INTERNATIONAL COMPARATIVE STUDY ON MEGA-EARTHQUAKE DISASTERS: COLLECTION OF PAPERS Vol.1

巨大地震災害の国際比較研究報告書 - 1

2016 年 9 月

名古屋大学大学院環境学研究科

September 2016

Graduate School of Environmental Studies
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緒　言

本報告書は、日本学術振興会科学研究費補助金（基盤研究 A）「多層的復興モデルに基づく巨大地震災害の国際比較研究」の報告書（第 1 報）であり、巨大地震やその他の地球物理的災害、防災制度やその変化などを扱った 8 編のワーキングパーパーを収録した。また、研究プロジェクト開始以降の 1 年半におけるワークショップや研究会等の活動記録も掲載した。

米国地質調査所のデータベースによれば、21 世紀の 15 年間で死者 1 万人以上を数えるような地震災害は世界全体で 7 つあり、そのうちの 6 つがアジアで起こっている。被害の大きさや影響の社会的・空間的な広がり、その後の国の防災政策の転換に及ぼした意味において、とりわけ、2004 年スマトラ地震、2008 年四川大地震、2011 年東日本大震災（東北地方太平洋沖地震）の 3 つが重要である。一方、地域的スケールで起こる規模の地震災害は、それよりも頻度が高いものの、他の自然災害に比べて低頻度であることには違いはない。また、国際的には注目されることが少ないが、当該社会にとっては重要な意味を持つ。このことは、小さな規模の災害で見られることが大きな規模の災害で見られることの縮小版なのかという、災害研究をめぐるスケーリング（あるいはリスケーリング）の問題とかかわる。

ここで主として取り上げる巨大地震災害は、ひとつの国や地域においてはめったに起こらないが、いったん起こると社会の存続が危ぶまれるほどの甚大な被害を及ぼす。多くの研究者の努力にもかかわらず、いつ、どこで、どのくらい大きさの地震が起こるのかを厳密に予測することは難しい。また、低頻度ゆえに、地元社会の仕組みの中に災害経験が教訓として残りにくい。それゆえ、その知見を時間と空間を超えて共有することが学術上も防災上も重要であり、そのためには、国や地域の社会的文脈によって異なる様々な差異を整理する理論的視座と、ローカル経験をグローバルに共有するようなグローバルな学術プラットフォームが必要である。

上記の 3 巨大地震災害に話を戻せば、主要な被災地は、共通して、元々人口稠密で、国民経済の成長を経験しつつも、各国の中では相対的に低開発であり、自然災害に対する社会的な脆弱性が増大していた。ハザードの規模やタイプは異なるものの、被害の種類や程度が地元の防災制度や災害対応によって異なる上に、災害後復興の道筋も大きく異なっている。これらの差異は、国際的な観点から見たとき、どのように理論的に整理できるだろうか。

自然災害は、自然ハザードと社会の脆弱性とが出会うことによって発生する。両者の広がりが空間的に限られるという意味において地理的な暴露性が重要であり、コミュニティアプローチの観点から、ふつうの人たち経験とそれを取り巻くローカルな自然的・社会的条件が注目される。多くの場合、巨大地震災害では、被災地が空間的・社会的に大きく破壊されるために、知識や技術も含む、救援や復興のための様々な資源が被災地外から投入される。こうした被災地をめぐる支援構造は、多層的な社会空間で作用する様々なアクターの相互関係によって形作られ、それは大きく社会（共同）の領域と政府（行政）の領域との水平的関係と、ローカルからグローバルに至る空間相互の垂直的関係とから構成される。災害によって破壊された空間が修復される中で新たな社会空間が作り出され、そして、それが次の災害時における支援構造に影響する。災害や復興は、こうした社会と空間との相互作用と、その循環的プロセスとして捉えることができる。

本報告書は、このような観点から近年の地震などの被害や復興状況を詳細に調べ、巨大地震災害の国際比較に乗り出すための基本的な考え方を整理するものである。

2016 年 9 月　　高橋　誠（名古屋大学大学院環境学研究科）

International Comparative Study on Mega-earthquake Disasters: an Introduction

Takahashi, Makoto
Department of Geography, Graduate School of Environmental Studies, Nagoya University, Japan

From the beginning of the 21st century, the world has experienced more mega-earthquake disasters than ever before. According to the USGS, for recent 15 years in the world there are seven earthquakes that have caused death toll of more than 10 thousand people, six of which have occurred in Asian countries. In particular, the three in humid Asian are significant in terms of the social and spatial extent of impacts: the 2004 Sumatra, the 2008 Sichuan and the 2011 Tohoku (Great East Japan) Earthquakes (Table 1). Not to say mega-scale, almost every a couple of years in these countries, deadly earthquake disasters of local and regional scale occur, including: Nias-Simeulue in 2005, Central Java in 2006, Pangandaran in 2006, Padang in 2009, Mentawai in 2010 in Indonesia; Yushu in 2010, Lushan in 2013, Ludian in 2014 in China; Chuetsu in 2004, Fukuoka in 2005, Noto Peninsula in 2007, Chuetsu Offshore in 2007, Iwate-Miyagi in 2008, Northern Nagano in 2011, Kumamoto in 2016 in Japan.

Table 1. Comparing the recent mega-earthquake disasters in humid Asia

	2004 Sumatra	2008 Sichuan	2011 Tohoku
Date	December 26, 2004	May 12, 2008	March 11, 2011
Magnitude	M9.1-M9.3	M8.0	M9.0
Hazard	Tsunami	Quake	Tsunami
Most severely affected area	Northern Prov. Aceh, Indonesia	Mid-north Sichuan Prov., China	Iwate, Miyagi and Fukushima Pref., Japan
Deaths (incl. missing)	Approx. 169,000 (ID)	Approx. 87,000	Approx. 17,000
Injured	Approx. 100,000 <	Approx. 374,000	Approx. 6,000
Extent of affected area	Semi-global	Regional	Semi-national

As such, Indonesia, China and Japan are all earthquake-prone countries, many parts of which are much densely inhabited in the globally most active seismic zones. How to respond earthquakes in particular of mega-scale is an urgent issue not only for the governments and the communities but also for the academics in the three countries. Thus, in order to share the experiences, we had launched the four-year research project from April 2015 onward, which aims to build the academic platform for exchanges of knowledge about earthquake disaster from the multi-disciplinary perspectives, targeting not only those three mega-sized earthquake disasters but also important earthquakes and other geo-hazards of rather smaller scale, and supported mainly by the JSPS (Japan

Society for the Promotion of Sciences) Grand-in-Aid for Scientific Research (A) "International comparative study of mega-earthquake disasters based on the multi-layer actors model".

The mega-sized disaster is significant in the sense that it often leads the government to change the policy for disaster countermeasures. In Indonesia, for example, based on the experiences of the Sumatra Earthquake, the government decentralized the disaster management systems under the law 24/2007, reorganizing both at the central and at the local levels. China's government properly introduced the counterpart support policies at the 2008 earthquake, and growingly become aware of the powers of civil society organizations for the disaster relief and recovery, as well. In Japan, after the Tohoku Earthquake, the government twice revised the Basic Act on Disaster Control Measures, which was first enacted in 1961 based on the experiences of the 1959 Typhoon Vera causing over five-thousand casualties.

Despite many scientists' efforts, nevertheless, no one knows exactly when such a magnitude natural hazard will occur. Scientists have some exact knowledge about the geographical area where a hazardous event is possible in the near future, unfortunately without any detail information about the location and its socio-spatial exposure. At the community levels, further, the local people's experiences of mega-disasters are rarely institutionalized as a disaster-responding mechanism or embedded into the local culture much less improve the existing social structures, often related to the root causes for the vulnerability, in the nature of infrequency. It is a problem to prepare such a large-scale natural hazard, which brings about enormous damages once it occurs.

A catastrophic disaster rarely happens in one country or region, but often in the whole world as mentioned above. In this sense, we emphasize the necessity of the world-wide academic platform. This is for explaining the experiences in the local context at first, interpreting them trans-contextually for a cross-cultural comparison, sharing the experiences theoretically and globally, and then re-embedding the knowledge into the local context. How can we theorize differences in the local societal contexts?

Mega-earthquakes occur periodically if not frequently as are well known. According to the theory of hazard-disaster cycle, ways of the post-disaster reconstruction determine how to prepare a next disaster, enhancing or reducing the society's vulnerability. Thus it is important to discuss ways of risk managements of the post-disaster society at the inter-disaster period, closely related to the post-disaster reconstruction. As for the three earthquakes mentioned above, the housing and settlement reconstruction works have really just been started in many affected places in Japan even 5 years after the earthquake, while both in Aceh and in Sichuan the governments had already declared the completion of the reconstruction at the time half a decade passed. This difference in the speed is related to the difference in how the local society views the nature and risk linked to natural hazards, reflecting ways of reconstruction (Table 2).

Table 2. Varied ways of the reconstructions at the three mega-earthquake disasters

	2004 Sumatra	2008 Sichuan	2011 Tohoku
First priority	Housing, then livelihood	Housing and development	Avoid future risk
Speed of reconstruction	Relatively fast	Fast	Slow
Place of resettlement	Original place, some displaced	Displaced, some original places	Relocation or land raising
Population trend	Population growth: in-migration, baby-booming	Continuing depopulation, out-migration for work	Shrinking, deprivation, rigidified organization
Community change	Diversification, individualism	Some deprivation, some revitalization	Shrinking, deprivation, rigidified organization
Economic development	Economic booming, social disparity	Basically backward, new opportunity for tourism	Basically backward, regionally uneven
Guideline for reconstruction	Not-strategic *(ad hoc)*	Planning on scientific knowledge	Planning on scientific knowledge
Aid resource	Global actor/NGO	Central/inter-governments	Central government
Main actor	Community + NGO	Central/local governments	Local/central governments
Implementing mechanism	Top-down, later community-based	Government-driven	Government-driven, community-approval
Coordination mechanism	UN/central government (special agency)	Government-oriented	Central government at first, then community
Preparing hazard risk	Not-embedded into community mechanism	Based on science/ technology, but not-enough	Over-estimation to uncertainty, hopelessness

In most if not all devastated places by the tsunami in Tohoku, for example, each community should make a choice between relocating to a higher place and raising-up their original place following the guideline that the central government made, after the local government designates building-prohibited areas in the severely affected places. This guideline is to avoid possible future tsunami and/or other coastal hazard risks. Thus, in either case, the reconstruction works take much time, in some places further 10 years being necessary.

In Banda Aceh, meanwhile, the central and city governments made a blueprint for reconstruction at first, including a 2-3 km coastal buffer zone that would prevent the communities from resettling in their original places. Nevertheless, almost all communities were reconstructed back there, and eventually the blueprint was revised. The communities' efforts were financially and technically supported mainly by international and domestic NGOs and international organizations, which sometimes intervened in the recovery processes based on the central government's strategies, advocating the grassroots perspectives. In the coastal area of Banda Aceh, the interaction between society and space had driven the recovery of settlements and housings accommodating families, some of which were newly coming from non-affected areas inland, and then their economies and livelihoods (Fig. 1), although such communities remain to be exposed to coastal hazards in terms of geographical condition.

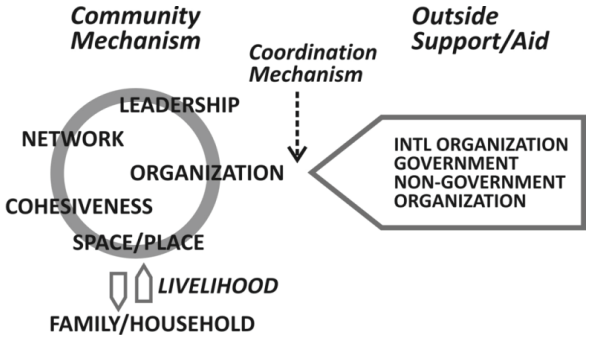

Fig. 1. The interaction between society and space in the community recovery

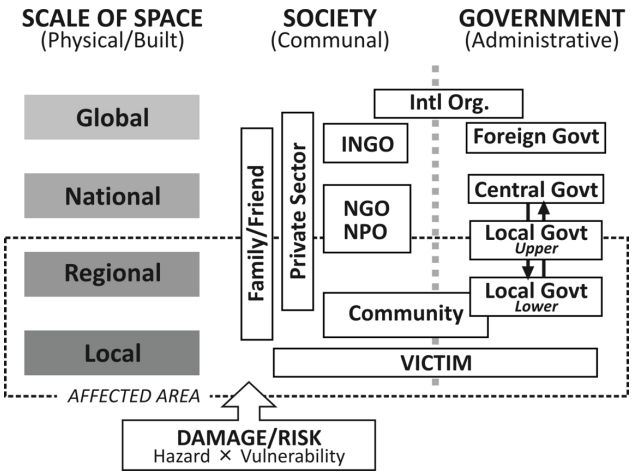

Fig.2. Multi-layered actors spaces in the post-disaster reconstruction

These differences in ways of the reconstructions are closely related to those in how different actors play their roles in relation to each other in the multi-layered social spaces of the post-disaster reconstruction process. Those interrelationships can be seen as ways of bridging between two spheres of the society and the government interacting each other, in each of which various actors vertically interact in the power relations (Fig. 2). Ways of horizontal and vertical interactions are different in different contexts in terms not only of hazard type and magnitude, degree of physical and human damages, ways of emergency responses and so on but also of social, economic and political structures before the disaster. In general, for example, there are two kinds of disaster risk reduction: top down or government-driven and grassroots or community-based mechanisms, in which scientific and local knowledge is involved differently in the different cultural background.

Thus, we can pose a big question: does a mega-earthquake disaster fundamentally change the society? In the post-disaster periods, the society is strengthened, bringing about new facets of a next disaster, or the existing social structures are reproduced or even strengthened in the reconstruction process, leading to another tragedy?

In Japan, for example, the post-Tohoku reconstruction centers on (re)arranging or further modernizing built environments for containing possible hazard risks, supported by the scientific

knowledge and engineering technology. In this process, the central government seems increasingly powerful to control the local governments and communities, and the community resilience partly based on the local knowledge is probably declining, regardless of the recent government's emphasis on the community-based disaster management and people's increasing awareness of disaster preparedness. In Aceh, the housing reconstruction was said successful due to a plenty of aid influx. As for the longer-term reconstruction especially for the local economy, however, the policy tend to be *ad hoc*, lacking a consistent strategy at the decision-making level and with some problems at the implementation level, which are produced by and/or reproducing the uneven power relation between the government and the community. In Sichuan also, bad arrangement between the top-down and bottom-up recovery mechanisms seems to cause continuing underdevelopment of the regional economy, though it may be possible to expect potential roles of the community-based development.

This collection of papers is published as the first report of the research project on internationally comparing the mega-earthquake disasters, including nine research papers, each of which focuses on the 2011 Tohoku, the 2004 Sumatra or the 2008 Sichuan mega-earthquake, or other important geo-hazard disasters, asking such questions from the multi-disciplinary perspectives. Some of them were presented at the workshops that we organized, as mentioned in the pages of archives of this volume.

The first three papers are about the aftermaths of the 2011 Tohoku Earthquake. First, Reo Kimura, a social psychologist, makes a preliminary analysis on the current situations of the recovery based on the questionnaire survey that was conducted in three affected prefectures in collaboration with NHK (Japan Broadcasting Corporation), and argues that local people suffer from precarious lives mainly caused by the delay of resettlements. Ryushi Uchida, a sociologist, has deliberately conducted field works about the housing reconstructions in two devastated cities located in suburban Sendai region, pointing to networking stakeholders as critical for revitalizing communities. Yoshihiko Kuroda, a political sociologist, discusses how the government turns to potential roles of the local community based on the 2011 experiences and increasingly stresses the community-based mechanisms, perusing the recent history of the governmental policies in Japan.

In the next two papers, Nobuhisa Matsuta, a physical geographer, and Fumiaki Kimata, a seismologist, deal with problems of the natural mechanism of geo-hazard and human damages in smaller but deadly regional-scale earthquakes and in the 2014 Ontake Volcano Eruption respectively both from the natural scientist perspective. They argue that the number of casualties is determined fundamentally by the physical mechanism, *not* paralleling with spatial distributions of physical devastation, *but* greatly related to the social vulnerabilities including poor information, fragile buildings and so on. Complicatedly, what and how is vulnerable in the society is different between different types of hazard. Thus, a multi-disciplinary approach is stressed.

Lastly in the first part about Japanese cases, Shigeyoshi Tanaka, a sociologist, discusses changing basic concepts of the disaster prevention policies at the national level and their socio-political backgrounds, in his term "paradigm", through retrospective histories since the late 19th century of the modernization of Japanese society in relation to politicalizing science and seismologists' collective actions. Tanaka, an author of *Sociology of the publicness* (2007) and *Publicness from the community* (2010), questions the state monopoly of disaster countermeasure efforts based on scientific knowledge and technology, which should be democratized to the public, coinciding with the modernization and centralization of the administration of Japan.

In the next part, we move to Indonesian case. As for the longer-term reconstruction especially of economy and livelihood, Masaya Iga, an economic geographer, discusses changing supply chains of inland aquaculture products based on the detail interviews in the areas of Banda Aceh and Aceh Besar, Indonesia that were severely destructed by the 2004 tsunami, and concludes that the recovery efforts were successful for relatively shorter time in physical terms, but that they lacked structural improvements in social and economic terms regardless of some hope for the future. Last, Kenji Muroi, a sociologist, reviews mainly sociological literatures on a wide range of topics concerning the 2004 Sumatra Earthquake, focusing on naturalness of damage, social vulnerability, process and main actors of the reconstruction, roles of community and non-governmental organizations, post-disaster risk reduction and so on after discussing basic concepts of sociologies of natural disaster in the context of Japanese society, and propose some critical research issues.

This collection of papers is dedicated first and foremost to the people in the regions of Aceh, Sichuan, Tohoku and so on who survived but have still suffered from the crises of tsunami, earthquake and volcanic eruption. We want to express our greatest thanks for their kind helps in the fields, on which all the empirical researches are based. We are also grateful for the JSPS for its financial support and the Graduate School of Environmental Studies, Nagoya University for its administrative support. We have a plan to publish another couple of collections of papers during the research project period up to 2018.

