officials' responses illustrate the implications of the non-flexible

¹⁶ Interview with Onagawa Town officers in 2015.

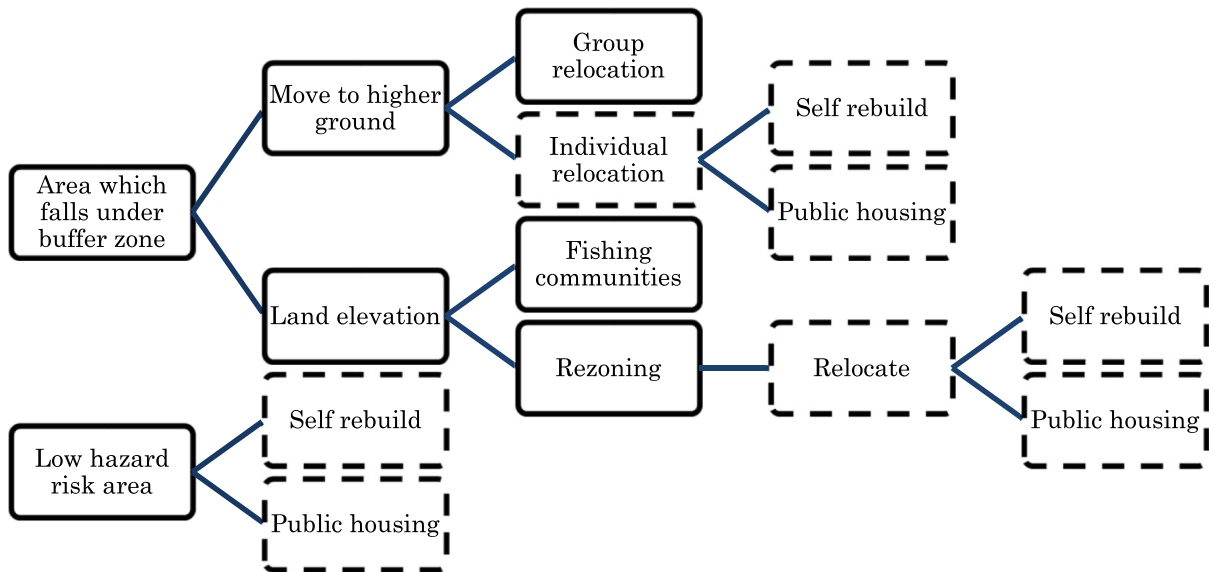
¹⁷ Field note from Interview with Onagawa Town officers and residents in 2015.

¹⁸ Minamisanriku Town Public Survey on Disaster Recovery *Machizukuri* 2011 November <http://www.town.minamisanriku.miyagi.jp/index.cfm/6,301,c/html/301/2218.pdf>.



Source: Created by the author.

Fig. 7. Onagawa Town planning.



Source: Author's creation based on case review

Fig. 8. Decision-making framework for residents.
Source: Author's creation based on case review

decisions relating to the buffer zones.¹⁹

Although the financial burdens of local municipalities were lifted, relocation planning for both the local government and residents was challenging, leading to loosening the unity between residents and local authorities. Moreover, the disaster management system is a vertical structure involving many ministries. The Reconstruction Policy was promulgated in July 2011, four months after the disaster, and took time for the municipalities to understand it, especially budget-sharing arrangements. None of the local governments could develop a plan three months after the promulgation of the reconstruction policy. These problems led not only to delayed planning but also to conflicts between local authorities and residents. Due to delays in resettlement planning, many residents decided to choose individual relocation over group relocation. Later, people who had agreed to group relocation left due to delayed collective relocation and public housing building. Land restoration also affected the recovery of the fishing industry, which led to an outflow of people in search of jobs outside the affected area [48,49].

Table 3 above shows the length of time for the reconstruction plan to develop, the number of projects for group relocation, the completion date for group relocation and public housing, and the percentage of the population that migrated from 2010 to 2013. The municipalities were able to present recovery plans two to three months after establishing the recovery policy. The term for recovery is set between 5 and 10 years, with most municipalities having a 10-year timeframe. The date of completion for the group relocation and public housing varied among the municipalities. However, the actual decision-making of collective relocation is at the district level. Therefore, the visibility of progress at the municipality level may be distorted.