ARCHIVES／活動記録

Trilateral Workshop on Mega-earthquakes and Their Aftermaths: Changing Institutions for Disaster Risk Reduction
国際ワークショップ：巨大地震とその後－災害リスク軽減の制度的変化

Date: Saturday, November 7, 2015

Venue: Conference Hall, Integrated Research Building for Humanities & Social Sciences, Nagoya University, Nagoya, Japan

- Makoto Takahashi (Graduate School of Environmental Studies, Nagoya University): Legacy or regenerated society? Multi-layer actors framework for analysis of the post-disaster reconstruction
- Takeshi Sagiya (Disaster Mitigation Research Center, Nagoya University, Japan): Institutional changes regarding earthquake risk reduction in Japan after 2011
- Yoshihiko Kuroda (Graduate School of Environmental Studies, Nagoya University): The Great East Japan Earthquake and change of disaster management: toward community-based approach
- Irwan Meilano (Faculty of Earth Sciences and Technology, Bandung Institute of Technology, Indonesia): Earthquake risk reduction in Indonesia after the 2004 tsunami disaster
- Saiful Mahdi (Faculty of Mathematics and Natural Sciences, Syiah Kuala University, Indonesia): Assessing efforts to 'build back better' 10 years after 2004 Smong (Tsunami) in Aceh, Indonesia
- Djati Mardiatno (Faculty of Geography, Gadjah Mada University, Indonesia): University initiatives for disaster risk reduction in Indonesia: examples from Universitas Gadjah Mada Yogyakarta
- Wu Guochun (Institute of Geophysics, China Earthquake Administration, China): Changing institutions for disaster risk reduction after Wenchuan Earthquake
- Zhao Yandong (Institute of Science, Technology and Society, Chinese Academy of Science and Technology for Development, China): Monitoring the reconstruction of Sichuan Earthquake-affected areas: main findings of a three-round longitudinal survey

公開ワークショップ「東日本大震災からの復興：社会学アプローチ」
Open Workshop on the Reconstruction from the 2011 Tohoku Earthquake Disaster: Sociological Approaches

日時： 2016 年 5 月 22 日（日）13:00～17:00

場所： 名古屋大学情報文化学部（全学共通教育棟・中棟 4 階）SIS4 教室

趣旨： 東日本大震災から 5 年が経ちながらも、被災地の復興はなかなか進まない状況にある。国際比較から見えることは、日本のこれまでの復興政策や制度が世界的にはかなり特殊だということであり、その特殊性ゆえに様々な矛盾が指摘されている。このワークショップでは、被災地における現状をつぶさに観察されてきた二組の社会学者を招聘し、社会学アプローチにフォーカスした上で、復興のプロセスにある様々な課題について議論する。

- 高橋誠（名古屋大学）：趣旨説明と問題提起
- 吉野英岐（岩手県立大学）、内田龍史（尚絅学院大学）、高木竜輔（いわき明星大学）「新しいステークホルダーの合意形成とコミュニティ再生に関する研究」

- 東日本大震災からの復興と岩手県の状況（吉野）
- 宮城県名取市・岩沼市における復興まちづくりの展開（内田）
- いわき市沿岸部の復興と災害公営住宅の課題（高木）

- 大矢根淳（専修大学）「これからの復興・防災の構制：リベラルな防災社会論構築のための事例検討」
- 室井研二（名古屋大学）：議論とまとめ

Special Panel: Comparative Study of Mega-disaster and Society in Japan, China, Indonesia at the International Conference on Aceh and Indian Ocean Studies VI
特別パネル：巨大災害と社会に関する比較研究－日本・中国・インドネシア

Date: Monday, August 8, 2016

Venue: Syiah Kuala University, Darussalam Campus, Banda Aceh, Indonesia

- Makoto Takahashi (Graduate School of Environmental Studies, Nagoya University): Mega-earthquake disasters and reconstructing the societies: an introduction
- Yoshihiko Kuroda (Graduate School of Environmental Studies, Nagoya University): Reconstruction of town with nuclear power plant: a case study of Onagawa-cho after the Great East Japan Earthquake
- Kenji Muroi (Graduate School of Environmental Studies, Nagoya University): The impact of Great East Japan Earthquake on the countermeasures for next huge earthquake and tsunami disaster
- Irfan Zikri (Faculty of Agriculture, Syiah Kuala University): Strengthening social institutions: a study of community collectiveness and cohensiveness of post-tsunami Aceh 2004

公開ワークショップ「リスクをめぐる地震学×社会学」
Open Workshop on Risk: Conversation of Seismologist vs. Sociologist

日時： 2016 年 8 月 23 日（火）14:00～17:30

場所： 名古屋大学情報文化学部（全学共通教育棟・中棟 4 階）SIS4 教室

趣旨： 災害リスクは、一般に、ハザードイベントが起こったときに被害が発生する蓋然性として理解される。地震学者は、それを評価するために自然の声に耳を傾ける。一方、社会学者は、それを人々の営みに関連づけて理解しようとする。このワークショップでは、地震学のリスク評価と、社会学を中心にしたリスク論の最前線にいる二人の専門家を招聘し、リスク概念にフォーカスした、普段であれば出会うことのない異種混交によって、今日の災害や防災をめぐる 様々な齟齬の根底にある問題を議論する。

- 小松丈晃（東北大学大学院文学研究科准教授）：地震リスクと二つの不確実性
- 鷺谷威（名古屋大学減災連携研究センター教授）：地震リスクの計り方と伝え方

Also see, http://www.geogr.lit.nagoya-u.ac.jp/makoto/sumatra.html

CONTENTS／目次

東日本大震災から 5 年を迎えた被災者の復興状況（NHK 報道局社会部実施調査）

木村玲欧
兵庫県立大学環境人間学部／大学院環境人間学研究科

1. 被災者への質問紙調査の実施

2011 年 3 月 11 日に発生した東日本大震災は、現代日本社会に発生した未曾有の広域巨大災害である。被災から 5 年が経過した 2016 年 3 月時点の復興の進捗状況を見ると、避難者数 17.4 万人、高台移転完成 32%、災害公営住宅建設完成 49%となっており、住宅再建の目処は道半ばである（復興庁 2016）。これは 1995 年阪神・淡路大震災において、震災 5 年後の 2000 年 1 月には仮設住宅の全入居者が退去し、3 月末には撤去工事が完了（完全解消）したことと比較すると、復興の構成要素である住宅再建の進捗状況が遅いことが考えられる（兵庫県 2009）。

筆者はこれまで東日本大震災の発災後 2 年および 3 年時点において、NHK に協力して被災者への質問紙調査を行ってきたが、これらの結果でも人間の生活基盤となる「住まい」の整備の遅れが、被災者にとって「すまいの見通し」が立てづらく「すまいの決断」ができないまま「復興実感」に至らず、「家族関係」や「こころとからだ」が悪化している現状が明らかになっている（木村ほか 2014a, 2014b; Kimura et al. 2014）。そこで震災から 5 年を迎える 2015 年 12 月～2016 年 2 月にかけて、NHK 報道局社会部・東日本大震災取材班に協力するかたちで、被災者あわせて約 4,000 人を対象に郵送・対面調査を実施した（なお、本調査は無作為抽出調査ではないことに注意が必要である）。

2. 調査概要・調査対象者の属性

調査対象者は、被災時に岩手県・宮城県・福島県の 3 県の被災者や原発事故の避難者あわせて約 4,000 人である。これらの調査対象者は、これまでに全国の NHK 記者が取材を行い住所や連絡先を教えていただいた被災者のリスト等を活用した。このリストをもとに、質問紙の郵送配布・郵送回収を行い、また取材過程においての対面でも調査を行い、あわせて 1,209 人からの回答を得た（回答率約 30%）。調査期間は、2015 年 12 月～2016 年 2 月にかけてである。なおこれらの調査概要からもわかるように、本調査は、住民基本台帳や選挙人名簿からの無作為抽出ではなく、あくまでも NHK の取材リストに基づくものであり被災者全体の姿を表していないことに注意が必要である。

これらのリストに基づいて行われた回答者の属性をみると、性別は、男性 60.5%、女性

39.5%、年代は、49 歳以下 14.7%、50～69 歳 47.8%、70 歳以上 37.5%であった。震災当時の居住地は、岩手県 26.2%、宮城県 29.2%、福島県 44.6%であった。自宅被害程度をみると、全壊 53.9%、大規模半壊 6.1%、半壊 8.5%、一部損壊 22.2%、被害なし 9.4%であった。現在の住まいの場所は、震災前と同じ場所 14.4%、震災前と同じ市町村 45.8%、県内の別の市町村 31.7%、震災前と別の都道府県 8.1%であり、現在の住居形態をみると、元の場所にある自宅が 13.2%、別の場所に再建した自宅（マンション含む）24.5%、仮設住宅 31.6%、みなし仮設の賃貸住宅 6.5%、復興住宅・災害公営住宅 14.3%、自分で借りた賃貸住宅 6.4%、親族・知人の家 1.3%、その他 2.1５であった。これらの結果から考えると、自宅被害が大きく、別の場所に転居して、仮設住宅や復興住宅等に居住している被災者の声が大きいことが考えられる。以降の結果を読み取る際には、これらのことについて注意が必要である。

3. 地域の復興状況（結果 1）

調査項目は、1）現在の状況について、2）今の心境について、3）住まいについて、4）仕事・家計について、5）絆について、6）これまでの 5 年、そして被災地の未来についての 6 つのカテゴリーにおける計 29 問である。このうち、本調査では、被災者・被災地の震災 5 年の状況を明らかにする項目について結果を取り上げた。まず、地域の復興状況に対する被災者の主観的評価について取り上げたあと、避難・転居回数、被災者の家計の事情、家族・地域・被災地外との絆について取り上げた。なお全体的な調査結果の概要については NHK 報道局社会部・東日本大震災取材班（2016）を参照されたい。

震災時に暮らしていた地域の復興状況について、どのように感じるか 4 つの選択股で尋ねたところ、「想定よりも早く進んでいる」が 2%、「想定どおりに進んでいる」が 12%で、した。これに対して、「想定よりも遅れている」が最も多く 53%、「進んでいる実感が持てない」が 32%と、この 2 つの回答で 8 割を上回っていることがわかった。

具体的な分野ごとの復興の進み具合を尋ねたところ、「遅い」、「やや遅い」と答えた人が最も多かったのは「復興住宅・災害公営住宅の整備」で 67%であった。次いで「地域経済の再生」が 62%、「宅地の供給」が 60%と、「住まい」や「経済」の分野に遅れを感じている人が多かったほか、「原子力災害や被ばくへの備え」も 61%に上った（表 1）。

一方、アンケートでは地域差が出ている回答結果もあり、中でも復興状況について、「進んでいる実感が持てない」との回答は津波による被害が大きかった岩手・宮城では、いずれも 18%だったのに対して、原発事故の影響が続く福島では 50%と岩手・宮城と比べて 3 倍近くになっていることがわかった（表 2）。

これらの結果は、生活の基盤となる住まいの問題が解決していないことが大きいことが一因として考えられる。被災者の自由回答をみると、「5 年経てば仮設から出る人も多く、

復興していると思っていました。現状は、まだまだ仮設住宅から出られない人が多いです。まず住宅地の整備が必要な中、オリンピックは早かったのではないかと。オリンピックも大事ですが、資材や建設に関わる人材がいないのはオリンピックのせいだと思ってしまいます」（岩手県山田町 30 代女性）、「ふるさとに帰ることが本当の復興と思い続けてきました。でも、避難生活が長くなるにつれて戻る人も減ってきているなか、まちとして成り立つのかと不安になります。自宅も劣化していき、立て替えとなると金銭的に無理でしょうし、このままの生活でもいいのかなと揺れる日々です」（福島県浪江町 50 代女性）との回答があった。震災から 5 年の段階でも仮設住宅で暮らす人が多いことが、まちの基盤・自分の生活の基盤ができあがっておらず、これが「復興が進んでいない」という回答につながっているのではないかと考えられる。特に原発事故の影響が残る福島県では、ふるさとに「戻りたいけれども、戻れない」、さらには今後の見通しも立たないという人が多い。このため、他県に比べて「復興が進んでいる実感が持てない」という回答が多いのではないかと考えられる。

表 1　この 5 年の復興の進み具合についての主観的評価（%）

	① 遅い	② やや遅い	③ どちらとも言えない	④ やや早い	⑤ 早い
A　復興住宅・災害公営住宅の整備	34.6	32.4	20.9	9.3	2.8
B　宅地の供給	35.7	24.8	29.8	7.7	2.1
C　雇用・生活資金の確保	17.2	25.1	50.9	6.2	0.6
D　心身の回復	18.5	25.8	42.8	10.6	2.2
E　地域のつながり	22.8	28.6	35.0	11.4	2.2
F　地域経済の再生	30.7	31.3	32.3	5.4	0.3
G　原子力災害や被ばくへの備え	39.9	21.6	34.6	3.2	0.8
H　学校の整備	27.0	22.5	33.6	12.5	4.4
I　道路の整備	27.5	28.8	25.6	14.6	3.5
J　観光客の回復	31.5	24.2	35.6	7.5	1.2
K　医療や福祉のサービス	23.0	22.2	37.3	14.2	3.2
L　防潮堤の整備	31.6	26.5	30.8	9.6	1.4

表 2　地域の復興状況の主観的評価（県別、%）

回答	岩手	宮城	福島
①　想定よりも早く進んでいる	2.6	3.5	1.7
②　想定どおりに進んでいる	12.5	19.0	7.6
③　想定よりも遅れている	67.3	59.4	40.8
④　進んでいる実感が持てない	17.6	18.2	49.9

4. 避難・転居回数（結果 2）

次に、「震災発生以降に避難や転居した回数」について尋ねたところ、「5 回以上」繰り返したと回答した人は 28%に上った。これを 3 県別に見ると、岩手県と宮城県がそれぞれ平均で 2.7 回だったのに対し、原発事故によって今も自宅に戻ることができない人が多い福島県は平均で 4.6 回と多く、10 回以上という回答も 13 人いることがわかった（図 1）。

「住まいが変わったことで家族に影響があったか」との設問に対しては、「大きな影響があった」が 46%、「多少影響があった」が 36%と、「それほど影響はなかった」が 12%、「全く影響はなかった」が 3%、「住まいは変わっていない」が 3%と、合わせて 82%の人が影響があったと回答していた。具体的な影響を複数回答で尋ねたところ、「近隣との交流が減った」が 39%、「体調が悪化する人が出た」が 33%、「家族が別々に暮らすことになった」が 29%、「家族関係が悪化した」が 12%などとなっていた（表 3）。また、転居回数と影響の大きさについてみてみると、「大きな影響があった」と回答した人の割合は、回数が 4 回以下の人が 39%だったのに対して、5 回以上の人は 61%とおよそ 1.5 倍となっていた。具体的な影響でも、「家族関係が悪化した」や「体調が悪化する人が出た」と回答した人の割合は、転居回数が多いほど高くなる傾向が見られた。

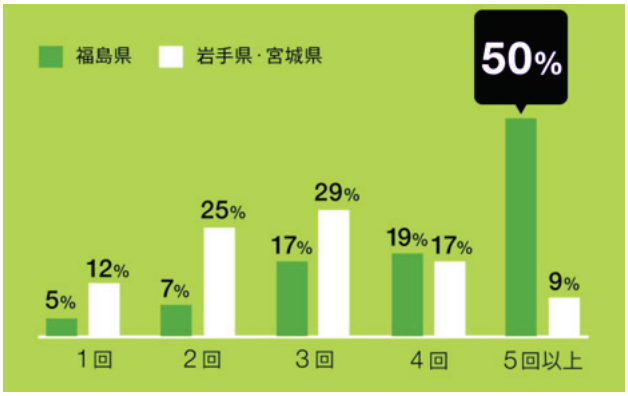

図 1　震災発生以降の転居回数

表 3　住まいが変わったことが家族に与えた影響（%）

	回答	全体
①	経済的に苦しくなった	21.4
②	体調が悪化する人が出た	32.8
③	家にこもりがちになった	24.0
④	仕事を辞めた・変えた	20.9
⑤	心理的負担が増えた	37.1
⑥	近隣との交流が減った	39.2
⑦	ふるさとへの意識が薄れた	12.6
⑧	家族が別々に暮らすことになった	29.3
⑨	家族関係が悪化した	11.8
⑩	その他	9.3

この結果を考えると、避難や転居を 5 回以上繰り返した人が 3 割近くいることに東日本大震災の被害の大きさがあらわれていることがわかる。阪神・淡路大震災では発災から 5 年後には仮設住宅が解消されたが、今も仮設住宅に多くの人が住んでいることから転居回数はまだ増えると思われる。転居回数が多くなれば家族や地域との絆が弱まることが考えられるために、生活再建にとって大きな問題だと考えられる。

自由記述をみても、「転居を 10 回しました。いまは災害公営住宅で暮らしています。80 歳になりました。この歳になって、自宅に戻って何をするのでしょうか。今の生活では年齢のことを考えると未来はありません。前の生活に戻ることはもう無理です」（福島県富岡町 80 代男性)、「震災以降、避難先として親族や知人の家などを転々、5 ヶ所目がいまの仮設住宅です。震災から 1 年も経てば自宅に戻れると思っていましたが、いまだに仮設住宅での暮らしが続いています。母は 94 歳、いまも自宅に帰りたい帰りたいと言い続けています。普通の生活がどれほど幸せなことだったかと思います」（福島県南相馬市 60 代女性)、「当時中学生だった長男は仮設住宅で受験勉強。高校を卒業して就職しました。狭い仮設住宅での勉強は大変だったと思います。いま中 1 と高 2 の娘も勉強に集中できずにいます。早く住宅が再建できていれば、有意義な高校生活や受験勉強ができたのではないかと親としては申し訳ない気持ちでいっぱいになります。5 年はあまりにも長すぎる気がします」（宮城県東松島市 40 代女性）というような回答があり、避難や転居、仮設住宅での生活が、被災者の生活そのものや生活再建へ向かう気持ちに大きな影響を与えていることがわかる。

5. 被災者の家計の事情（結果 3）

震災以降の家計の状況について尋ねたところ、「当初から苦しい状況が続いている」が 9%、「だんだん苦しくなっている」が 43%、「変わらない」が 38%、「だんだん楽になっている」が 9%となり、「当初から苦しい」と「だんだん苦しくなっている」があわせて半数以上にのぼった。特に「だんだん苦しくなっている」と回答した人が多く、大きな住宅被害や転居などが影響を与えていて、今後も苦しい生活が続くことが懸念される結果となった（図 2 左)。

どのような支出が増えたかについて尋ねたところ、支出が増えた項目では、交通費が 62%と最も多くなった。自由回答を見ると、「震災で職を失い再就職したが職場まで遠い」や「避難のために離ればなれになった家族と会うため」などといった声が寄せられた。また、自宅を再建する人が増えていることや、建設費の高騰などから、住まいに関する支出も 43%となり、3 年前の NHK が行った同様の調査と比較しても（木村ほか 2014a）が増える傾向にあることがわかった（図 2 右)。

自由記述をみると、「仮設住宅から災害公営住宅に移り、家賃がかかるようになりました。

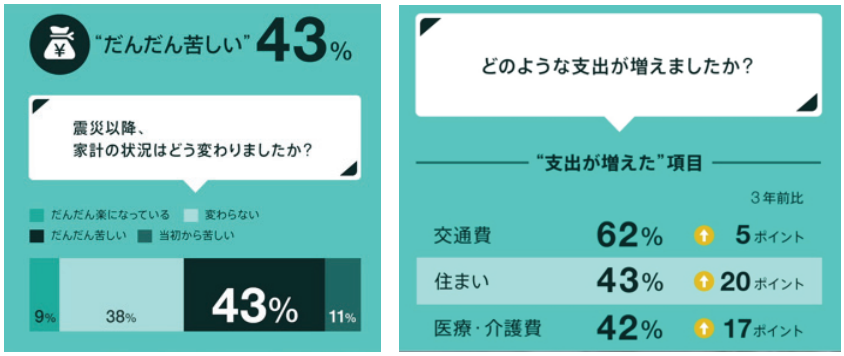

図 2　震災以降の家計の状況の変化（左）と支出増になった費目（右）

手取りで月 10 万円のうち、家賃や奨学金の支払いを引くと、残りは 6 万 5000 円。お風呂も毎日入りたいけれど我慢していますが、月 5 万円以上預金を崩しています。今後、家賃が大幅に増えると生活保護になるかもしれないと、毎日そればかり考えています」（宮城県気仙沼市 60 代女性）、「新築、増築と一安心のところを震災にあい、また家を建てなければなりませんでした。孫たちもだんだん大きくなり、高校 2 年生もいて、大学に行くといったらどうしようと思います。家族が 7 人と多いので、家計の支出は増えるばかりです」（岩手県陸前高田市 70 代女性）といった住まいに関する家計の支出増大を知ることができる。

また「震災で自宅が流され、妻を亡くしました。いまは仮設住宅で 1 人暮らしをしています。5 年目までに自宅を自力で再建することを目標にしてきましたが、まだ整地しかできていません。経営している会社も、顧客数の減少と設備の復旧ができないので、仕事量が減っています。再建を目指して、家計を切り詰めて貯蓄にまわしています」（岩手県陸前高田市 60 代男性）、「自分の店がオープンして 1 年 4 か月で被災。平成 23 年 7 月にコンテナで再開し、その翌年には仮設商店街でオープンしました。でもその時が売り上げのピークでした。そのあとは、年々1 割ずつ売り上げが減少していっています。仮設商店街の退去期限も迫る中、新設の商店街に移る費用が捻出できません」（岩手県陸前高田市 40 代男性）といった意見もあり、1 つの家庭の家計だけに着目するのではなく、地域全体の経済の落ち込みとあわせて解決していかなければならない問題であることがわかる。

6. 家族・地域・被災地外との絆（結果 4）

東日本大震災では「絆」という言葉が報道などでよく取り上げられている。財団法人・日本漢字能力検定協会が実施する、その年の世相を漢字ひと文字で表す「今年の漢字」においても、震災が発生した 2011 年は「絆」という文字が選ばれており、家族や地域などの大切な人とのつながりや、被災地への復旧・復興支援を象徴する言葉として使われている。

そこで「震災直後、“絆”という言葉がよく使われました。当時感じた“絆”について、今はどのように感じていますか」と尋ねたところ、当時と比べて家族との絆は強まったと

感じる人が多かったのに対して、地域の人との絆や被災地の外との絆は弱まっていると回答した。具体的には、家族との絆は、震災当時と比べて「強まっている」「やや強まっている」が合わせて 38%、「変わらない」が 48%、「弱まっている」「やや弱まっている」が合わせて 14%であった。一方、地域の人との絆は、「強まっている」「やや強まっている」が合わせて 19%、「変わらない」が 30%であったのに対して、「弱まっている」「やや弱まっている」が合わせて 51%であった。また被災地以外との絆も、「強まっている」「やや強まっている」が合わせて 22%、「変わらない」35%であったのに対して、「弱まっている」「やや弱まっている」が合わせて 43%であった（表 4)。

表 4　震災直後と比べて“絆”についてどのように感じているか

	①強まっている	②やや強まっている	③変わらない	④やや弱まっている	⑤弱まっている
A　家族との絆	20.7	17.3	47.7	9.0	5.2
B　親戚との絆	7.4	12.4	41.2	20.8	18.2
C　友人・知人との絆	8.9	13.4	39.0	23.4	15.3
D　職場の人との絆	4.9	9.7	48.7	14.4	22.4
E　地域の人との絆	5.1	14.0	30.1	24.0	26.8
F　ボランティアとの絆	8.0	13.6	34.6	18.9	25.0
G　被災地以外との絆	7.7	14.2	34.9	18.2	25.0

自由回答を見ると、「いままでは家族、妻と一緒に生活しているのが当たり前でした。そばにいて当たり前でした。けんかしたり、怒ったり。震災当時も同じような生活をしていました。しかし、いまは妻のありがたさ、家族のありがださ、身にしみて感じています」（宮城県仙台市 60 代男性)、「子どもたちの笑顔や家族の笑顔が心の支えになっています。震災後、のど自慢に出場したメンバーとの交流はいまも続いています。被災したことで絆が強まったり、たくましくなったり。悲しんでいる人ばかりではないことを伝えたいです」（宮城県岩沼市 40 代女性)、「避難所にいる時、応援で来ていたおまわりさんが 6 歳の息子と遊んでいただき、今でも地震があったりするとメールをくれます。とてもありがたく、心の支えとなっています。息子は兄ちゃんを津波で亡くしているので、兄ちゃんみたいに感じているのだと思います」（岩手県山田町 50 代女性）など、家族・地域・被災地外などの人との絆を強く感じている意見が多く見られた。

しかし一方で、「震災直後、絆という言葉であふれかえりましたが、がれき受け入れの反対運動や行政の対応を見て、絆という言葉のうそ臭さを感じるようになりました。私の周

囲には絆という言葉にアレルギーを持つ人が少なからずいます」（岩手県大船渡市 60 代男性)、「正直、絆ってなんですか？テレビでは頭にくるくらい、この言葉がしょっちゅう流れていました。震災当時は人間の汚い部分もたくさん見てきたので、この言葉の意味がわかりませんでした。テレビはきれいごとばかりで本当の姿を放送してないのではないでしょうか?」（岩手県宮古市 40 代男性）といったような、絆という言葉に対して否定的な意見も 40 件以上見られた。被災地と被災地以外との結びつきをどう深めていくのか、震災から 5 年が経過するなかで、被災地の外からのさまざまな支援やつながりが薄れかけていることも考えられる。復興はまだ道半ばであり、これからも被災地外からの注目・支援は、被災地に向かわなければならない。被災地内外の絆というものを、もう一度見直さなければならない時期に来ていることが、震災 5 年の課題のひとつだと考えられる。

7. 長期的な復興にむけて

本稿では、東日本大震災の震災 5 年目の状況について、NHK と協力して行った調査結果を紹介してきた。回答者は、自宅被害が大きく、別の場所に転居して、仮設住宅や復興住宅等に居住していることに偏ってはいるが、住宅再建は途上であり、生活基盤である「住まい」について、今後も、支援を続けていくことが必要であることが明らかになった。特に津波災害や原子力事故の影響など、広域災害においては自分の住んでいる地域全体が居住不能もしくは長期にわたって戻ってこられないために、「住まいの再建にむけてのさまざまな道筋（ルート)」を提示していく必要がある。

このためにはまずは「生活拠点を決定する」という決断を被災者にしてもらえるような施策・環境づくりが必要である。避難指示区域について 10 年スパンでの復帰が難しいようならば政府と被災者との交渉のもとで「新たな土地で生活をはじめる」ための支援も必要ではないかと考えることができる。そのためには土地や建物を物理的に用意するだけではなく、生業・産業支援を迅速・適切に行う必要があることもわかった。震災から 5 年目の時点においても、仮設住宅などに代表される仮住まいが続いており、今後、被災者の個人属性や置かれている状況の変化によって、医療・福祉や教育、仕事など解決すべき課題が多様化していくことが考えられる。

図 3 が阪神・淡路大震災の検証によって提案された復興の構造（復興の 3 層モデル）である（神戸市震災復興総括・検証研究会 2000; 復興の教科書 2014)。まずは「社会基盤の復旧」が必要であり、その上に、住宅再建・都市計画といった「都市再建」（東日本大震災では地域再建）と、経済の活性化・中小企業対策といった「経済再建」が必要である。そしてこれらの再建の上で、ようやく被災者の「生活再建」が成りたつというものである。生活再建の目標（ゴール）は、どの被災者についても共通して「生活再建」である。しか

し生活再建に至る道筋（ルート）は、ライフラインの復旧やまちづくりに目処がたち新たな住まいを手に入れた後は、個人の状況にあわせて細かく枝分かれしていくことが考えられる。今後、行政などの災害対応従事者は、支援対象者・支援内容の細分化などの準備・支援を進めていき、「取りこぼしのない」支援を一層進めていく必要があると考えられる。一方で、被災者の個別の対応だけに陥るのではなく、「まち全体」をどのようにしていくのかについて住民と行政が合意を重ねながら、復興状況にあわせて修正をしながらも地域の未来の姿についてのグランドデザインを作り上げていくことも重要である。

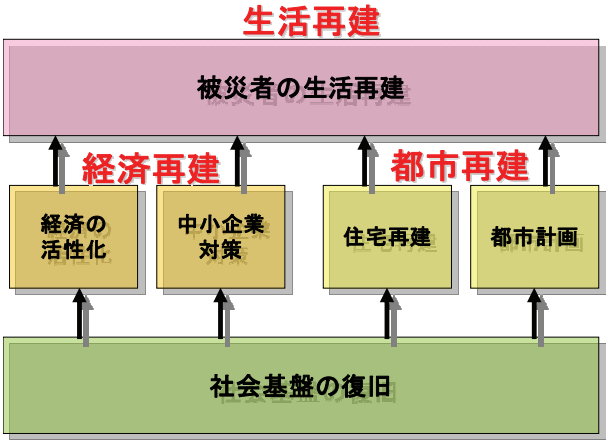

図 3　阪神・淡路大震災からの復興構造

自由回答をみても、「避難指示は解除されましたが、学校の再開がまだのため避難を続けています。コミュニティーが崩れましたが、子どもたちなりにマックスで頑張っています。親にとっては、フレコンバックの隣で子どもが遊ぶ姿がイメージできず、まだ戻るかどうか判断がつきません。子どもの気持ちを第一に考えたいと思います」（福島県楢葉町 50 代男性）、「復興はひとつひとつ、帰った住民の手で、進めていくしかないと思います。すべて行政の計画で進めても、その後が続かない。生活できない住民が出てくると思います。自分の手足で復興はしていきたい。あせらず無理せず確実に、一歩ずつ前へ行こう」（福島県楢葉町 50 代男性）、「震災前に戻るのではなく、それを超える形での復興を目指し、後世につなげていく、新しい取り組みが行われ、新しい技術が生まれる。さまざまな分野で日本の、世界のハブとして情報を発信していくような形で復興を成しとげたい。世界の手本になる復興を成しとげましょう」（福島県大熊町 40 代男性）、「新しい街づくりにはスピード感が必要だが、みんなが横一線で進む必要はなく、それぞれのペースに合わせていけばいいと思う。行政も法律や規制に縛られず、大きな構想、心躍るような発想で計画を進めてほしい。ゆっくりと進んで、新しい街づくりに悔いを残したくない。急がず慌てずゆっくりと心豊かに生活できるように進んでいきたいです」（岩手県陸前高田市 60 代男性）、「国

道 6 号線沿いに植えた桜の木、着実に成長しています。小さいながら、花が咲いていた木もあります。信じましょう！必ず明るい未来が来ることを！桜の苗木のように少しずつでも成長していける！いつの日か満開の桜の花が見られる！被災地だったことを忘れるような明るい笑顔があふれる地域になることを願っています」（福島県南相馬市 30 代女性）というかたちで、復興へ向けての着実な歩みや意識も多く見られるようになったことが震災 5 年目の質問紙調査結果の特徴であった。

阪神・淡路大震災においても、兵庫県は前期 5 か年、後期 5 か年の計 10 年の復興計画を作り上げ実施した。東日本大震災の復興のスピードが、阪神・淡路大震災の復興のスピードと同じだったとしても、震災 5 年を迎えた調査時点は、ようやく折り返し地点である。震災 6 年目を迎えるにあたって、長期的な復興に向けて、被災地内だけでなく被災地外からも注目・支援をしつづける「仕切り直し」が必要である。

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New Research in Post-disaster Reconstruction on Building Stakeholder Consensus and Community Revitalization: the Evolution of Reconstruction Plans in the Cities of Natori and Iwanuma in Miyagi Prefecture

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Abstract: This study examined the reasons for the difference in progress, mainly focusing on the rebuilding of living environments, that arose in the reconstruction planning processes of the cities of Natori and Iwanuma in the southern Sendai metropolitan region. The study took the perspective that building resident consensus could be considered a key factor in post-disaster reconstruction. While the process of reconstruction has been slow in Natori's Yuriage district, the reconstruction of the city's Shimomasuda district and of Iwanuma's coastal area have already been completed. The study found that the factors underlying the rapid progress was made in these two areas were: 1) they were small and cohesive before the disaster, 2) the extent of damage was small so there were few stakeholders, and 3) they were able to maintain a sense of community among their residents while they were in temporary housing after the disaster.

Keywords: The Great East Japan Earthquake, reconstruction, city planning, Natori, Iwanuma

1. Introduction

During the Great East Japan Earthquake the coastal region of the greater Sendai metropolitan area, which is the urban center of the Tohoku region, was struck by a 7-8 meter tsunami and suffered an enormous loss of human life and property (Fig. 1). In the city of Natori near Sendai, 27 square kilometers including the prosperous fishing port of Yuriage and Shimomasuda, the home of Sendai Airport, were inundated, resulting in 954 deaths and 39 missing people. In the city of Iwanuma 29 square kilometers were inundated and the damage included 186 deaths and 1 missing person (Miyagi Prefecture, 2016).

Natori and Iwanuma are neighboring municipalities. Although they decided on reconstruction plans at about the same time, they pursued very different city reconstruction planning processes for their "Reconstruction and Land Readjustment Projects" and "Disaster-prevention Collective Relocation Promotion Projects".

This study used the two cities' reconstruction planning processes as case studies to examine the reasons for differences in progress which arose, mainly focusing on the planning process for

reconstructing living environments from the perspective of what could be referred to as the key to the process of post-disaster reconstruction: “resident consensus”.

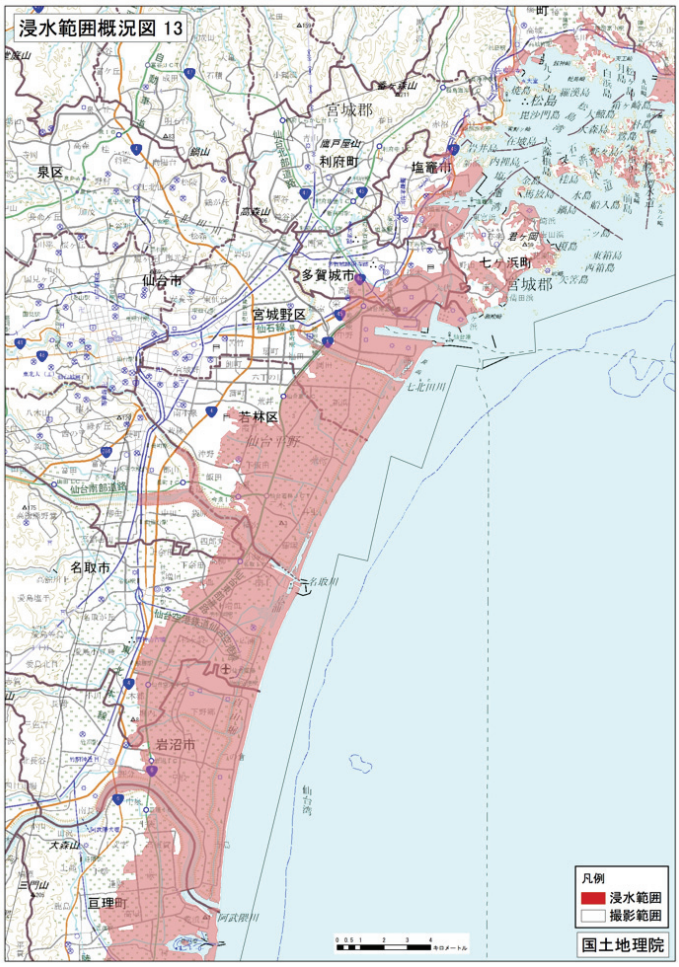

Figure 1. Inundated Area
Source: Geospatial Information Authority of Japan, 2011

2. Consensus building in the reconstruction process

In Japan, after a large-scale disaster the government usually implements “Reconstruction Planning Projects”, but often because of the problems involving land ownership alone, conflicts arise between the interests of government trying to push the project along and the interests of the region’s residents. The difficulty of building consensus in these situations has already been discussed by Yoshikawa (2007).

In the aftermath of the Great East Japan Earthquake, as well, “Reconstruction and Land Readjustment Projects” and “Disaster-prevention Collective Relocation Promotion Projects” to move neighborhoods to higher ground, etc., were implemented in disaster afflicted areas. However, as afflicted areas decided how to proceed with reconstruction, including whether to rebuild in the same location and build seawalls, or to relocate the entire town, there frequent reports of difficulties being encountered in the building of consensus.

This study looked at the cases of the cities of Natori and Iwanuma, both located in the southern part of the Sendai metropolitan area, as examples. While neighboring each other, these communities pursued very different reconstruction processes reflective of their different situations. Part of those processes included trying to build consensus between the government and residents. For example, the media have frequently portrayed Natori's Yuriage district as a place where residents have been unable to reach consensus, while the coastal area of Iwanuma is presented as a prime example of successful reconstruction because they reached consensus early on. In fact, when Miyagi Prefecture quantified the rates of progress in reconstruction for residential areas, public housing for disaster victims, industrial areas and public facilities as of June 2016, Iwanuma was the municipality which had made the most progress among the prefecture's municipalities at 73%, far surpassing second-place Watari's 58% and fifth-place Sendai's 48%. On the other hand, Natori had made the least progress at 18%, which was almost 10 points below Shiogama's 27%, which was the next lowest percentage.

In the rest of this report on our study we hope to demonstrate some lessons to be learned for future reconstruction planning by explaining why these differences in progress arose, mainly looking the planning processes for reconstructing living environments. We focus on what might be called the key to the process of reconstruction after a disaster, "resident consensus".

3. Overviews of Natori and Iwanuma and their disaster victim assistance efforts

Before looking at their reconstruction processes, we would like to present overviews of Natori and Iwanuma and the assistance they provided to disaster victims.

3.1. Overview of Natori and its disaster victim assistance efforts

The city of Natori was originally a town formed in 1955 from the merger of six towns and villages (Masuda, Yuriage, Shimomasuda, Tatekoshi, Medeshima and Takadate). It converted into a municipality in 1958. It has excellent accessibility as it adjoins the southern part of Sendai, the principal city of the Tohoku region. Sendai Airport is located there to which there is access by rail, and the Japan Railway (JR) Tohoku Line, the Tohoku Expressway and the East Sendai Highway run through it.

In the 2010 national census Natori's population was 73,134 (25,124 households). Both the population and the number of households had grown rapidly due to development, which included housing developments on the city's west side and developments along the Sendai Airport Line in the east. Natori had a reputation for being a good city to live in. In Japan's "The Best Cities to Live In 2015" (Toyo Keizai News Company, 2015), Natori came in first for the Tohoku Region and fourth nationally.

As bedroom communities for the Sendai metropolitan region grew up around Natori's original towns and villages, the number of elementary school districts grew to 11 and a community center

was opened in each district. Of those districts Yuriage (2,551 households and a population of 7,013 as of the end of February 2011) was completely devastated in the disaster and other districts including Kitagama (123 households and a population of 396 as of the end of February 2011) and the coastal area of the Shimomasuda district also suffered significant damage.

Right after the disaster there were more than 40 evacuation shelters and the number of evacuees reached 10,715. Construction of pre-fab emergency temporary housing began on March 28, 2011. 889 were built in 8 places in the city (Fig. 2). People began moving into this temporary housing on May 3rd and the evacuation shelters were closed on June 23rd. The number of people living in temporary emergency housing in the city rose to a little under 6,000 (more than 2,000 households) with about half in pre-fab housing and half in government-sponsored rental housing. Residents in Mitazono Temporary Housing Sites No. 2 and No. 3 were mainly from Shimomasuda or otherwise Yuriage, but generally, people were assigned to temporary housing according to their original neighborhood association.

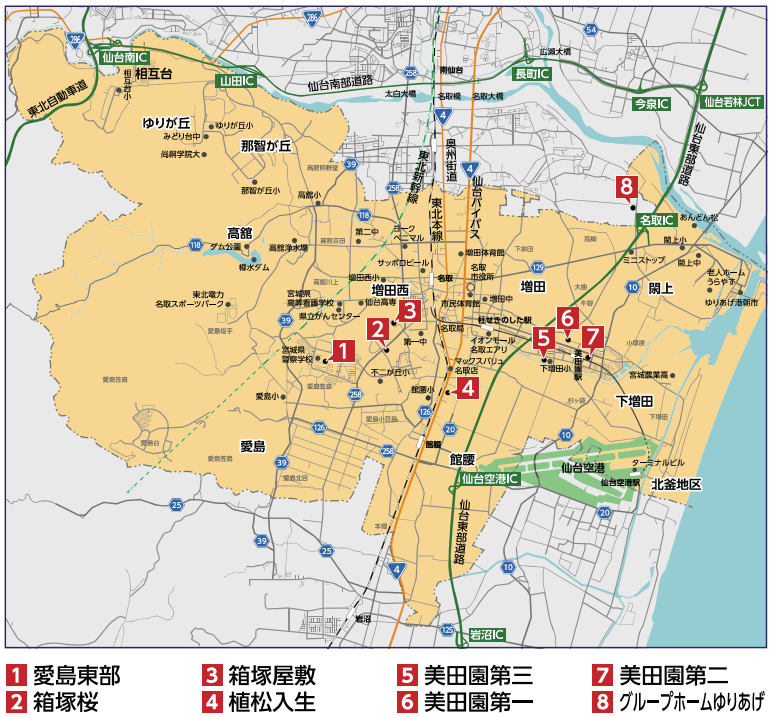

Figure 2. Location of temporary housing in Natori
Source: Natori city (2015: 9)
Note: 1: Medeshima Tobu, 2: Hakozuka Sakura, 3: Hakozuka Yashiki, 4: Uematsu Iryu, 5: Mitazono No.3, 6: Mitazono No.1, 7: Mitazono No.2, 8: Group home Yuriage

The Natori City Social Welfare Council, which operated the Natori City Disaster Volunteer Center beginning immediately after the disaster occurred, continues to be active. Beginning in August 2011, the council set up the "Natori City Reconstruction Assistance Center "Hiyori" ("fine weather") to support their reconstruction activities, which mainly consisted of providing support for people with their daily lives, such as making daily living advisors available in the meeting room at

each pre-fab temporary housing site, coordinating with temporary housing governance committees and watching out for the safety of residents. The Japan Overseas Cooperative Association (JOCA) has also been active in providing support for people in government-sponsored rental housing, For example, beginning in October 2012, the JOCA began holding “get-together salons”—venues where people in rental housing could get together to socialize.

3.2. Overview of Iwanuma and its disaster victim assistance efforts

The original town of Iwanuma merged with the villages of Sengan and Tamaura in 1955 forming the new town of Iwanuma, which then converted to a municipality in 1971. It is strategically located from the perspective of transportation, because it is at the junction of the JR Tohoku Line and the Jouban Line as well as being at the place where National Highways 4 and 6 converge. Sendai Airport is at the northern end of its municipal boundary with Natori. As companies moved into the industrial area near the airport, it developed into a center for commerce and industry.

In the 2010 national census, Iwanuma had a population of 44,187 (15,519 households), and both the population and number of households have been growing. In the “Best Cities to Live In 2015” rankings already mentioned, it came in second for Miyagi Prefecture after Natori (Sendai was third).

Regarding community organizations, as of this writing on July 31, 2015 there were 35 administrative districts in the western part of the city, formerly the village of Sengan, 40 in the central part of city, formerly the town of Iwanuma, and 24 in the eastern part, formerly the village of Tamaura. In spite of the fact that the conditions in some of the communities have changed since the disaster, neighborhood associations are more or less organized by administrative district. Severe damage from the Great East Japan Earthquake occurred in the 6 districts located on the coast, Ainokama, Fujisone, Ninokura, Hasekama, Kabasaki and Shinhama.

The number of evacuees in Iwanuma reached a maximum of approximately 6,800 people. To house some of them, 384 pre-fab temporary housing units were constructed throughout the Satonomori district using the parking lots of public facilities such as the civic center (Fig. 3). The evacuation centers were closed on June 5, 2011 and all households who wished to were able to move into temporary housing. Starting in the evacuation shelters Iwanuma organized the evacuees’ lives by district, and this also applied to how they were moved into pre-fab temporary housing.

Support for the daily lives of disaster victims was mainly the responsibility of the city’s Disaster Victim Assistance Office which coordinated with each municipal agency to support residents living in pre-fab housing or in government-sponsored rental housing. Members of JOCA, which has experience providing disaster relief overseas, became the personnel who provided assistance with daily living to temporary housing residents at the Satonomori Support Center which opened in July 2011. JOCA members provided support such as looking out for residents’ safety, organizing events, and managing meeting rooms. For residents in government-sponsored rental

housing, beginning immediately after the disaster occurred, the Iwanuma-City Social Welfare Council operated the Iwanuma Disaster Volunteer Center and in August 2011 replaced it with the Iwanuma-City Reconstruction Center "Smile" (closed March 31, 2016), which provided residents with advice and social support by, for example, holding "get-together salons".