Two reasons for the delay to complete the projects were time-consuming relocation projects: the landfill in the mountainous coastal area and the conflict between the authorities and residents. Collective relocation in Japan is usually accomplished with the absolute consent of everyone at the district or village level of administration. The practice of collective relocation (*Boshu Jigyo*) originated in the relocation of small communities with a risk of heavy rainfall and flood to a safer area before the hazard outbreak. They were carried out voluntarily and on a small scale, making it easy to get consent and carry out the process. The faster each community gets an agreement, the quicker the project can be completed [47].

On the other hand, the higher the number of relocation districts, the longer it takes for municipalities to reach the target completion date. For example, in Ishinomaki City, there were 56 relocations, the completion of which took five years, with public housing under construction until 2017. In some districts, the population decreased to more than half the level existing before the disaster (e.g. in the Ogatsu District in Ishinomaki City), even though it is invisible at the municipality level.

The following section is the last section of the case study findings. It studies the ageing populations and resource-dependent populations. It is done by observing and interviewing the rural communities.

4.6. The rural lifestyles and beliefs

Other populations vulnerable to migration and displacement were investigated through direct observation and interviews, including ageing, resource-dependent, and farming households. The severity of depopulation and senior communities were found on the nearby islands around Ishinomaki City and the mountain village (*Shuraku*) in Minamisanriku Town. The island of Tashirojima, under the administration of Ishinomaki City, no longer has elementary schools due to the low birth rate. Most residents were elderly, and there was a small population.²⁰ Similarly, the Haraikawa Village in Minamisanriku Town had very few farming households left, with elderly people in residence.²¹ There was evidence of displacement among these elderly people. However, out-of-town migration among older adults is rare in the case of Miyagi Prefecture. Most elderly people chose to live in public housing provided by the government in place of relocation because their children were no longer coming back to inherit the land.

Resource-dependent populations are vulnerable to loss of livelihoods and displacement [48]. In Shichigahama and Onagawa, the fishermen and seaweed producers faced many challenges returning to their businesses and the conditions before the disaster. The fishermen were probably the most brutal hit, losing everything to the tsunami. Cases were reported of fishers who were able to move out of temporary housing and resettle in Shichigahama. Reasons contributing to this relocation were: getting a loan from the cooperative to invest in land and support from an NGO. At the same time as having a loan to repay, fishers also had to follow regulations on radioactive contamination of the fish. Many were unable to continue their work as fishermen, as the subsidies for industry recovery favoured supply-chain industries, which contributed more to the national economy.

According to Thiri [1]; there are several constraints on migration in farming households, such as culture, attachment to community, demographics, and legal issues of farming rights and ownership. A farming household interviewed for this study stated: "We are not the actual owner of the land. We are just borrowing it from nature. Our ancestors borrowed it, and then they passed it to our generation. Whether the next generation will succeed to the land or not is for them to decide, but it is our responsibility to hold on to it and maintain it in our lifetime."²² Farmland is more than just a source of income to the farm owners. It has a deep spiritual meaning and sentimental value. Therefore, the relocation decision for the elderly farming households is bounded by cultural values and sentimental attachments.

Moreover, the laws on farming and getting approval to conduct farming are strict. Although the law does not restrict farmers from migrating and continuing farming in other prefectures or other municipalities or starting a farming business, the regulation for obtaining farmland is burdensome. The regulations on the relocation of farmland and transfer of rights are stated in the *Agriculture Law*

¹⁹ Minamisanriku Public briefing on Bufferzone 2012 March.

²⁰ Field note collected in Ishinomaki City in 2015.

²¹ Field note collected in Minamisanriku Town in 2015.

²² Participant observation at public talks of farmers from Tohoku in Nagoya City, 2016.

1952 s.2.3–15 (Japan).²³ A person wanting to apply for a permit must find a seller of farmland among the limited number of farms available. Furthermore, ownership cannot be established unless the application passes several screenings and recognition from the Agriculture Committee.²⁴ So despite the effect of the tsunami, farmers may not be able to relocate their farms to other regions.