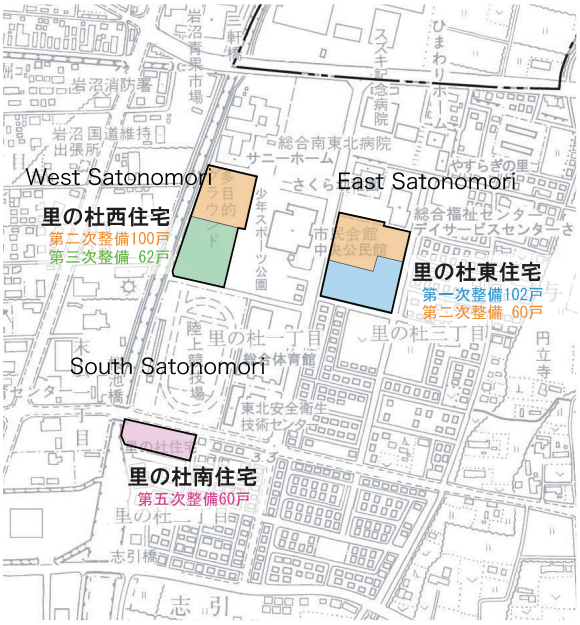

Figure 3. Location of temporary housing in Iwanuma
Source: Iwanuma city (2011a: 19)

An important characteristic of Iwanuma's approach could be said to be that these support organizations were located in a General Welfare Center set up close to the pre-fab housing so that governmental agencies, support centers and the council of social welfare were in close physical proximity to the residents in temporary housing.

4. Natori's Reconstruction Process

In this section we review on Natori's city reconstruction planning process.

4.1. Natori's city reconstruction planning

As part of working out its Post-Disaster Reconstruction Plan, the city set up a "Council on Natori's New Future" in order to develop a proposal that reflected the opinions of the city's residents. The council consisted of 24 members. The majority of the members were outside experts: the chairman was a former university professor, the two vice-chairmen were university professors, 6 other members were university-related academics and 4 members were officials from the national and prefectural governments. Local representation consisted of 2 people from the Yuriage neighborhood association, the chief district administrator of Kitagama, 2 people from the parent-teacher associations for the local elementary and junior high schools, and officials from the

agricultural cooperative, the fishermen's cooperative and the chamber of commerce and industry. The first meeting was held on May 22, 2011 followed by 8 more meetings. On August 23rd the Future Council submitted a draft of its proposal for drawing up a Post-Disaster Reconstruction Plan for Natori to the mayor.

A review of the minutes of the council meetings confirmed that in public meetings for the residents in temporary housing about reconstruction for the Yuriage district, which had suffered severe damage, some people wanted to live in a safer place further west and some people wanted to return to Yuriage as soon as possible. Concern was already voiced in the council that it might not be possible to achieve a consensus among these residents and they would end up dividing into camps. However, as part of putting the proposal together, in the sixth meeting of the council, 5 of the local members supported reconstruction at the original site and 3 supported mass relocation, so a draft proposal for reconstruction at the original site was adopted (Natori Reconstruction Planning Department, 2011).

Based on this draft proposal, in September a round-table discussion was held and a "Survey of City Residents' Opinions Concerning Post-Disaster Reconstruction" (Natori city, 2011a) was performed. A final "Post-Disaster Reconstruction Plan for the City of Natori" (for fiscal years 2011–2017) was created in October 2011 (Natori city, 2011b).

4.2. The Yuriage district reconstruction process 1: Repeated plan revisions and reconstruction project delays

In this plan, the "Urban Disaster Area Reconstruction and Land Readjustment Project" for the reconstruction of the Yuriage district at the original site called for the building of a seawall with a Tokyo Peil (T. P.) +7.2 meters along the coast and an additional T. P. +5 meters for a 70-hectare residential area as a disaster prevention measure. To clarify the other details of the reconstruction plan for Yuriage, in December 2011 the "Joint Council for the Promotion of Yuriage Reconstruction" was set up. It had 15 members made up of 4 representatives for the neighborhood associations in the Yuriage district, 5 members recruited from the public, 3 representatives from trade associations, and 3 members of city planning groups. The Natori Reconstruction Planning Department was the administrative office for the council. Because the city was intending to obtain approval for its reconstruction project in July 2012, the council was scheduled to meet by June 2012. However, in the face of opposition by many residents to reconstruction on the original site out of concern about future tsunamis and other issues, it was decided to interview every household individually about their views on the future project plan and the interviews took place from July through August 2012.

The results of this opinion survey showed that about 34% wished to rebuild on the original site and 56% wished for the land to be sold (Natori Reconstruction Division, 2013). As a result, the city looked at implementing both a "Land Readjustment Project" to reconstruct the Yuriage district on the original site and a "Disaster-prevention Collective Relocation Promotion Project" to move

residents outside of the district. However, the proposal to implement both was set aside because of the large gap that would be created for disaster victims affected by the two projects in the kinds of assistance they would receive. In addition, as a financial buffer, the national government required that the population density at night when the project was completed be at least 40 people per hectare to qualify for public subsidies. To meet that requirement, it was necessary to ensure there would be at least 2,800 residents, which would have been difficult to do if a "Disaster-prevention Collective Relocation Promotion Project" were implemented at the same time.

As a result, in February 2013 the city reduced the buffer zones to 45 hectares and, further, made the planned post-reconstruction population 3,000 people by proposing a "Disaster Prevention Collective Relocation Promotion Project" in which households from areas on the coast which were set to become non-residential areas would be moved into Yuriage public housing for disaster victims.

The city accepted these changes to the plan and from April through May of 2013 conducted another survey of residents' opinions. However, the percentage of households in favor of reconstruction within the Yuriage district further decreased to 25% (Natori city, 2013). In the meantime, various media organizations picked up the story of how the building of consensus regarding the future outlook for the Yuriage district was stymied (NHK Special Correspondents Team, 2013).

Finally, it was decided to reduce the scale of the reconstruction project and promote the implementation of both a Devastated Urban Disaster Area Reconstruction and Land Readjustment Projects and Disaster-prevention Collective Relocation Promotion Project. First, on September 11, 2013, approval was received from the Minister of Land, Infrastructure and Transport for a Disaster Prevention Mass Relocation Project which made about 65 hectares in the east part of Yuriage a disaster hazard area. In addition, on November 22nd of the same year Miyagi Prefecture approved a reconstruction project that included both a Land Reallocation Project and a Disaster Mass Relocation Promotion Project, so on November 25th the city settled on plans for a Land Reallocation Project for about 57 hectares, of which 32 hectares were to be raised 3 meters so that they would be 5 meters above sea level for housing. Thus, the total area for reconstruction ended up consisting of about 122 hectares.

The ground-breaking ceremony for the Land Reallocation Project took place on October 20, 2014 with completion targeted for March of 2018. Plans were for the application process for public housing for disaster victims to begin in the fall of 2015 and for people to take up residence in single-family housing in the spring of 2016 and in condominiums in the spring of 2017. However, the first phase of construction, which was for 90 single-family homes, did not actually begin until December 23, 2015 with completion targeted for June of 2016. The future plan is to have built a total of 524 homes (267 condominiums and 257 single-family houses) in the Yuriage district and 100 homes (50 condominiums and 50 single-family houses) in the Takayanagi district by December of 2018.

Ironically enough, the repeated changes to the reconstruction plan and the project delays have caused significant rifts between the government and the residents who have both wanted reconstruction to proceed smoothly. As a typical example, a problem occurred in May of 2014 involving the return of the land being used for temporary housing in east Medeshima to its owner. The city had rented private land to build this temporary housing site but because the reconstruction project was delayed beyond the initial schedule and the lease could not be extended, the city came up with a plan to move half of the residents into other temporary housing. This plan was stridently opposed by the residents and the residents' association which had worked hard to create the temporary housing communities. In the end, the city decided to buy the land from the owner to resolve the problem , but residents' trust in their relationship with the government was further damaged.

4.3. The Yuriage reconstruction process 2: Resident-driven city planning

The Joint Council for the Promotion of Yuriage Reconstruction introduced above convened 20 times because of the difficulty of reaching a consensus until September of 2013 when ministerial approval was obtained for the reconstruction project. The council was, then, temporarily dissolved in order to make the body more inclusive and lessen the leadership role of the government. Starting in January of 2014 public meetings were held to create a new body, which was inaugurated on May 11, 2014 as the "Joint Council for Yuriage City Planning" and was the result of efforts by members of committees of self-appointed individuals and people recommended by others to do preparatory planning.

The council has as its objectives to create a vision for the new layout of the district and develop ideas of what it should look like by engaging residents in discussions of their views for the district and to serve as a point of contact with the City of Natori and relevant agencies to negotiate and propose concrete plans for the district. It held its first meeting on July 12, 2014. Anyone who was a Yuriage resident and supporter of reconstruction, interested in becoming a resident of the district's public housing for disaster victims, a landowner in the district, or an individual or legal entity doing business in the district could qualify to join the council. As of March 15, 2016, 382 households were members. The council is run by the residents with all officeholders required to have been Yuriage residents at the time of the disaster. Official roles consist of 2 secretaries and between 8 and 15 other leadership roles, including president and vice-president. The council leadership is relatively young with the president being in his early fifties and the secretary-general being in his late forties.

Concerning actual operations, a city planning consultant assists the secretary-general and city officials and others participate as observers. The leadership committee meets at a pace of about once a week. As construction, such as in the buffer areas for Yuriage has proceeded, by August of 2015 the council had submitted proposals to the City of Natori four times and the City by and large accepted the council's wishes.

4.4. The Shimomasuda district reconstruction process: Relocation according to a disaster prevention collective relocation project

Meanwhile, the districts of Kitagama, Hiroura, North Sugigafukuro and South Sugigafukuro located in the agricultural area of Shimomasuda decided early on to look at disaster area recovery/reconstruction assuming relocation via a Disaster Prevention Collective Relocation Project. On April, 2012, a "Joint Council for the Collective Relocation of the Kitagama District" was formed and the council requested that the district be relocated en masse to the north side of the Sendai Airport Line's Mitazono Station. Consequently, on September 10, 2013 consent was obtained from the Minister of Land, Infrastructure and Transport and the Minister of Agriculture, Forestry and Fisheries to convert 5.5 hectares of agricultural land to residential use.

On October 28, 2013 site preparation began for homes for 162 households (92 publically funded homes for disaster victims on 70 housing parcels). The ground-breaking ceremony for the new public housing took place on July 23, 2014 and 50 condominiums and 42 single-family homes were built. The condominiums opened for residence in March of 2015 and the single-family homes, in August 2015. The opening of the new town took place on October 4, 2015 as did the founding of the North Mitazono Neighborhood Association.

5. The City of Iwanuma's reconstruction process

This section reviews the City of Iwanuma's reconstruction planning process.

The City of Iwanuma established its Post-Disaster Reconstruction Headquarters on April 25, 2011, and on the same day determined its "Basic Guidelines for the Post-Disaster Reconstruction of the City of Iwanuma". "Undertake reconstruction with a sense of urgency and an awareness of cost" became the city's reconstruction slogan. In May of the same year, a "Post-Disaster Reconstruction Committee" convened which was made up of a total of 12 members (5 scholars, such as university professors, 2 officials from a trade association and an agricultural cooperative to represent industry, 2 representatives of the disaster victims, and 3 representatives of the townspeople). On August 7th of the same year, in its fourth meeting the committee decided on a "Ground Design Plan for the Post-Disaster Reconstruction of Iwanuma", which was proposed to the mayor, and on the same day the plan became the fastest to be decided in the afflicted areas(Iwanuma city, 2011a).

In September of the same year, this plan was inserted into a 7-year "Master Plan for the Post-Disaster Reconstruction of Iwanuma" created for fiscal years 2011–2017 (Iwanuma city, 2011b). In September of 2013, a revised version of this master plan was drawn up which adjusted the original plan's progress schedule and direction (Iwanuma city, 2013), thereby advancing efforts being made toward the project's realization.

Iwanuma's reconstruction planning principally involved developing a Disaster Prevention Collective Relocation Project to move all its residents to a newly created district called West Tamaura. On March 23, 2012 it was the first mass relocation project to receive approval from the

Minister of Land, Infrastructure and Transport and the Minister of Agriculture, Forestry and Fisheries. On August 5, 2012 it was the first afflicted area to break ground for and begin full-scale site preparation for the building of 178 homes on 158 housing parcels for a mass relocation.

Regarding the planning for the town of West Tamaura at the relocation site, on June 11, 2012, a "West Tamaura Town Planning Investigative Committee" was founded to continue looking at how the town should be built. Of the committee's 23 members the chairman and vice-chairman were academic scholars, but the rest of the members consisted of 3 representatives from each of the city's 6 afflicted districts plus 3 townspeople from neighborhoods near the relocation site. On March 26, 2013 approval was received from the Prime Minister for the "City of Iwanuma Reconstruction Promotion Plan (West Tamaura Special Zone for Reconstruction)" which incentivized the integration of retail businesses, commercial industries and service industries directly related to everyday living into the community to ensure the needs of residents were met, including medical care and child care services and assistance for the elderly.

In the West Tamaura relocation site ties with former neighborhood associations continued to be considered important and influenced discussions among residents about where they wanted to live. On December 21, 2013, a ceremony was held to celebrate the delivery of the first tranche of housing, which was the nation's first large-scale post-disaster housing constructed for the mass relocation of residents from an afflicted area. On March 29, 2014 the second tranche of housing was delivered and on April 27th of the same year the third tranche was delivered, which completed the delivery of housing for the relocation.

On April 16, 2014 the ground-breaking ceremony was held for the construction of the disaster victim public housing and in around October a portion of the housing was opened for residence. On July 19, 2015 an event was held to celebrate the opening of West Tamaura giving birth to a new town in name and in reality.

6 Outlook for reconstruction and distrust in the government

These differences in progress in reconstruction planning are strikingly reflected in residents' distrust of the government. A survey by the author (Uchida, 2013) from October through December of 2012 of all of the households in Iwanuma's temporary housing and 2 temporary housing developments in Natori for residents of the Yuriage district ("Natori A" and "Natori B") asked residents to what extent they were satisfied with the reconstruction efforts of the national and local governments.

Regarding the national government's reconstruction efforts (Fig. 4), while only somewhat over 20% of the Natori residents (25% in Natori A and 22.4% in Natori B) were "satisfied" or "somewhat satisfied" with the national government's reconstruction efforts, the rate of satisfaction among Iwanuma residents with the national government's efforts exceeded 40% (42.2%).

Meanwhile, Natori residents' opinions of their local governments' efforts (Fig. 5) were lower

than for the national government with not even 20% (16.2% in Natori A and 17.2% in Natori B) indicating they were satisfied or somewhat satisfied. In marked contrast, the Iwanuma residents rated the local government highly with more than half (54.9%) indicating some level of satisfaction.

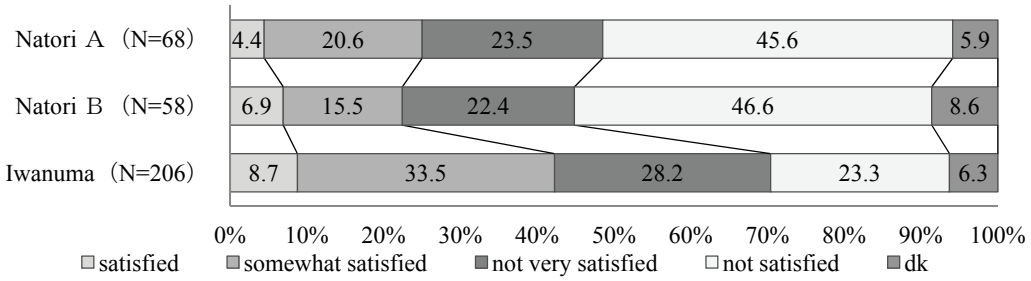

Figure 4. Satisfaction with the national government's reconstruction efforts

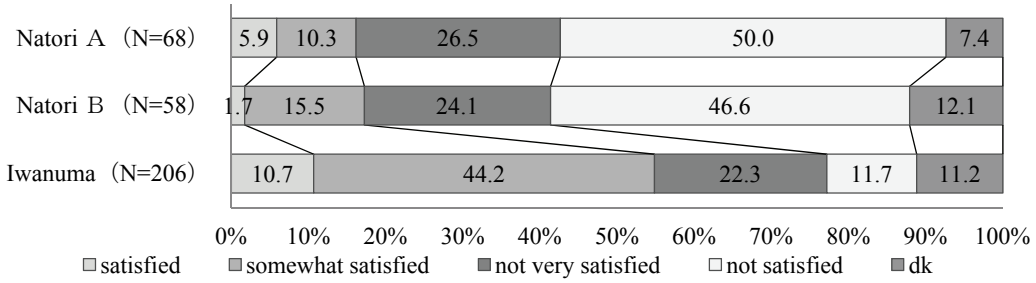

Figure 5. Satisfaction with local governments' reconstruction efforts

A conceivable reason for this difference is that, at that time, the outlook for Natori's reconstruction was almost completely unclear while Iwanuma had already secured the relocation site for its collective relocation project. Thus, one could say that these results showed the importance of having a clear outlook on the future.

In free responses to a question regarding their outlook on the future, the Natori residents frequently used words that expressed their anxiety about the lack of a future outlook: "I don't know", I can't think about it", "I have no outlook for the future", "I'm so worried", and "I try not to think about it!" Regarding their outlook regarding relocation, young people tended to answer that they would buy a house and old people tended to answer that they would move into disaster victim public housing. In addition, in what may be an indicator of the difficulty of building consensus among the residents, while some residents responded that they did not want to return to Yuriage, others supported rebuilding on the original site and responded that they wanted to build a house on the land in Yuriage that was going to be built up higher above sea level.

On the other hand, the responses from the residents of Iwanuma differed from those of the Natori residents in that among the people who knew what their future held (e.g., "I bought some land to build a house", "I'll join the relocation", etc.), there were also people with positive opinions like "I want to move forward!" Having said that, it is important to note that while not numerous, there

were also comments such as “I can’t think about it!” and “I’m worried what life will be like at the relocation site!”

7. Summary

As explained in section 1, the importance of building resident consensus as part of the process of post-disaster reconstruction has often been highlighted. Further, as shown in sections 3 and 4, while the cities of Natori and Iwanuma are both located on the Pacific coast in the southern part of Miyagi Prefecture, reconstruction in Natori appears to have been slow and Iwanuma’s, fast and there is no doubt that the ability to build resident consensus has been a significant influential factor underlying this difference. What, then, might the factors be in these two cities that caused the differences in resident consensus and the progress in reconstructing their living environments? In the section that follows we make a few observations about those factors.

7.1. Factors which brought about quick reconstruction of living environments

Three observations can be made regarding the factors which enabled Iwanuma and Natori’s Shimomasuda district to quickly build consensus among their residents and rebuild their living environments: 1) before the disaster the districts were small and cohesive; 2) the scale of damage in the districts was small and stakeholders few; and 3) residents were able to maintain their communities while in temporary housing after the disaster.

Regarding observation 1), that before the disaster these districts were small and cohesive, Natori’s Yuriage district had a population of 2,551 households and 7,103 people before the disaster (Natori city, 2011c) and had been built up as an area zoned for urban development. While, previously, it had prospered from the fishing and marine product processing industries, more recently it had become more occupationally diverse because of its proximity to Sendai. In addition to those points, not only were the procedural hurdles to relocating the community further inland by securing agricultural land to convert to residential use high, but the cost of doing so would be enormous. Moreover, the old town of Yuriage had a unique culture fostered by its port and deciding to relocate would separate the district from its port, which would make it difficult to preserve its culture into future generations. While it could be said that, as time passed after the disaster, the number of people wishing to rebuild diminished, in actuality they were never a complete minority. Between the people with an attachment to the port town of Yuriage and the people who worked in Sendai and only thought of Yuriage as a bedroom community, it goes without saying that it would be difficult to come to a consensus on whether to rebuild or relocate.

On the other hand, the 6 afflicted districts of Iwanuma each had between 20–132 households, totaling just 497 households and 1,697 people. Furthermore, this was a farming area and the community bonds through the neighborhood associations can be assumed to be strong.

Regarding observation 2), that the scale of damage was small and the stakeholders few, the

afflicted areas in both Natori and Iwanuma sustained catastrophic damage, but the scale of the damage in the Yuriage district was larger due to its larger population. As the scale of damage becomes larger, so does the scale of the post-disaster reconstruction project. As already explained, generally, compared to communities with populations that are large and diverse, it is easier to build a community consensus among residents in communities with smaller, more homogeneous populations. It is, thus, reasonable to think that compared to the afflicted communities in Iwanuma, exactly because the scale of its population was larger and therefore the number of stakeholders greater, consensus building in Yuriage would have to have been more difficult and the process more complicated.

Regarding observation 3) that residents were able to maintain their communities while in temporary housing after the disaster, the scale of damage in Natori was so large that emergency temporary housing, including public housing, had to be set up in 10 different places. Because larger pieces of land could not be secured, in spite of the fact that the original neighborhood association was to be taken into consideration when determining temporary housing residence, residents from the same community had to be housed in disparate locations. This created an environment that discouraged interaction among residents of different temporary housing locations (Fig. 2).

On the other hand, in the year before the disaster, as part of an initiative led by Miyagi Prefecture, Iwanuma had participated in a simulation exercise regarding the securing of temporary housing at the time of a disaster. Just as in the simulation, as has already been explained, the city was able to secure the parking lots of several public facilities in the Satonomori district to use for the setting up of temporary housing . Further, because the city took care to enable people from the same district to live together from the time they were in the evacuation shelters, it was easily able to assign temporary housing residence according to each resident's administrative district.

In addition, during 2011 a voluntary organization called the Temporary Housing Affairs Liaison Group was set up, thanks to the convenient locations of the temporary housing sites and to the efforts of the administrative district chiefs and administrative officers, to arrange monthly forums in which, in spite of not being official, government administrators, the Satonomori Support Center, social welfare councils and the administrative district chiefs met together in a room to gather into one place issues related to the operation of temporary housing, the use of volunteers, various requests being addressed to the government, etc. This group continued to be active until the temporary housing facilities were closed in March of 2016. It is conceivable that the particular conditions of the environment in Satonomori and the initiatives taken there could have facilitated resident consensus. The setting up of that kind of forum for the residents of the Yuriage district in temporary housing would have been unlikely given the site conditions.

Because, as already explained, the media have typically portrayed Iwanuma as progressing in its reconstruction and Natori as being delayed, that portrayal may be generally accepted but it was not necessarily brought on due to lack of effort on the part of governmental agencies and residents.

Currently, even in Natori, which tends to be portrayed as being behind in its reconstruction, as already shown, the agricultural areas of the Shimomasuda district, which include the community of Kitagama, have made as much progress as Iwanuma in the construction of a new living environment. If no attempt is made to carefully verify what environmental and social conditions may have affected the building of consensus, it is easy to blame the residents or the government, which could end up making it even more difficult for residents or residents and the government to come to an agreement.

7.2. Lessons to be learned from these examples

In recent years it has been pointed out that, given how difficult it is to reconstruct after a disaster, it is important to create a reconstruction plan in anticipation of a disaster occurring. Furthermore, residents need to be included in the process of creating such a "preparatory reconstruction plan" (Oyane, 2007). We believe the examples in this study suggest three lessons to be learned regarding preparatory planning for reconstruction to preempt the creation of situations which may thwart the building of consensus among residents: 1) the importance of having resident organizations make detailed preparations, 2) the importance of looking at things from the perspective of disaster mitigation, and 3) the importance of making preparations for evacuation shelter life so it is an opportunity to build post-disaster solidarity.

Lessons 1) and 2) should go without saying. Neighborhood associations with their tight-knit day-to-day relationships among small numbers of households and individuals are the ideal organizations to facilitate the building of consensus during the post-disaster reconstruction planning process. And, in the first place, in theory, from the perspective of disaster mitigation, if it is possible to limit the scale of damage, the hurdles to the building of consensus regarding reconstruction will be lower.

Lesson 3) was drawn from the fact that Iwanuma's temporary housing was concentrated in one place. A lesson emphasized after the Great Hanshin Earthquake was to assign temporary housing by community in order to prevent people from dying alone. As a result, both Natori and Iwanuma tried to assign housing in this way, but there were differences in the degree to which this was achieved. Iwanuma was able to set up its pre-fab temporary housing in places near public facilities, and because of the convenience of site locations, forums for cooperation between government agencies, aid providers, and the residents in temporary housing were formed, which was a characteristic in Iwanuma's reconstruction process worthy of special note.

The Great East Japan Earthquake demonstrated the difficulty of securing land to use for temporary housing, mass relocation at times of disaster. In a way, one could say that Iwanuma was lucky, but the idea of securing enough public land at the time of a disaster to keep its former communities together was an especially important insight.

7.3. Future issues

While the City of Iwanuma and Natori's Shimomasuda district were shown to be places where the fastest progress has been made in reconstructing living environments, that is not to say there are no other issues of concern. One future issue regards the formation of new communities after relocation.

In particular, Iwanuma relocated all of its residents to the new town of West Tamaura, meaning that residents who were in temporary housing and residents who were in government-sponsored rental housing will have moved into the same community. Even though they were originally from the same community, whether community solidarity will smoothly redevelop among residents who lived in different places during the 3–4 years after the disaster will be interesting to watch as will the evolution of the relationships between the new residents of West Tamaura and the residents of older communities in the area. These issues are also relevant to North Mitazono, the relocation site for Shimomasuda.

Regarding future issues arising from relocation, we would like to focus on how original community residents, government agencies, and civic groups, etc. respond to these relocations and study those efforts.

Note: This study is part of the results from the following studies: "The effects of temporary housing scale, community characteristics, leadership and group activities, etc. on occupants' sense of belonging to a group and group efficacy after the Great East Japan Earthquake" (Shokei Gakuin University Comprehensive Human Sciences Research Institute, Keizo Mizuta, principal researcher); "The Great East Japan Earthquake and the rebuilding of Japanese society — Damage from the earthquake, tsunami, and nuclear accident and the road to recovery" (Grant-in aid for scientific research (A), topic number 60261559, Masayoshi Kato, principal researcher/project member); and, "New research in post-disaster reconstruction on building stakeholder consensus and community revitalization" (Grant-in-aid for scientific research (B), topic number 25285155, Hideki Yoshino, principal researcher/project member).

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The Great East Japan Earthquake and Change of Disaster Management in Japan: Toward Community-based Approach

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1. Introduction

The Great East Japan Earthquake struck at 2:46 PM on March 11, 2011. The epicentre was the seabed located 130 kilometres off the east-southeast coast of the Oshika Peninsula in Miyagi Prefecture. The focal region spread from the coast of Iwate Prefecture to the coast of Ibaraki Prefecture, covering approximately 500 kilometres from north to south and 200 kilometres from east to west. The earthquake, which was magnitude 9.0, became the largest in the history of observed earthquakes in Japan and generated tsunamis which struck the Pacific coast of Tohoku and Kanto regions. The tsunamis reached more than 10 metres in height; the ones struck the *ria* coast reached a maximum run-up height of 40.5 metres. The earthquake and tsunami, especially the latter, caused severe damages to many areas, resulting a total of about 22,000 deaths and missing persons, 6,200 injured, 124,690 completely-destroyed buildings and houses, 275,118 half-destroyed buildings and houses, and 764,843 partially-destroyed buildings and houses. More than 400,000 evacuees sought refuge to temporary shelters during the peak period and the number of households that moved into temporary housing (including private housing turned into temporary housing) which were subsequently constructed reached 120,000, for a total of approximately 305,000 people. Even as of February 2016, which is almost five years since the disaster, about 160,000 people still live in temporary housing (including private housing turned into temporary housing).

The Japanese government has put a considerable amount of effort into disaster countermeasures such as embankment centring on hard infrastructure since the Comprehensive Countermeasures Basic Act was enacted in 1961. After the Act on Special Measures Concerning Countermeasures for Large-Scale Earthquake was enacted in 1978, the government allocated a large budget for earthquake prediction in the field of seismology and also implemented earthquake countermeasures, both hard and soft, mainly around Shizuoka Prefecture which is said to be closest to the epicentre of Tokai earthquakes. As a result, at least the number of deaths and missing persons due to typhoon has dramatically decreased since Typhoon Ise-wan (also known as Typhoon Vera) as shown in Figure 1. It is clear that the government-led disaster countermeasures had a certain effect.

Yet, the Great Hanshin/Awaji Earthquake in 1995 resulted in about 5,000 victims and, as mentioned above, there were about 22,000 victims in the Great East Japan Earthquake in 2011. Regretting that there were some shortcomings with the previous disaster measures, the Japanese

government therefore amended the Comprehensive Countermeasures Basic Act twice — in 2012 and 2013 — after the Great East Japan Earthquake in order to modify the disaster policy.

The purpose of this paper is to explain the following three points in Japan: (1) how the disaster countermeasures established in post-war Japan in the early 1960s were characterised, (2) what issues became apparent with the previous disaster countermeasures in the wake of the Great East Japan Earthquake and (3) how the disaster countermeasures were modified after the Great East Japan Earthquake.

2. Disaster Countermeasures in post-war Japan

It was Typhoon Ise-wan in 1959 that became a turning point for disaster countermeasures in post-war Japan.

The 15th typhoon of the year made landfall on the tip of Kii Peninsula in the evening of September 26, 1959, causing 5,098 deaths and missing persons which is the largest typhoon damage since the Meiji era. The typhoon was named Typhoon Ise-wan because about 80 per cent of the victims were concentrated in Aichi and Mie Prefectures due to the occurrence of storm surge, although there were victims across 32 prefectures in Japan.

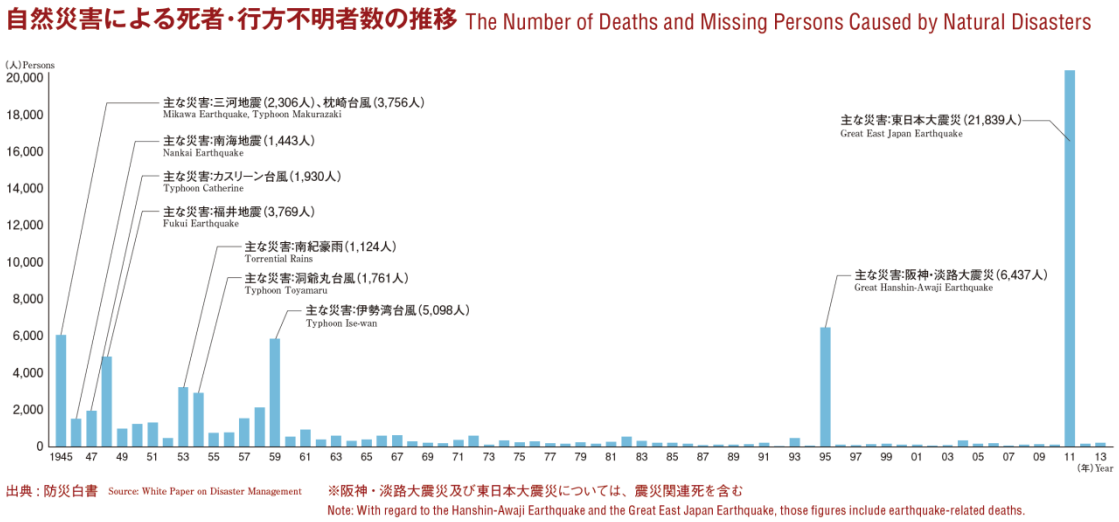

Fig. 1. The number of deaths and missing persons caused by natural disasters
Source: www.bousai.go.jp/1info/pdf/saigaipamphlet_je.pdf (accessed on November 5, 2015)

Prior to Typhoon Ise-wan, Japan's disaster countermeasures were not integrated or consistent and the areas of responsibilities for the central and local governments were also unclear. Therefore, the government enacted the Comprehensive Countermeasures Basic Act in 1961 as a general method of disaster countermeasures. The Act subsequently became the starting point of disaster management in Japan.

According to the Comprehensive Countermeasures Basic Act, the command headquarters for disaster countermeasures is to be placed under the Central Disaster Management Council which is an

organisation directly reporting to the Prime Minister (i.e., under the control of Cabinet Office). The Central Disaster Management Council sets up committees for technical investigation as needed and 19 of them have been established so far.[1] Members of committees for technical investigation are experts, primarily including university researchers. The speciality areas mainly include natural sciences such as seismology, meteorology, engineering and information science. The social science-related fields include economy.

To formulate a basic disaster management plan, damages are first projected by technical committees based on the latest scientific knowledge. Based on that, the plan is formulated with the cooperation of relevant ministries and agencies led by the Ministry of Land, Infrastructure and Transport. According to this disaster management plan of the central government, 47 prefectures formulate a basic disaster management plan. Municipalities then develop their basic disaster management plans in accordance with the prefectural disaster management plan.

As described above, the first characteristic of Japan's disaster countermeasures established in the early 1960s is the fact that damage prediction based on the latest scientific knowledge lies as the foundation of disaster countermeasures. The second is the fact that the basic disaster management plan is formulated in a top-down style, from the central government to prefectural government and municipalities (local government).

Figure 2 is the contents of the national basic disaster management plan. First, the scope of applicable disasters includes both natural disasters and accidents. Natural disasters include earthquakes, tsunamis, floods, volcanic eruptions and snow disasters while accidents include shipwrecks, aircraft accidents, rail accidents, traffic accidents, nuclear power plant accidents, hazardous substance pollution, large fires and wildfires. As for disaster responses, the roles of the national government, local government, and residents are stipulated for each of the following three phases: (a) disaster management measures before the disaster, (b) emergency response at the time of the disaster and (c) disaster recovery. Since (a) 'disaster management measures before the disaster'

[1] The currently active committee for technical investigation is the Disaster Management Implementation Committee. The committees that have already completed their technical investigations are as follows: the Committee for Policy Planning on Disaster Management, the Committee for Technical Investigation on Evacuation at the Time of Disaster, the Committee for Technical Investigation on Tokai Earthquakes, the Committee for Technical Investigation on the Way Future Earthquake Countermeasures Should Be, the Committee for Technical Investigation on Tonankai and Nankai Earthquakes, the Committee for Technical Investigation on Basic Disaster Management Plan, the Committee for Technical Investigation on Tokai Earthquakes Countermeasures, the Committee for Technical Investigation on Developing and Utilising Human Resources for Disaster Management, the Committee for Technical Investigation on Sharing Disaster Management Information, the Committee for Technical Investigation on Improving the Disaster Management Capability that Utilises the Abilities of the Private Sectors and Market, the Committee for Technical Investigation on Earthquakes that Directly Hits the Tokyo Metropolitan Area, the Committee for Technical Investigation on Subduction Zone Earthquake Around Japan Trench and Chishima Trench, the Committee for Technical Investigation on Promotion of National Movement to Reduce Disaster Damage, the Committee for Technical Investigation on Countermeasures for Earthquakes that Directly Hits the Tokyo Metropolitan Area, the Committee for Technical Investigation on Large-Scale Flood Damage, the Committee for Technical Investigation on Passing on the Lessons Learned from Disasters, the Committee for Technical Investigation on Countermeasures for Earthquakes and Tsunamis Based on the Lessons Learned from the '2011 off the-Pacific coast of Tohoku Earthquake', and the Committee for Technical Investigation on the Way Earthquake Disaster Management in Areas such as Regional Cities.

mainly involve hard measures such as embankment maintenance, the national government plays a major role. Local governments are responsible for soft measures such as preparing and publishing hazard maps and conducting evacuation drills. In contrast, the central player in (b) 'emergency response at the time of the disaster' is the local government which is closer to the affected site. The disaster countermeasure headquarters is placed under the local government in the affected area and the head of the local government is supposed to take the lead while coordinating with the national and prefectural governments. The role of the local government is considerable in formulating a reconstruction plan during (c) 'disaster recovery' as well. The main role of the national government is to secure and allocate budgets for reconstruction.

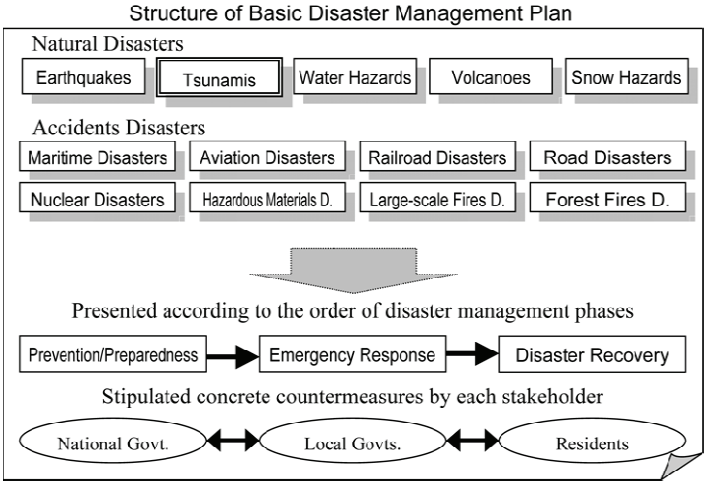

Fig. 2. Structure of basic disaster management plan
Source: www.bousai.go.jp/taisaku/keikaku/english/disaster_management_plan.html (accessed on November 5, 2015)

3. The Issues with Disaster Countermeasures that Became Apparent after the Great East Japan Earthquake

As described above, these basic disaster management plans formulated with the lead of the national government, particularly the disaster countermeasures, have achieved a certain level of results. At least the number of deaths and missing persons due to typhoon and heavy rain has dramatically decreased since Typhoon Ise-wan (see Figure 1).

However, the Great Hanshin/Awaji Earthquake in 1995 and Niigata Chuetsu Earthquake in 2004 brought to light the issues with the disaster countermeasures in Japan. One of the issues is the limitation of damage prediction based on the latest scientific knowledge. Another is that there are limitations to the previously envisioned political measures for emergency response and post-disaster reconstruction in case the damage spreads over a wide range of area in the mountainous regions. With respect to the former, there were very few seismologists who had predicted the Great Hanshin/Awaji Earthquake. As for the latter, the weakness of the conventional disaster countermeasures became apparent during the Niigata Chuetsu Earthquake which was a major earthquake disaster that struck the mountainous region where the population was decreasing and

aging.

The Great East Japan Earthquake had three characteristics of being widespread, extensive and complex. There, the above-mentioned issues with the conventional disaster countermeasures were exposed in an amplified manner. First, with regard to earthquake, large earthquakes that seismology in Japan had predicted were the plate tectonics, interlocking triple earthquakes of Tokai, Nankai and Tonankai earthquakes; an earthquake on the Pacific side of the Tohoku region was not expected at all. Just like the case of the Great Hanshin/Awaji Earthquake, it became clear that there is a limit to the ability of seismology to predict earthquakes. Second, as far as tsunami was concerned, it was expected because the Pacific coast of the Tohoku region was a tsunami-prone area[2]. Hazard maps for earthquake and tsunami based on the damage prediction had been prepared and made available to the public by each local municipality. Those maps specified information such as evacuation shelters based on the past record of the maximum inundation range. However, it actually did everyone a disservice; there were victims among people who evacuated to the shelters specified on the hazard map because the tsunami was an 'unexpected' one this time and caused damages that far exceeded the expectation. It showed that the disaster countermeasures based on the latest scientific knowledge have a problem of actually increasing the damage when an 'unexpected' hazard strikes. Third, the limitation with placing the disaster countermeasure headquarters under the local government in the affected area became apparent again. In the case of the Great East Japan Earthquake, some local governments lost the administrative capability after losing many of the staff members to the tsunami and couldn't even assess the extent of the damage. It made it clear that, when the damage is extensive, there is a serious flaw in the emergency response system prescribed by the existing Comprehensive Countermeasures Basic Act.

Furthermore, yet another issue with the conventional disaster countermeasure became apparent after the Great East Japan Earthquake: detailed disaster management measures sometimes diminish the awareness toward disaster management.

Let me give an example. Figure 3 (1) is a pre-Great East Japan Earthquake aerial photograph of a residential area. Called Arahama New Town, the area was located in the suburb of Sendai City and facing the Pacific Ocean. This residential area did not exist prior to the 1980s. There was only a few hundred-metre wide disaster-prevention forests which were created along the sandy beach during the Edo era. It was created because the area was susceptive to tsunami. Residents who had lived around this area had a common knowledge not to build a house close to the coast.

What changed that situation was the construction of the coastal embankment. The six-metre high embankment extending a few hundred kilometres was built shown in Figure 3 (1) along the coastline. The disaster-prevention forest was subsequently cut down in this Arahama District to develop a residential area and, as the suburbanisation of Sendai metropolis progressed, the middle

[2] Since the Meiji era, tsunamis have occurred in conjunction with the 1896 Sanriku earthquake (approx. 22,000 deaths and missing persons), the 1933 Sanriku earthquake (approx. 3,000 deaths and missing persons) and the 1960 Valdivia earthquake (142 deaths and missing persons).

class people who sought single-family homes went there. Some of the newcomers must have known that Arahama was a tsunami-prone area; however, the huge coastal embankment must have given a sense of security. The local knowledge shared among local residents was generally not accepted among the newcomers.