5. Discussion

The relationship between social vulnerability and environmental migration was hypothesised and tested in previous studies [1,15]. However, when measured as a proportion, say, of the size of the economy, national income, or the level of education, understanding how concepts such as social vulnerability impact processes such as migration are challenging. Aspects that might contribute to people's behaviours, such as culture and the social fabric, are not easily quantifiable. Additionally, ambiguities remain in conceptualising how vulnerability and changes in the environment interact to affect migration. Research findings have helped extend our understanding of the limitations for local administrations and town residents and villagers in shaping the future of their place of origin, which may have led to out-migration and depopulation in some disaster-affected areas. The study found what the previous studies lacked to explain by presenting the struggles of residents and officials to remain within their towns. The progression of social vulnerability was fabricated by intertwining economic, political and social challenges within a particular geographical area. Therefore, social vulnerability is difficult to generalise as a fixed set of values in other places. Moreover, each stage of evacuation, temporary housing, policy and planning, group relocation and the rural life and beliefs are all interconnected in shaping the outcome of the disaster.

This study suggests that in the context of Miyagi prefecture, the social vulnerability of the local municipalities was deeply rooted in their history of reconstruction and promotion of industrialisation, central-peripheral nature, and traditional rural values. Municipality administrations were encouraged to implement large-scale reconstruction projects which exceeded their financial capacities. The power and autonomy to make decisions were obviated by the limitations of institutional arrangements. Such limitations were further exacerbated by the disaster, which exposed the powerlessness of local administration in reconstruction. Furthermore, the rural setting and attachment to nature additionally make the process of collective relocation difficult. The dispersed temporary housings loosen the community network further to voice their visions into shaping the future.

In the evacuation process, the out-of-town and out-of-prefecture evacuation led to permanent migration among displaced persons, as did the delay in reconstruction. The reasons for the delay in housing recovery were rooted in costly and time-consuming buffer-zone and relocation projects resulting from policy-driven standardised planning. Moreover, projects were highly dependent on national budget allocations, the extent of which was not clear at the beginning of the planning stage and led to confusion among local governments and residents. The ambiguity and frequent change of regulations contributed to decreased social cohesion between the local authorities and residents, further heightened by a delayed recovery that influenced residents' decisions to migrate or remain in place. Moreover, the concept of risk reduction was incorporated within the basic reconstruction policy, the prefectural policy, and the plans of 15 municipalities in the post-disaster reconstruction phase. The risk reduction aspect implied the towns' rezoning, which led to the drastic change of coastal land-use structure and the relocation of many communities. Although some municipalities and districts could complete the relocation and had an inflow of migrants two years after the disaster, these were limited to municipalities and districts with good communication among the residents and officials before the disaster and proactive participation of the residents throughout the recovery process.

The significance and contributions of this study are the provision of an in-depth analysis to deepen the understanding of the nature of social vulnerability in the reconstruction process. It has contributed to the debate over installing buffer zones in coastal regions after a tsunami disaster. The resettlements in the post-disaster phase, which involves buffer-zone relocation, have many complications. For instance, the municipalities with socially created vulnerabilities before the disaster, such as the lack of institutional power and administrative capacity, were prone to suffer secondary disasters, such as economic and social problems. The municipalities with delayed relocations evidenced more out-migration, while the municipalities that could complete the relocation had less. Municipalities with delayed relocations had many projects for group relocation due to buffer-zone installation. These long-term reconstruction practices affected the movement of disaster-affected people during the evacuation, their transitional housing, and permanent housing recovery. The policies and plans formulated by national and local governments tended to be well-intended, emphasising risk reduction. However, given the magnitude of the hazard and the extensive impact on residents, time-consuming projects led to dismantling social ties among communities, environmental migration, and ultimately depopulation.

On the other hand, the delayed housing recovery was influenced by conflicts between residents and officials. The successfully relocated municipalities and districts were found to have had good social cohesion between residents and authorities. It appears, then, that migration is somehow influenced by unquantifiable aspects in the social fabric that existed before the disaster. While a policy change or intervention can either increase or decrease the level of social vulnerability in a community, the results of this research indicate that policy affects different municipalities differently. The extensive policy-induced relocation plans affected environmental migration for some municipalities but not for others. The vulnerability of the administrative authorities influenced migration, but communities' efforts were remarkable in remaining stable, despite being affected by a large-scale disaster and having limited resources for disposal. Traditional communities dependent on local natural resources exhibited a strong connectedness, thick social fabric and resilience to adversity [50,51]. These were evident in some districts within the municipalities. These suggest that social vulnerability

²³ *Agriculture Law*, in Japanese (Nochihou) was established in 1952. It was revised in 2009.

²⁴ Agriculture Committee, in Japanese (Nogyoiinkai) is the public administration the municipality governing over the agriculture businesses and farmlands in the municipalities.

may better be explored at the community and neighbourhood level.