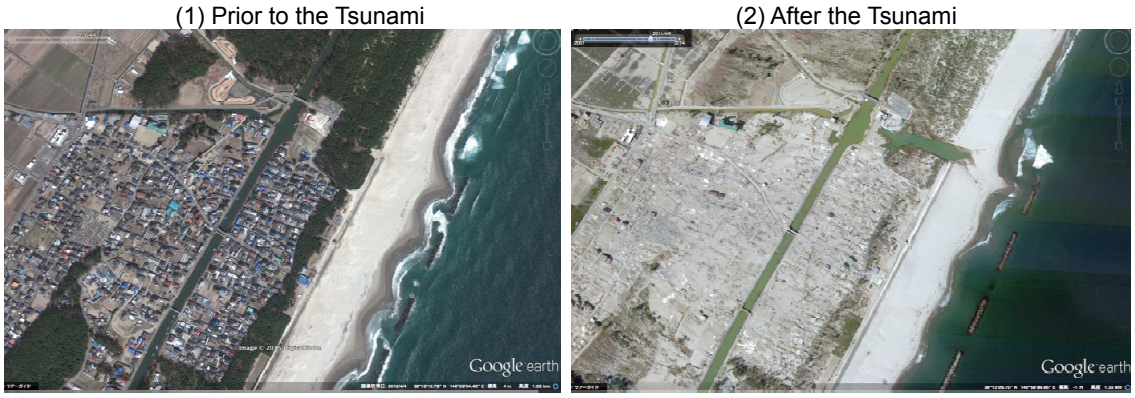

Fig. 3. Arahama District before and after the tsunami
Source: Google Earth

What happened as a result? Figure 3 (2) is an aerial photograph of the same area after the earthquake and tsunami. At 10-metre high, the tsunami was much higher than the coastal embankment. The flood inundation reached up to 5 kilometres from the coastline. Both were well beyond the supposed damage prediction. Consequently, as the photographs tell, Arahama New Town received a devastating blow that killed several hundred people. It was not that the residents of New Town lived there because their income level was low and they could only live in dangerous areas. On the contrary, many of the residents were urban middle class commuting to the city of Sendai. It can be said that the fact the residents lacked the awareness of the danger — or the fact that the existence of the huge, endless coastal embankment gave a sense of security to the residents — led them to make a decision to live in New Town and resulted in an extensive damage.

4. Modifying Disaster Countermeasures after the Great East Japan Earthquake

In response to the Great East Japan Earthquake, the central government investigated to identify issues with the previous disaster countermeasures and, with the next expected large disasters in mind[3], established a committee for technical investigation called the Committee for Policy Planning on Disaster Management in October 2011 within the Central Disaster Management Council in order to enhance disaster management measures. After the investigation by experts in the Committee for Policy Planning on Disaster Management, the central government amended the Comprehensive Countermeasures Basic Act twice, in June 2012 and June 2013. Table 1 summarises the amendments to the Comprehensive Countermeasures Basic Act by disaster response phase. ‘The first iteration’

[3] Specifically, the supposed large disasters are Nankai megathrust earthquakes and earthquakes that directly hits the Tokyo metropolitan area.

and ‘the second iteration’ listed in the table refer to the amendments in June 2012 and June 2013, respectively. In addition to amending the Comprehensive Countermeasures Basic Act, the central government newly enacted a basic act on post-disaster reconstruction in order to address large disasters in the future.

In terms of the key points of the Comprehensive Countermeasures Basic Act amendments that I’d like to focus on in this paper, the first is the enhancement of the ability to quickly respond to a large, extensive disaster. As already pointed out, there was a series of problems that were beyond the ability of the local government to respond to because the Great East Japan Earthquake was a disaster that brought serious and extensive damages. The amendment clarified the way the central government is to provide support and divide roles with the local government in such a case. The second is to ensure smooth and safe evacuation of residents and other people and improving the measures to shelter victims. It aims not to repeat the situation in which residents who evacuated according to the hazard map were victimised. The third is to strengthen disaster management at normal times. More specifically, community-based disaster management planning by residents was introduced with the aim to promote proactive disaster management activities through self-help and mutual assistance and improve the disaster management skills at the community level in a bottom-up style. This is to improve the situation where the awareness toward disaster management as own issue has been lost among residents.

5. Conclusion

At this point, they have merely amended the laws at the national level; more time is required for the amendment to be incorporated into the basic disaster management plans at prefectures and municipalities. To improve awareness toward disaster management among residents who are key players in disaster management, it is further necessary for various entities such as the national, prefectural and municipal governments, civic organisations like NPOs and NGOs and resident organisations in the community to share the aim and steadily work in cooperation toward the enhanced community-based disaster management.

Table 1. Disaster Response Phases and the Details of Amendments to the Comprehensive Countermeasures Basic Act

	Area	Previous Comprehensive Countermeasures Basic Act	The First Iteration of Amendments	The Second Iteration of Amendments ◊ denotes measures based on the Laws Concerning Reconstruction After Large Disasters
Preparation under Normal Times	Disaster Management Council	• National government: Central Disaster Management Council • Prefectures and municipalities: Local disaster management councils	• Added academic experts to the members of the local disaster management council • Clarified the division of roles between the Disaster Management Council and the Disaster Countermeasure Headquarters	-
	Disaster Management Plan	• National government: Basic disaster management plan • Prefectures and municipalities: Local disaster management plans • Designated public institutions: Disaster management business plans	• Positioned support agreements with other local governments as part of the local disaster management plan	• Positioned local disaster management plan as a plan at the community level
	Disaster Prevention (each party's duty)	• The duty of the person in charge of disaster prevention included streamlining the organization, conducting training, stocking goods and materials, etc.	• Added 'passing down the lessons learned from disasters' as a duty of residents • Added 'implementing disaster management education and measures for smooth mutual support' as a duty of the person in charge of disaster prevention	• Clarified that residents are responsible of preparations such as stocking goods • Added 'implementing measures (executing agreements, etc.) to obtain cooperation from entities such as providers of goods' as a duty of the person in charge of disaster prevention • The head of municipality is to establish a scheme to identify separately the designated emergency evacuation shelters (meet a certain level of standards such as safety) and designated evacuation shelters (meet a certain level of standards to ensure living environment, etc.) • Prescribed to create a list of individuals who need special support to evacuate at the time of a disaster and establish a system to utilise the list • Made it mandatory for municipalities to try to prepare a disaster management map
	Establishment of System	• National government: (Emergency) Disaster Countermeasure Headquarters • Local governments: Disaster Countermeasure Headquarters • Declaration of the state of disaster emergency by the Prime Minister	• Clarification of the division of roles between the Disaster Management Council and the Disaster Countermeasure Headquarters [reiteration] • Added cooperation requests from the disaster countermeasure headquarters of the national and local governments to relevant parties	• Added 'preparation of basic response policy' (to be done under the instruction and supervision of the Prime Minister) as an implication of the state of disaster emergency declaration

Emergency Measures (particularly during the initial period)	Information Collection, Sharing and Communication	• Information collection in a bottom-up manner (noting the extent of the damage) • Communication of warning by the head of the municipality	• Prescribed prefectural governments to institutionalise proactive information collection • Prescribed to institutionalise the utilisation of geospatial information	• Prescribed the national government to institutionalise proactive information collection • Prescribed the national government to establish a scheme to inform the public about evacuation under an extraordinary disaster (call for evacuation) • Added request to the Internet service providers to provide information • Prescribed to institutionalise Prime Minister's announcements and cooperation requests to the citizens at the time of the state of disaster emergency declaration
	Issuance of Evacuation Advisories and Directives	• Only eviction for the purpose of evacuation was stipulated	-	• Prescribed to establish a scheme for safety measurements (getting under a shelter, etc.) related to evacuation directives • Prescribed the national and prefectural governments to establish a scheme to advise the heads of municipalities • Prescribed to create a list of individuals who need special support to evacuate at the time of a disaster and establish a system to utilise the list [reiteration]
	Interim Agency for Emergency Measures	• Prefectural governments to take over and implement emergency measures when the chain of command at the municipality is compromised	-	• Prescribed to establish a system for the national government to take over and implement emergency measures (clearing debris on the road for emergency vehicles, etc.)
	Measures for Transporting and Supplying Goods	N/A	• Prescribed provision of supplies (by the national government) • Prescribed to establish a system to request designated public agencies (forwarding agencies) to transport goods	• Added measures (executing agreements, etc.) to obtain cooperation from entities such as providers of goods [reiteration]
	Sheltering of Victims	• The basic policy of disaster management clearly states to try to implement necessary measures for individuals such as the elderly and disabled who require special consideration	• Prescribed to establish a system for evacuating people in a wide area (procedure to accept evacuees, coordination by the national and prefectural governments)	• Made it mandatory to try to provide a living environment at shelters • Made it mandatory to try to take into consideration the victims who are staying at places other than shelters • Prescribed to establish a system for the national government to take over the procedure to evacuate people in a wide area • Prescribed to establish a scheme to request designated public agencies (forwarding agencies) to transport victims • Prescribed to establish a system to provide information on people's safety

Emergency Measures (after the initial period)	Support	• Dispatch and refer government employees • Local governments to support each other only when it comes to emergency measures (rescue, life saving, etc.)	• Expanded the scope of mutual support between local governments (emergency measures → emergency disaster countermeasures in general) • Expanded and enhanced coordination for support done by the national and prefectural governments	• Prescribed to establish a system for the national government to provide support (emergency disaster measures in general) • Prescribed to establish a system for the national government to pay temporarily on behalf of the prefectural government to cover the cost required to provide support for saving lives in the disaster [amendment to the Disaster Relief Act]
	Cooperative Activities with Volunteers	• The basic policy of disaster management clearly states to try to streamline the environment for volunteer activities	-	• Made it mandatory to try to coordinate cooperation among the national government, local public organizations and volunteers
	Foundation for Relief Provision for Victims	• The basic policy of disaster management clearly states to try to provide relief to victims	-	• Consultations from the victims for ensuring their mental and physical health was added to the basic disaster management policy • Prescribed to institutionalise the issuance of victim's certificate (to be promptly issued by the head of municipality) • Prescribed to establish a system to create a victim registry system (created by the head of municipality)
	Measures to Exempt Regulations under Normal Times	N/A	-	• Added special provisions related to the Medical Service Act, Act Concerning Graveyard, Burial, etc. and Waste Management and Public Cleansing Act at the time of disaster emergency
Restoration and Reconstruction	Post-Disaster Restoration	• Post-disaster restoration implemented by the person in charge of post-disaster restoration • Dispatch and refer government employees [reiteration]	-	◊ Prescribed to establish a system for the national government to outsource post-disaster restoration business
	Reconstruction	• The basic policy of disaster management clearly states to try to reconstruct promptly	-	◊ Prescribed the national government to institutionalise the placement of the reconstruction measure headquarters and the preparation of a basic policy for reconstruction ◊ Prescribed to prepare a reconstruction plan and establish a scheme to simplify various administrative processes using the plan ◊ Prescribed to establish a system to dispatch national government employees during the reconstruction phase

Source: Murata, K. (2013). Higashinihon Daishinsai no Kyōkun o Fumaeta Saigai-taisaku Hōsei no Minaoshi: Saigai-taisaku Kihon-hō, Daikibo Saigai Fukkō-hō (Re-examining the Disaster Countermeasure Legislation based on the Lessons Learned from the Great East Japan Earthquake: The Comprehensive Countermeasures Basic Act and the Laws Concerning Reconstruction after Large Disasters. *Rippō to Chōsa (Legislative Process and Investigation)*. No.345

北丹後地震に見る活断層近傍の被害について

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1. はじめに

地震は、岩盤に蓄積した歪みが開放されるときに岩盤が割れてずれる自然現象である。地震災害は岩盤のずれが地表まで達した活断層、岩盤のずれによる隆起や沈降によって生ずる津波、岩盤がずれるときに生ずる地震波などによって、人命や財産に被害が及ぶと発災する（図 1)。被害を受ける人工物や社会構造は地域によって異なり、時代によって変化するため、地震災害は同じ自然現象であっても、地域や時代によって異なる災害になる。したがって、自然現象である地震が地震災害になるメカニズムを時代ごと、地域ごとに明らかにすることは過去の地震の災害像に迫ることになり、歴史記録から古地震を解明することや、その場所で将来発生する地震の被害予測やその減災対策をするうえで重要となる。

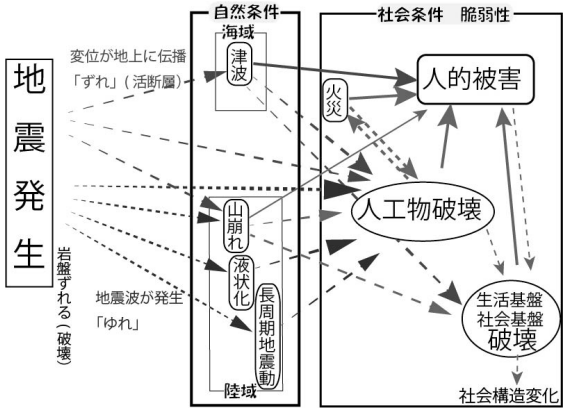

図 1　地震と地震災害の関係

例えば、地震による人的被害は、人工物の倒壊、火災、津波、山崩れによって主にもたらされる。一般に、火災や津波は犠牲者の数を著しく増加させる一方で、避難の経緯や地理的条件で地域によってその犠牲者の数には大きな差が出る。また、山崩れは局所的な現象で、個々のケースが考えられる。それに対して人工物の倒潰による犠牲者は主に家屋の倒壊による圧死であることが予想される。したがって、家屋倒壊を防げば、人的被害は減少することが予想され、耐震対策が重要となる。しかし、家屋が倒壊に至るプロセスは、「ゆれ」によるものだけでなく「ずれ」によるものが存在する。これらを区別して考えずにおもに「ゆれ」に対する対策をおこなった場合、「ずれ」に対する被害が想定外になる可能性が高い。そこで、本報告では建物倒壊と人的被害の関係性に着目することで、地震災害に

おける建物倒潰にいたるプロセスについて考えていきたい。

まず、「ゆれ」と「ずれ」の違いについて考えてみる。

「ゆれ」とは岩盤がずれることで発生した地震波である。この地震波は地面を弾性変形させ、地震が終われば元の状態にもどる。これによって「ゆれ」の大きさは一般に規模が大きいほど、震源からの距離が近いほど大きい。「ゆれ」による地震災害には人工物が強い揺れによって倒壊するもの、人工物が共振することによって倒壊するもの、人工物が液状化によって倒壊するものが考えられる。したがって、「ゆれ」による地震災害は震源からの距離が大きくなるほど小さくなる傾向だけでなく、軟弱地盤の地域で被害が大きくなる（宮村 1946; Omote 1951; 大庭 1957 など）。

一方、「ずれ」とは、岩盤が割れて生じた「ずれ」がいわゆる地震断層として地表に達した地殻変動である。これは地表を永久変形させる。一般に「ずれ」の量は地震の規模が大きいほど大きく、マグニチュード 6.7 程度より大きいと地表まで「ずれ」が達する。「ずれ」による地震災害は、人工物の土台が地盤の変形にともない破壊されることによると考えられる。この「ずれ」の量が地表近くで減衰したり、地表近くで断層の傾斜が変化したりすることで「撓曲」と呼ばれる幅を持った変形帯が生じることも多い。

また、一般的な地震波とは異なり、浅部の「ずれ」に伴った慣性力によって生じた弾性変形が人工物にダメージを与える可能性もある。これを「ゆれ」と「ずれ」のどちらに分類するべきか分からないが、ここでは「ずれ」が生じる場所の近傍で発生すると考えられるため、「ずれ」の影響に含めて考える。

これら「ずれ」に関する地震災害は、断層上に線的に生じると考えられ、一般に断層の上盤側で被害が大きい（飯田 1978; 植村 2011 など）。また、岩盤を覆う未固結な堆積物などによって「ずれ」の量が吸収されて小さくなると被害が小さくなる可能性も考えられる。

2. 地震と人的被害の関係

中央防災会議「東南海・南海地震等に関する専門調査会」資料（第 6 回、平成 14 年 11 月 21 日）は、津波や火災の影響がほぼ無く、比較的最近に発生した地震で主に建物崩壊による犠牲者が 300 人以上の 5 つの地震（鳥取地震、東南海地震、南海地震、福井地震、阪神・淡路大震災）の被害事例をもとに、建物の全壊率と死者率を算出した。その結果、死者率と建物全壊率の関係は、木造家屋の場合、全壊戸数に対する死者数である犠牲者率が約 6.7 パーセントと算出しており、これは死者 1 人あたり全壊戸数が 14.9 戸にあたる。飯田（1978）では、昭和東南海地震を例に犠牲者と全壊家屋の関係を、死者 1 人あたり全壊戸数が 14.4 戸としている。水谷（1983）は全壊率だけでなく、半壊率を重み付けして全壊率に加算した値と家屋被害に対する犠牲者率とを 6 つの地震で比較し、濃尾地震、北伊豆

表 1　1800 年以降の地震における犠牲者、全壊戸数、災害の特徴、犠牲者率の関係

地震名	発生年	M	死者・行方不明者	全壊家屋	被害要因	全壊家屋／死者
佐渡付近	1802	6.5-7.0	19	732		38.5
羽後・男鹿付近	1810	6.5	57	1003		17.6
三条地震	1828	6.9	1443	9809	活断層？	**6.8**
佐渡付近	1833	7.25	42	475		11.3
善光寺地震	1847	7.4	5767	13810	活断層	**2.4**
小田原付近	1853	6.7	24	1000		41.7
伊賀伊勢付近	1854	7.25	900	2700	活断層	**3.0**
安政東海地震	1854	8.4	2500	30000	津波・火災	12.0
安政の江戸地震	1855	7	4000	14000	火災	3.5
安政の八戸地震	1856	7.5	26	199	津波	7.7
飛越地震	1858	7	203	319	活断層	**1.6**
浜田地震	1872	7.1	550	5000		9.1
熊本県西部	1889	8	20	239		12.0
濃尾地震	1891	8	7273	140000	活断層	**19.2**
庄内地震	1894	7	726	3858	活断層？	5.3
明治三陸地震	1896	8.5	27122	9878	津波	0.4
陸羽地震	1896	7.2	209	5792	活断層	**27.7**
芸予地震	1905	7.25	11	64		5.8
姉川地震	1909	6.8	41	978		23.9
喜界島地震	1911	8	12	422		35.2
仙北地震	1914	7.1	94	640	山崩れ	6.8
島原地震	1922	6.9	26	195		7.5
関東大震災	1923	7.9	1E+05	105000	火災・津波	1.0
丹沢地震	1924	7.3	19	1200		63.2
北但馬地震	1925	6.8	428	1295	活断層	**3.0**
北丹後地震	1927	7.3	2925	12584	活断層	**4.3**
昭和三陸地震	1933	8.1	3064	5851	津波	1.9
鳥取地震	1943	7.2	1083	7485	活断層	**6.9**
東南海地震	1944	7.9	1223	17599	津波	14.4
三河地震	1945	6.8	2306	7221	活断層	**3.1**
南海地震	1946	8	1330	11591	津波	8.7
福井地震	1948	7.1	3769	36184	活断層？	**9.6**
十勝沖地震	1952	8.2	28	815	津波	29.1
チリ地震	1960	8.5	142	1500	津波	10.6
新潟地震	1964	7.5	26	1960		75.4
十勝沖地震	1968	7.9	52	673	津波	12.9
伊豆半島沖地震	1974	6.9	30	134	活断層	**4.5**
伊豆大島近海地震	1978	7	25	96	がけ崩れ	3.8
宮城県沖地震	1978	7.4	28	1183		42.3
日本海中部地震	1983	7.7	104	934	津波	9.0
長野県西部地震	1984	6.8	29	14	がけ崩れ	0.5
北海道南西沖地震	1993	7.8	230	601	津波	2.6
阪神・淡路大震災	1995	7.3	6437	100000	活断層	**16.3**
新潟県中越地震	2004	6.8	68	3175	活断層	**46.7**
新潟県中越沖地震	2007	6.8	15	1331		88.7
岩手宮城内陸地震	2008	7.2	23	30	活断層・がけ崩れ	**1.3**
東日本大震災	2011	9	21839	10000	津波	5.9

地震、福井地震、南海地震に比して、三河地震や北丹後地震では犠牲者率が高かったことをみいだし、その原因を逃げる間もなく家が倒壊したためと推定している。飯田（1978）でも、三河地震では、死者 1 人あたり全壊戸数が 3.1 戸と非常に割合が大きいと指摘している。水谷（1983）も人工物の被害に対して死亡率が大きいという特徴が三河地震と北丹後地震にあるとする。これらは、いずれも集落が点在する地域に明瞭な地震断層が出現した内陸直下型の地震である。

そこで、19 世紀以降 2011 年までで犠牲者が 10 人以上の日本の地震災害をリストアップしてみる（表 1)。犠牲者一人当たりの全壊家屋数が小さい地震は、火災、津波、山崩れなどが発生した地震である。それ以外の地震のうち、その値が小さいものは活断層が出現した直下型地震である。これは、同じ全壊家屋であっても、直下型地震の全壊家屋は、そうでない地震の全壊家屋と同じではないことを意味する。ただし、阪神・淡路大震災以降はその値が大きくなっており、耐震対策が進んだことと、全壊の基準が変化したことが理由としてあげられる。

図 1 に示したように、人的被害をもたらす人工物の破壊の原因は「ずれ」（地盤変位）と「ゆれ」（地震動）があり、活断層が出現した直下型の地震被害にはその両者の原因が考えられる。「ゆれ」だけでなく「ずれ」を原因とする人的被害が活断層による内陸直下型地震の犠牲者率を相対的に高くした可能性が考えられ、同じ家屋倒壊であっても異なったメカニズムで倒壊に至ったことが予想される。「ずれ」と「ゆれ」の地震災害に至るメカニズムの差異を人的被害と建物被害の差から検討するためには、「ずれ」である地震断層が出現した地震のうち、建物被害や犠牲者の詳細なデータが存在する地震を対象としなくてはならない。三河地震は、その条件を満たす地震として考えられる。

3. 三河地震

三河地震は 1945 年 1 月 13 日午前 3 時 38 分に発生した地震で、震源は三河湾、気象庁マグニチュードは 6.8 の内陸直下型地震である。この地震の震度は被害の状況から碧海郡や幡豆郡で 6 または 7 を記録したと思われる（飯田 1978)。この地震によって、総延長 28 km におよぶ深溝断層および横須賀断層が地表に出現した。三河地震の被害は現在の碧南市、安城市、西尾市である碧海郡や幡豆郡に集中する。このほかも蒲郡市、幸田町などで被害が大きく、住家の全壊は 7221 戸、死者・行方不明者 2306 人（飯田 1978）にのぼった。この地震は午前三時と早朝に発生したため、ほとんどの被害者は家で就寝中であったと思われる。三河地震のうち、特に死亡者 1 人あたりの倒壊家屋数が少ない地域として現蒲郡市の形原地区があげられる（木股・松多 2014)。旧形原町では 33 回忌に死者 209 名の氏名と年齢、住所を整理し、全壊家屋や死者の分布地図を作成した（わすれじの記編集委員会

1977)。図 2 は昭和 22 年の地形図をベースとして、そのデータをもとに全壊家屋と被害者の分布に地形分類と活断層を併記した図である。活断層の位置は杉戸・岡田（2004）を用い、地形分類は 1945 年米軍撮影の空中写真などを用いた。

図 2　三河地震における形原地区の人的被害と地震断層

しかし、これを図 2 における家屋単位でみると、断層の近傍でも、地震断層の近傍でも断層の下盤側にあたる東側ではほとんど被害が無く、犠牲者が出ていない。また地震断層の西側における全壊家屋は断層からの距離が遠くなるに従い少なくなり大縮尺においても断層からの距離により全壊率が指数関数的にちいさくなるという飯田（1978）の主張を指示する傾向が認められる。ところが、人的被害に関しては複数人の犠牲者を出した地点は圧倒的に断層近傍が多く、断層から遠ざかった全壊家屋では犠牲者の数はおおむね 1 人に

とどまっている。また、多くの家屋は段丘面上にあるため、統計的に有意であるとはいえないが、段丘を解析する谷の中では、地震断層の上盤側であっても全壊家屋、犠牲者がともに少ないように思われる。これらの特長から「ずれ」による被害は断層近傍で おおきくなり、その傾向は建物被害より人的被害でより顕著であることが認められる。これは、全壊と分類されるものに、「ずれ」による全壊と「ゆれ」による全壊があることを示唆している。また、地震断層近傍では、沖積低地で被害が大きいという常識が当てはまらない可能性がある。

4. 北丹後地震

三河地震は昭和東海地震の一月後に発生した地震であるため、すでに大きなダメージを受けていた家屋が倒壊したという指摘もある。そこで、火災被害があるものの火災以外でも大きな人的被害があり、人的データの記録が残存しており、地表地震断層が出現した内陸直下型地震である北丹後地震について検討してみる。

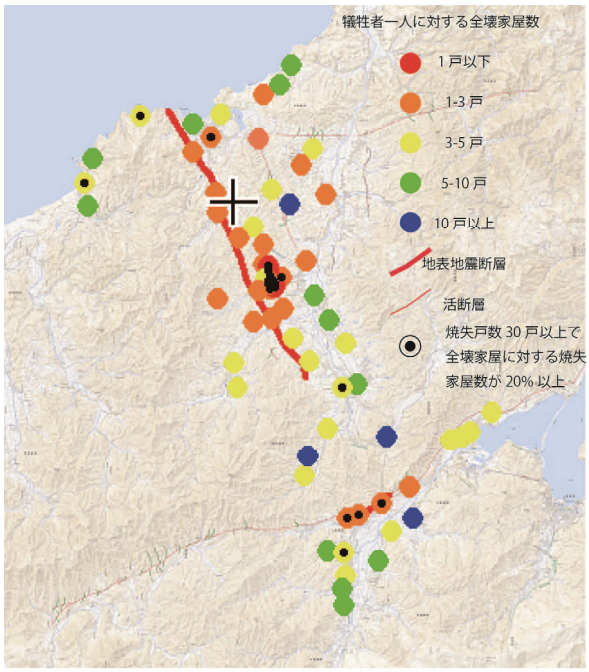

図 3　北丹後地震における字単位の全壊・全焼率
京丹後市教育委員会（2014）による

北丹後地震は昭和 2 年（1927 年）3 月 7 日に京都府丹後地方で発生したマグニチュード 7.3 の地震である。この地震は、峯山町（現在の京丹後市）を中心に火災が発生し、死者 2925 人、負傷者 7806 人、全壊家屋 12,584 棟、半壊家屋 9,443 戸、焼失 8,287 戸という、大きな災害になった。この地震によって、京丹後市網野町浅茂川から大宮町三重までの約 18 km にわたって、左横ずれ成分を主体とする郷村断層が、それと野田川町岩屋地区から宮津市

府中にいたる約 7 km に共役な山田断層が出現した。郷村断層は左ずれ 2.7 m に達し、西側が最大 0.8 m 隆起し、山田断層は右に 0.8 m ずれ、北側が最大 0.7 m 隆起した。郷村断層は網野町郷の小池地区と樋口地区、網野町生野内の 3 地点が 1929 年に国指定の天然記念物に指定され、現在も山陰ジオパークのジオサイトとして保存されている。この地震の死者は、火災によって大きくなったといわれる。図 3 は、北丹後地震における字ごとの全壊・全焼率である。

本論では、火災による焼失戸数が少ない字を中心に議論をする必要がある。

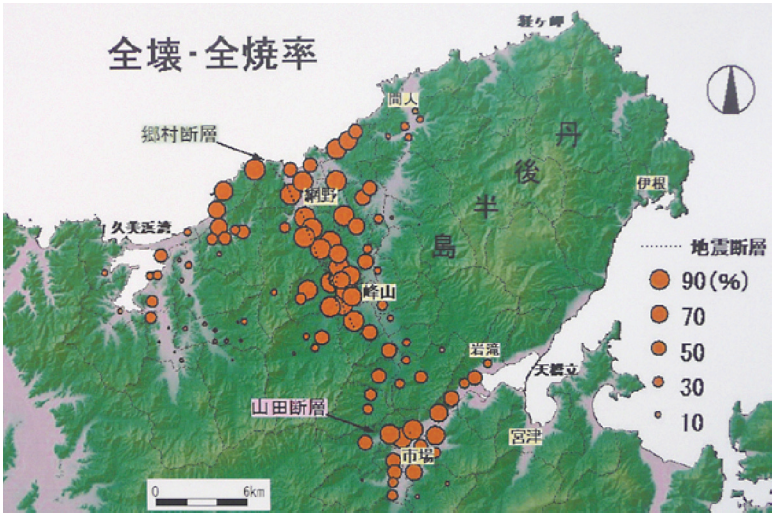

図 4　北丹後地震における字単位の全壊家屋に対する犠牲者率と地震断層

北丹後地震に関する統計資料は複数存在し、その数値は必ずしも統一されていない。ここでは、被害地域をほぼ同一の基準で網羅されている永浜（1929）の「丹後震災誌」のデータを用いることにする。永浜（1929）は、町村の小字単位で、総戸数、倒潰戸数、発火戸数、消止戸数、半焼戸数、消失戸数、人口総数、死亡者数、負傷者数、潰焼一戸に対する死亡者数が表になっている。そこで、本報告ではこのデータをもとに小字ごとの倒潰戸数と死亡者数に着目し死亡 1 人あたりの倒潰戸数を算出し、全壊戸数に対する焼失戸数も算出した。その結果、図 4 は小字ごとの全壊家屋数に対する犠牲者率と焼失家屋率を表したものである。これによると、大規模な火災が発生した字では犠牲者率が極めて高い一方で、火災があまり発生しなかった字だけに着目すると、地表地震断層近傍で全壊家屋に対する犠牲者率が著しく高いことがわかる。これは、一見図 3 の全壊・全焼率と類似しているようにみえるが、注視すると、地表地震断層から離れた場所における全焼・全壊率が高い字では犠牲者率が相対的に低いことなどが見て取れ、三河地震同様、地表地震断層近傍で人的被害が大きいことがうかがえる。ただし、このデータは字ごとであり、今後個人ベースまで落とし込んだより詳しい検討が必要である。

5. まとめ

以上のように、地表地震断層が出現した内陸直下型地震の場合、地表地震断層近傍でほかと比較してより大きな人的被害がでることが示唆された。これは、地表地震断層特有な現象であるため、「ずれ」による何かしらの現象だと推定できる。このことは、「ゆれ」に対する耐震対策だけでは十分でない可能性があることを意味するだけでなく、過去の歴史地震における人的被害の傾向から、地表地震断層が出現したかどうかの判断の指標ができることを意味する。今後、その検証として、北丹後地震の詳細な調査だけで無く、濃尾地震や鳥取地震など人的被害の大きい地表地震断層が出現した内陸直下型地震について検証していく必要がある。

また、この現象の物理的なメカニズムについては、実際に地表地震断層が出現した場所における地震波の解析結果に寄るしかない。2016 年の熊本地震本震や 2014 年神城地震は地震発生時に臨時に地震計が設置されていたため、これらの解析が進めば、「ずれ」による被害のメカニズムの解明が進むと思われる。

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私たちは御嶽山でなぜ63人を失ったのか

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概　要

2005年2月上旬、津波被災地のアチェに入り、調査をしていて驚くような証言を耳にした。アチェの人々は、津波が襲った時に「津波！」でなく「海が上がった！」と叫んだという。私たち、地震学者にいわせれば、アチェはインド・オーストラリアプレートの沈み込むスンダ海溝が目の前だけに、海溝で地震が起きれば津波の襲来を想定しなくてはならない地域だった。しかし、「津波」という言葉すらアチェの人々は忘れていた。それと同じようなできごとが日本でも繰り返された。2014年9月末の御嶽山、秋晴れの昼時、人々は目の前で噴煙が上がっても、避難を忘れ、噴煙をカメラに収める登山者もいた。新聞社のアンケートによれば、登山者と遺族の4割の人が御嶽山を火山と考えていなかった。確かに1979年の噴火はまさに有史初だった。でもその後35年間に合計3回も噴火していた。にも関わらず、火山という認識がきわめて低かった。私たち火山関係者もそんな登山者の現状が頭になかった。御嶽山噴火に関して、少なからずのところや雑誌で講演や報告を行ってきた。噴火から2年間を迎えたことから、この機会に「なぜ63人を失ったのか」について考えてみたい。

1. 御嶽山の悲報をアチェの山中で聴く

2014年9月27日、スマトラ地震津波被災も10年前の出来事になる。地球物理学的な関心は、巨大地震の影響を受けて千mを超える巨大なスマトラ断層がどのように動くかである。日本でも南海トラフでは巨大地震が発生する。その巨大地震のなかでも1707年宝永地震は一、二を争う規模である。地震から49日後に富士山が大噴火し、地震の前には関東地方で大地震が発生した。そんなこともあり、私はスマトラ断層の挙動を観測するために、スマトラ山中のアチェ州タケゴンにいた。ガヨコーヒー、いわゆるスマトラコーヒーの産地である。

GPS観測は同じチームといっても、各人はそれぞれ離れた観測点に張り付く。そんな独りぼっちの私のところに、日本人のチーム仲間から「御嶽山噴火、犠牲者あり」のメールが届いた。ネットは携帯で繋がるが、回線は細く、メールぐらいが限界である。それでも、登山者を中心に戦後最大の火山噴火災害になっていることがわかった。

大学を辞する前に、御嶽山での研究環境がきわめて悪くなった。簡単にいえば「研究業績の上がらない火山から、大学は撤退すべき」という文科省の方針が、十分な議論もないまま、一部の指導的立場にある火山学研究者に受け入れられた。御嶽山は大学が研究するに相応し

い活火山とは評価されず、名古屋大学は御嶽山の調査研究から引き下がり、火山のフィールドを持たなくなった。

しかし、御嶽山での噴火は、有史初の1979年の噴火、その後のごく小規模な噴火が2回続いた。幸いなことに閉山期で登山者も少なく、犠牲者はでなかった。これら三回の噴火を通して、当時は事後となりながらも、噴火に先行する現象が地震などとして確実に観測されていた。それだけに、観測を充実すれば、噴火も予測できる、少なくとも火山活動が活発化しているかどうかは明らかにできると考えていた。

そんな矢先に研究撤退､御嶽山を大学が調査研究するのは無駄という研究者も身内にいた。一方、王滝村では、ダム建設による村の1/4の住宅の強制移転、美林の伐採を終えた営林署の撤廃などにより、過疎と高齢化が急速に進み、村もとうとう「財政再生団体」転落に直面した。ここでも、国政が責任を負うべきことが、王滝村に重くのしかかってきた。このように御嶽山を見守る体制が揺らぐ下で、私は歯ぎしりを噛む思いで、『御嶽山　静かなる活火山』[1]を執筆した。

御嶽山を取り巻く社会環境など、理解できる素養はなかった。しかし、災害は社会がこうむるものであると考えれば、千人を切る人口の村が巨額な赤字財政から再建するか、いかに苦労していることも伝えたかった｡いわゆる火山学者の書いた火山の本として異例ながらも、火山活動のみならず、20年間の観測を通して感じた人々の暮らしにも触れた。

噴火当日の夜、新聞社から原稿の依頼がメールで届いた。幸いにしてタケゴンに持参したPCに『御嶽山　静かなる活火山』の原稿が収まっていた。ほぼ夜を徹して原稿を書き、共同通信社に投稿[2]した。

2. 御嶽山は信濃の山？東海の山？

御嶽山の出版を信濃毎日新聞社に頼んだ時に意外な返答を頂いた。「信濃の人は御嶽山が信濃の山とは考えていませんよ、御嶽山は信濃からほとんど見えませんし、もっと有名な高峰が沢山ありますから」というのだった。また、地元にほとんど本屋がない地域で、地元の山を取り上げた本の出版などは至難なことだった｡でもどうにか一刷分はほぼ売り尽くされ安堵した。

そんな経緯もあり、今回の御嶽山噴火では信濃毎日新聞社と長くつきあうことになった。逆に、私たち研究者が苦手とするところを新聞社にお願いすることもあった。

当初、信濃毎日新聞社はまだ「御嶽山は東海の山」と考え、東海を拠点とする中日新聞が大々的に取材を展開するものと考えていたようすだった｡中日新聞と比較し、信濃毎日新聞

[1] 木股文昭著、195pp、信濃毎日新聞社、2010 年。
[2] 「御嶽山噴火：火山観測体制　再考迫る事態」、9 月 29 日信濃毎日新聞をはじめ、全国で 24 紙が掲載。

は長野県だけが対象と、まさにローカル紙の範疇にある。それだけに、中日新聞と競争になれば、勝負にならないと心配していたらしい。ところが、時間が過ぎると中日新聞の報道体制が日に日に縮小していった。

その一方、被害の状況が明らかになるにつれ、犠牲となった登山者は全国から集まっていた。なかでも、愛知県の犠牲者は20人、全体の3割を超え、全国でもっとも多かった。愛知県に岐阜県、静岡県、三重県を加えた東海4県となると犠牲者は30人、ほぼ半数に達する。そもそも御嶽講が普及した尾張など、御嶽山は濃尾平野から眺められるだけでなく、東海地域との関わりが強かった。

表1　御嶽山噴火に伴う犠牲者の都道府県別分布

都道府県	死者数
愛知	20
長野	7
東京	6
神奈川・岐阜	5
兵庫・山梨	4
静岡	3
三重	2
埼玉・石川・京都・大阪・奈良・広島・愛媛	1

長野県警資料

今回の御嶽山噴火犠牲で今後の教訓とすべき一つは、広い意味での被災者支援が、地元の木曽だけでなく、御嶽山と関わりの大きな東海地域においても、考えられるべきだった。そのオピニオンリーダーとしてのマスコミの役割が求められていた。

しかしながら、現実には長野県も御嶽山で亡くなった犠牲者に対して、捜索活動は行っても、具体的な被災支援活動は行っていない。最大の犠牲者となった愛知県も登山中の事故として考え、県職員の派遣などの支援は行っていない。さらに、義捐金はどこも呼びかけもしなかった。

2011年のニュージーランド、カンタベリー地震では、被災地が世界的な観光地クライストチャーチだったこともあり、死者185人のうち、ニュージーランドの人が97人、残りの半数が外国人だった。なかでも外国人の犠牲者は日本が28人、中国23人、この2国で被災者全体の1/4を占めた。日本人は全員が語学留学生だった。当時の菅首相は緊急支援を行い、翌日に準備調査団が現地に到達し、翌々日に緊急援助隊が入り、2週間ほど活動した。

このように、今回の御嶽山噴火は被災地が僅か1 kmにも満たない局所ながらも、その被害は全国の16都府県に及ぶなど、ある意味では広域災害だった。しかし、広域災害という認識が少ないゆえに、被災の救援は確実に遅れてしまった。この意味でも観光地での災害につ

いて、2014年御嶽山噴火は課題を明らかにした。

3. 災害？山岳遭難？　明らかにされない災害原因

御嶽山噴火による犠牲者は63人､1991年の6月3日の雲仙普賢岳での火砕流による死者行方不明者43人を上回り、ご存じのように戦後最大の火山噴火災害となった。明治以降の日本における火山災害史では、1888年磐梯山での461人、1926年十勝岳での144人、1902年伊豆鳥島での125人に次ぎ、ほぼ90年ぶりの大惨事となった。この惨事が、気象庁が噴火災害減災を目的として導入した「噴火警戒レベル」が実施される火山で起きたことは、気象庁などの噴火災害対策体制の再検討が確実に必要であり､そのための課題を明らかにしなくてはならなかった。

また、御嶽山の噴火災害は全員が登山者だった。1991年雲仙普賢岳噴火の事故は、主として車の運転や警備も含めた報道関係者が占めて、その後、災害報道に関して再検討がなされた。となれば、御嶽山噴火災害も一つの山岳遭難として考えるべき面を持つ。

山岳遭難は、警視庁によれば2014年も死者行方不明者は全国で300人を超え、大きな社会問題である。しかし、個々の遭難で100人を超える犠牲者は、1902年八甲田雪中行軍遭難の199人だけである｡その次は1972年3月の富士山死者行方不明者24人ぐらいである｡となれば、今回の御嶽山噴火は山岳遭難として、登山者を火山噴火から如何に守るためには、重要な内容になる。

しかしながら、この両面とも現在まで、取り組みはきわめて不十分である。たとえば、気象庁は「その施策や業務を自ら評価し、評価結果を施策の企画立案や的確な業務の実施に反映させることにより、業務の改善に取り組んでいます。このような取組を実践することにより、次の目的の達成を目指しています」[3]と称し、業務評価レポートを作成公表する。

その2015年度版では、「分かりやすい噴火警報の提供」が業務指標として掲げられ、「B-1 目標に向けて進展あり。取り組みは適切」と評価される[4]。もっともこの評価の基準はどれだけの活火山に噴火警戒レベルが導入されたかであり､その導入された警戒レベルの評価はなされていない。簡単にいえば、数字を追うだけの業務評価に過ぎないと考える。

4. 2014年噴火：犠牲者は噴火口から1 km以内

有史初となった1979年の噴火時も、数は少なかったものの、山頂部に登山者が野営していて、噴火に遭遇した。この噴火は早朝に始まったが、登山者の話から判断するに、弱い噴気活動から始まった。早朝、テントの中でジェット機の轟音らしきものに登山者は目を覚ま

[3] http://www.jma.go.jp/jma/kishou/hyouka/
[4] 気象庁、気象庁業務評価レポート（平成 27 年度版、2016）。

した。ところが、ジェット音がなかなか消えない。ジェット機にしては変だと思い、テントから顔を出せば、空から泥が降り注いでいた。彼らは「何かが始まっている」と下山を始める。このあたりで「噴火！」と気づいた様子だ。普段ならば1時間半ほどで駐車場まで下山する。しかし、泥だらけの登山者が田の原駐車場に戻ったのは昼になってしまった。でも無事だった。

2014年は、79年噴火より激しい形で、まさに爆発として噴火が始まった様子である。以下は、噴火翌日に取材中の産経新聞ヘリが発見し、救出した女性の手記である。

> 「八丁ダルミを一人で歩いていた……異変は音で気づいた。何か弾けるような『ポン』という感じだったと記憶している。音がした方向を見ると、黒煙がモクモクと上がっていた。午前11時52分、御嶽山噴火。だが現実と受け止められなかった。『まさか、この山』と思わず、『どこか他の山かな』という感じで、臭いや揺れといった確かたる変化もなかったため、直後は周囲の登山客と同様に噴煙を写真に収めていた。」（産経新聞2015.9.27）