The abovementioned discussions on the dynamics of social vulnerability refer to the case of Japan and precisely of Miyagi Prefecture. The locality aspect of social vulnerability highlights the importance of identifying the variance of key factors that make populations susceptible to disasters. Japan's in-depth case emphasises the power struggle between the central and peripheral institutions. In contrast, case studies from the United States exhibit the issues of racial minorities, class, immigrants and their power to bring resources to the hazard affected communities [15]. In a relative sense, rural Japan may comprise racial and cultural homogeneity. Therefore, social vulnerability to disaster in Japanese megalopolises with racial, cultural and economic diversities can be an interesting case to explore in future.

Moreover, the setting of the study area with depopulation also marks the uniqueness of the nature of rural social vulnerability. Similarly, post-industrialised countries in Europe, such as Italy, France, and Spain, suffered from rural depopulation and are challenged by various natural hazards. Moreover, the case studies on Scottish borders, Vejle, Liverpool, show similar social problems such as ageing, depopulation, decaying infrastructures, and a low administrative capacity that makes these populations susceptible to various hazards [52]. However, the underlying structural challenges and drivers of social vulnerability progression are under-researched, and understanding such dynamics in rural contexts needs more exploration.

On the other hand, the insights from the Great East Japan Earthquake and Tsunami may not be easily replicated in other countries that lack the resources and funds that Japan was able to commit to the reconstruction efforts. However, as climate change accelerates, under adaption policies, the process of gentrification has been promoted to create resilient cities against sudden and slow hazards across the world [53]. Even though insights from the tsunami-resilience case may not apply to other cities globally, the cases of green or resilience gentrifications may have similar patterns of vulnerability dynamics, and thus, offer attractive scenarios for examination through the conceptual lens of social vulnerability [53,54]. These scenarios are the consequences of the predominant concept of risk reduction that emphasised reducing the physical aspect of vulnerability to hazards. Planners tend to focus on restructuring the physical habitat and fail to pay attention to socially vulnerable communities. Hence, social vulnerability scholars must pay attention to such rising problems of socially created disaster risk in marginalised communities and investigate their dynamics in the respective contexts.

Therefore, policy recommendations from this study are to set social vulnerability indicators so that the socially vulnerable municipalities can be identified, particularly in Japan which lacks such measures [55]. Secondly, preparing cities for disasters by improving communication among the residents and valuing traditional livelihoods may not contribute to economic growth directly but will tighten the social networks of communities that underpin the economy. Community-led participation in shelter and resettlement planning as disaster mitigation is recommended in disaster-risk regions before the hazard event. Risk reduction should be emphasised in mitigation measures with a greater focus on the social aspects identified in this research. Communities and residents should decide plans for evacuation and relocation before the disaster to avoid neighbourhoods being unconsciously dismantled. Thus, creating social vulnerability indicators is crucial in identifying vulnerable municipalities to a natural disaster and hence avoiding a social one. Through this identification process, the capacity of local governments and traditional institutions can be strengthened in all aspects of the disaster mitigation process.

6. Conclusion

The findings of this study are a theoretical contribution to the existing literature, arguing that vulnerability to natural hazards lies in societal issues existing prior to the impact of the hazard, which further progress into a social disaster [1,14,17,51]. The study contributes to bridging the gap in understanding the relationship between the social vulnerability of the municipalities and environmental migration by linking the conditions before the disaster to the responses made after the disaster. The results suggest that pre-existing structural weaknesses at the local government level can contribute to delayed and inefficient resettlement planning. Additionally, uncertainty and inconsistency in reconstruction policy can contribute to delayed planning and a decline in social cohesion between the local authorities and residents. The risk reduction practices that aimed to promote development, but were contrary to the sentimental values of traditional livelihoods, contributed to out-migration. The case of Miyagi Prefecture has demonstrated that, even though a high proportion of the population in affected municipalities were socially vulnerable, their capacity to survive as neighbourhoods and communities was strong. The social connectedness and attachments to traditional livelihoods and identities are the ties that pull communities together. Further, this paper makes a meaningful contribution to disaster risk reduction concepts through its identification of the linkage between the movements of people and the political and social aspects of vulnerability. It has established social vulnerability as a valid phenomenon to be treated equally alongside physical vulnerability and positioned for further study to promote better disaster risk reduction practices.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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