噴火に遭遇しながらも、彼女は緊迫感を感じていなかった様子である。

そのため、噴火口近くで多くの登山者が犠牲者になった。捜査を担当した長野・岐阜両県は犠牲者の発見場所を発表するが、非常に大雑把な形である。その資料を信濃毎日新聞[5]が整理したものを図1に示す。

犠牲者のほとんどが噴火口から1 km以内である。

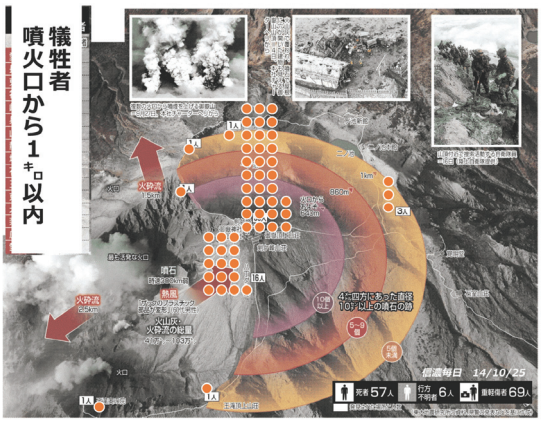

図1　御嶽山噴火による犠牲者の発見された場所（信濃毎日新聞社）

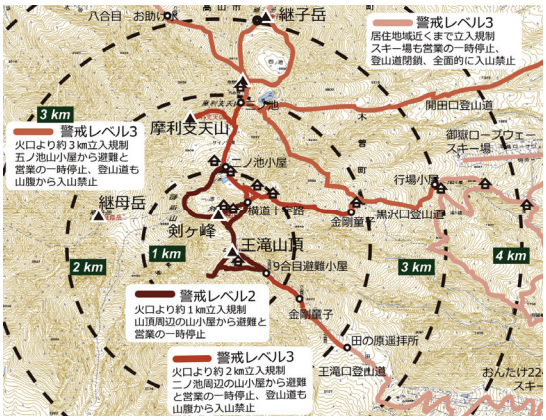

図2　御嶽山に導入された噴火警戒レベルによるおおよその立入禁止区域

気象庁は火山噴火災害の軽減を図るために、噴火警戒レベルというシステムを全国の活発

[5] 2014 年 10 月 23 日。

な活火山に導入していた。御嶽山では2008年に導入された。その警戒レベルによれば、気象庁は噴気活動や地震活動などの火山活動が活発になった場合、レベル2に引き上げ、地元自治体は火口周辺から概ね1 km以内を立入禁止にしなくてはならなかった（図2）[6]。

ということは、もしも山頂直下での地震活動が活発になった9月中旬に、気象庁が御嶽山の噴火警戒レベルを2に引き上げ、地元が防災対策通りに火口から1 km以内を立入禁止にしておいたならば、今回の犠牲者の多くは命を失わなかったと指摘できる。

5. 何のために設けたのか噴火警戒レベル

2007年のごく小規模な噴火後に、気象庁は御嶽山に噴火警戒レベルを導入した。確かに気象庁は地元に何度も伺い、導入の意義を説明した。私も大学で導入の意義の説明を受けた。確かに積極的な意義は理解できるが、当時の研究レベルでいえば、観測が不十分で、安全と称するレベル1でも噴火の恐れはある。私はレベル1の廃止を主張した。しかし、気象庁は地元に火山に対する安心感を与える意味で重要性を強調した。

それならばと、逆に気象庁が御嶽山は安全ということを登山者に知らせて、安心して登ってもらおうと、王滝村に村のホームページから御嶽山の噴火警戒レベルが解るようすることを提案した。でも、今回は警戒レベル1で噴火したことから、結果的には失敗してしまった。

私は『御嶽山　静かなる活火山』で御嶽山は律儀な活火山と評した。その根拠は、2007年までのごく小規模な噴火2回を含む過去3回の噴火とも、観測体制がきわめて不十分ながらも、噴火に先立ち、頂上付近で地震活動を伴ったことからである。とりわけ、91年と07年の噴火はごく小規模にも関わらず、地震活動が噴火に先立ち観測されている。しかも、山頂部は東山麓で発生する群発地震と対照的に、地震がきわめて少ない。まさに、目につく噴火先行現象が起きていた。残念なことはその地震活動が有珠山や三宅島のように有感地震の規模でなく、地震観測網しか観測出来ないことだった。

要するに、御嶽山の噴火に関して、気象庁の地震検出能力が大きく支配していた。山小屋を始め地元は気象庁頼りだった。

もう一つは、気象庁は専門家による連続監視が噴火予測に重要として、地方気象台や測候所が行っていた火山監視業務を札幌、仙台、東京、福岡の4管区に集中した。それまで、御嶽山の監視は松本測候所が行ってきたものが、東京管区の気象庁に集中され、測候所から火山監視業務がなくなった。それまでは、松本測候所には御嶽山の担当者がいたが、東京管区気象台は24時間連続監視するものの、御嶽山の担当者はいなくなった。

このことにより、御嶽山はデータを監視する人はいても御嶽山を看る人が気象庁にいなくなった。そして大学の調査研究から御嶽山が外れることにより、大学にも火山研究者はいて

[6] 木股文昭『御嶽山　静かなる活火山』信濃毎日新聞社、2010 年。

も、御嶽山の調査研究者がいなくなった。

2014年9月12日午前、私は気象庁の知人から私信のメールを頂いた。御嶽山では9月10日から地震が増加し、11日に火山情報を発表したが、今も「注意深く監視している」という連絡だった。名古屋大学の関係者とも連絡を取っているとも伝えてくれた。私にとり、御嶽山の火山情報は初耳だった。「微動が今後でるかどうかですね。名大は山頂で携帯電話を利用した地震の連続観測をやっているようです。ちょうど1984年9月14日の長野県西部地震からまもなく30年、前の日曜日には、御嶽山頂から、安全祈願の風船を放したとか。また連絡ください」と返事をした。彼は「まだ登山シーズンですので、何も無いことを祈ります」と応じてくれた。

私は、気になりながらも、スマトラに出かけてしまった。そして、御嶽山は27日に噴火した。

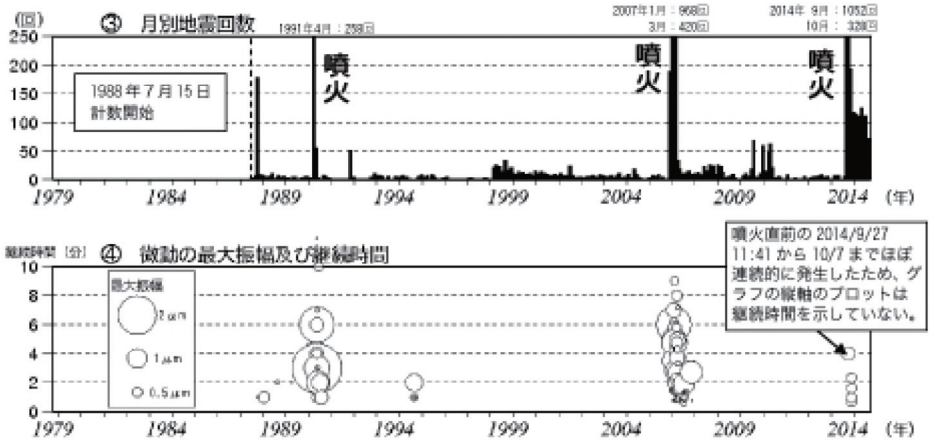

図3　御嶽山山頂付近の地震と微動の月別発生回数の推移（1989-2014年）
上：地震の発生回数、下：火山性微動の最大振幅と継続時間（気象庁）

噴火後に、図3に示すような1979年以降の地震活動の時間的推移を気象庁は発表した。山頂付近で発生する地震活動は、1988年以降しか統一したデータがない。しかし、山頂付近で発生する地震が月に150回を越える例が4回観測され、そのうち3回が噴火している。月単位だから噴火後も含まれる可能性がある。しかし、日ごとの地震発生回数を調べると、明らかに噴火の前に地震活動が活発化している。2014年9月10日の地震活動活発化は、まさに2007年噴火以降最大の事件だったことは確かである。

加えて、当時御嶽山の監視などに関わる人の多くは、9月に入れば夏山シーズンが終わると考えていたようすである。

気象庁で東京管区内の活火山監視の前線だった火山監視・情報センターのセンター長は札幌管区で北海道の活火山を監視し、14年4月に東京管区に転勤したばかりだった。わずか、5ヶ月間で管区内の火山を理解するのは無理だった。彼は「9月下旬、大勢の登山者が御嶽山の

景色を楽しんでいると想像したことはなかった」[7]。

噴火予知連絡会に幹事として加わる名古屋大学の山岡教授は、地震活動活発化のメールに対して「山頂登山シーズンは終わったので、しばらくは様子を見守ることで良いと思います」と応えていた[8]。

噴火警戒レベルの更新は、当日の監視担当者で判断するわけにいかない。裁量権のある上司が判断することになっていた。そのような人は、現場の経験はありながらも、長らく現場を離れたり、東京管区ながらも管区内の火山を訪れたことのない担当者もいる。そんなことから、御嶽山では8月になれば夏山も終わり、登山者がいるとは思いもかけなかった。どうも、監視カメラを噴火口に向けるのでなく、山麓にむけて、御嶽山を知ることの方が大切だったかもしれない。こんな状況では噴火警戒レベルも適切に運用できるはずがない。噴火警戒レベル導入の意味が消えてしまう。

6. 御嶽山が火山と知らない登山者

本来、当日の登山者へのアンケートなどは、今後の災害対策を検討する上で、絶対的に必要であり、国が率先してすべきと考える。しかし、国は実施しなかった。それどころか、現在でも犠牲者の遺体発見場所を遺族にすら教えていない。何処でなくなったか、それを知らずに対策もなにもないものである。

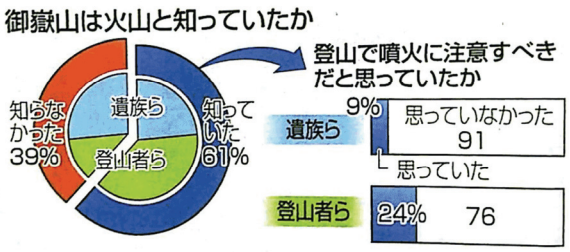

図4　噴火当日の御嶽山の登山者と遺族に対する「御嶽山を火山と認識するか」と「御嶽山の火山情報」のアンケート調査結果（信濃毎日新聞社）

そんな中、信濃毎日新聞が噴火当日、御嶽山に登っていた登山者とその遺族らにアンケート調査を行い、100人から回答を得た。その回答は私にとって意外だった。「御嶽山は火山と知っていたか」という質問に対し、遺族らは半数が、登山者は1/3、全体で4割が「知らなかった」と答えている（図4）。さらに、「登山で噴火に注意すべきだと思っていたか」の質問では、思っていなかったのが、登山者で76%、遺族らで91%に達した。79年の有史以来の噴火以降、35年間に3回も噴火する活火山御嶽山ながらも、登山者の圧倒的多くは、噴火など考えずに登山していた様子である。

[7] 検証　御嶽山噴火、信濃毎日新聞社、p52。
[8] 検証　御嶽山噴火、信濃毎日新聞社、p54。

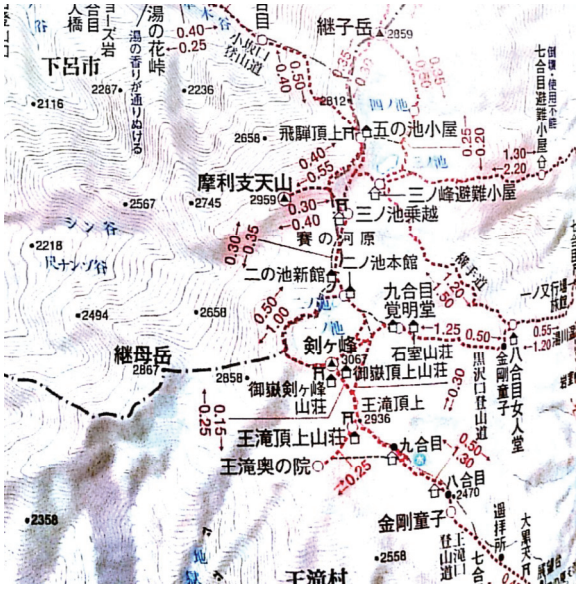

図5　ヤマケイの登山ガイドブックに掲載される御嶽山の登山道地図（抜粋）

確かに、私たちが調査でよく利用した王滝登山道でも、その登山口、田の原に「御嶽山が活火山であり、噴火に備える」ことを伝える看板があったかと聴かれれば、確かな記憶はない。自分が知っているから、活火山を知らせる看板がなくても、登山者は当然ながら御嶽山が活火山であることぐらいは知った上で登っていると私は思い込んでいた。

慌てて、御嶽山の登山ガイドブックを調べてみた。登山ガイドブックで御嶽山の扱いはきわめて少ない。唯一のガイドブックがヤマケイ・アルペンガイド「中央アルプス　御嶽山　白山」である。そのなかに御嶽山の案内が10ページほどに記される。少ないページの中で、活火山に関する記述は次の1行だけである。「奥社から一歩出ると硫黄の臭いが鼻をつく」。

ガイドブックに掲載される登山道の地図にも79年の噴火口の位置が記されていない(図5)。となると、噴火をもっとも警戒すべきところが何処なのかを知るのは、地元などの人に限られ、多くの人は知らないままに山にのぼることになる。

登山者の少なからずが、御嶽山を火山と理解していなかった。加えて、活火山の御嶽山に登る登山者が火山と知らずに登っていることを、私たちは理解していなかった。完全なる認識不足である。この結果が63人を失うことになった。

7. 津波をアチェでは知らずに、東日本では知っていて人々は亡くなった

2004年スマトラ地震津波では、私たち名古屋大学の文理連携調査研究チームは発生から1ヶ月後に、最大の被災地スマトラのバンダアチェに入り、それ以降、現在まで被災から復興のプロセスを社会の営みとして追っている[9] [10]。その成果の一つが、アチェの人々は、津

[9] 木股文昭・田中重好・木村玲欧『超巨大地震がやってきた』時事通信社、229pp、2006 年。

波が襲ってくるまで「津波」というイメージを持っていなかったことを明らかにできたことである。

それを象徴するのが、津波が襲った時にアチェの人々は「津波！」と叫ばなかったことである。彼らは、長ったらしいが「海が上がった！」と叫んだという。彼らの頭の中から「津波」の2文字が消えていたのである。それゆえ、海岸線でかつて経験したことのない地震の揺れを感じても、津波を思い出すことなく避難する人もほとんどいなかった。津波の轟音にも気づかず、気づいたのは津波を目撃してからである。

そんなことから、津波による町内ごとの死亡率はまさに海岸線に近くなるにつれ高くなる（図6）。内陸から海岸線にむかって2〜3 kmまでの町内ではほとんど死者はいない。世界中を津波の戦慄に陥れたビデオが撮影された周辺域が相当する。通りを津波が押し寄せるが、その周辺域では津波による死者はない。河口周辺だと海岸から2 kmの地域でも死亡率は5割を超えるほど高く、さらに海岸線に近づくにつれ、死亡率はさらに高くなる。海岸線の町内には死亡率100%、まさに、町民が誰も彼も亡くなったという全滅の町内も存在する。

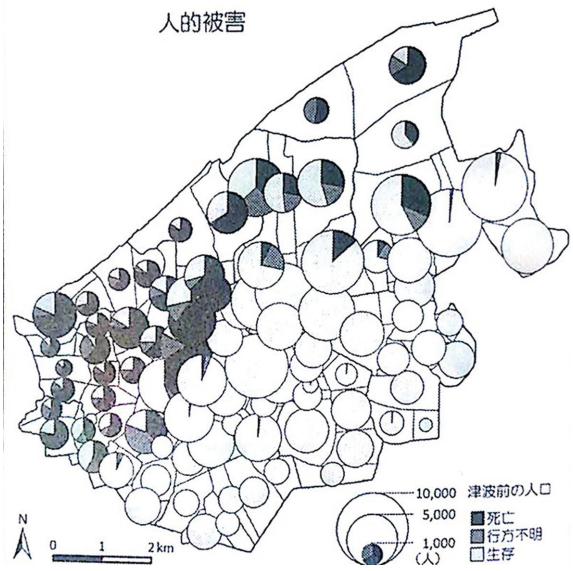

図6　2004年スマトラ地震津波によるバンダアチェ市内の町内ごとにおける死亡者と死亡率の分布

資料はアチェ市による（高橋ら 2006）

スマトラの津波から7年目、今度は巨大地震による大津波が東日本の太平洋沿岸を襲った。少なくとも三陸沿岸では、明治以降に、120年前の1896年明治三陸津波と経験者も生存する1933年昭和の三陸津波、そして1960年チリ地震津波と3回の津波被災を経験している。

加えて、気象庁は沿岸の准民を守るために津波警報の迅速な発令、地震から5分以内の発令をめざしてきた。それを補完するように、地震波の到達前に激しい揺れを告げ、注意喚起

[10] 高橋誠・田中重好・木股文昭『スマトラ地震による津波災害と復興』古今書院、404pp、2014 年。

する緊急地震速報システムの運用を始めていた。

3月11日午後、NHKテレビは国会中継の最中に、「東日本の太平洋沖で大地震発生」の緊急地震速報をテロップで流した。直ちに画面が切り替わり、3分後には気象庁の「大津波警報」が岩手、宮城、福島の3県に発令を告げた。

このように、東日本太平洋沖地震で発生した大津波は、津波に馴染みの深い地域を、事前に気象庁が津波警報を発令する中で、襲った。経験したこともない異様な揺れを感じ、地震発生直後から、避難命令のサイレンがけたたましく鳴るなかで、確かに、多くの人が避難した。しかし、避難できずに犠牲となった人も1万5千人と少なからずいた。

毎日新聞の安高記者は津波に襲われ亡くなった田老町の町民を、死亡記事から集めて、亡くなった150人ほどの住所を地図に示した（図7）。田老町では万里の長城と称された高さ10mの大防潮堤が建設されていた。しかし、大防潮堤を津波が乗り越した。この図からいろいろ指摘できる。ここで指摘したいことは、明らかにスマトラ地震津波に襲われたアチェとは異なり、海岸線近くの住民ほど多いという特徴はないことだ。逆に、安全だったはずの避難所や山際近くの住民の死亡が目立つ。

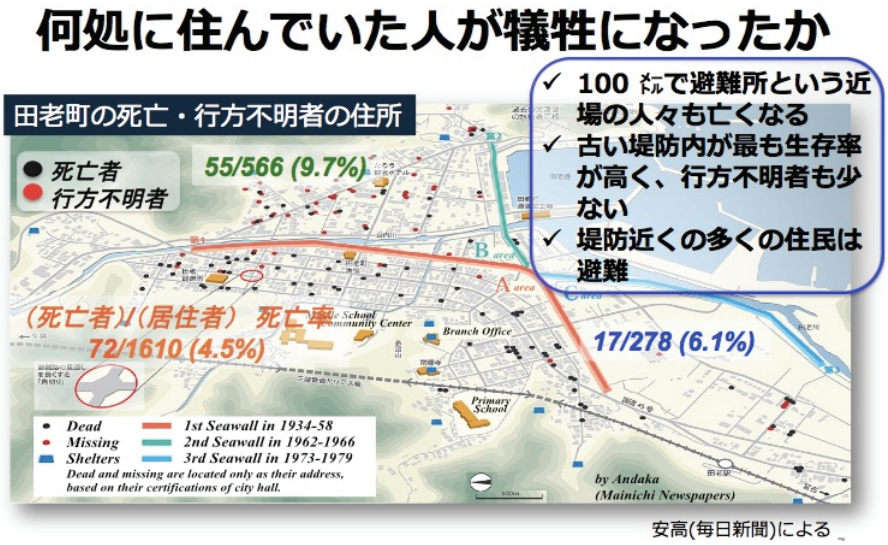

図7　2011年東日本大震災において田老町で津波により亡くなった人の住所の図示
毎日新聞安高記者による

東日本は2011年の大津波の1年前に、チリで発生した巨大地震により、気象庁は津波避難警報を発令した。しかし、多くの住民が避難しなかった。消防庁は東北3県で実施した避難対象域の住民アンケート調査を行った。その結果、1）ほぼ100%の人々が津波襲来を知っていた、しかし、2）避難所などに避難した人は1/3に満たなかった。3）避難しなかったのは気象庁の警報が大げさなどゆえ、私は津波におそわれないと当初から避難するつもりの無い人が1/3、避難するかと考えながら避難しなかった人が1/3を占めた。

加えて、東日本大震災ではその3日前に地震の規模M7クラスの大地震が発生し、気象庁は大津波警報を発令した。しかし、津波は1 mにも満たず、人的被害はなかった。「気象庁は大げさ、津波は襲わない」を増長させる事例が起きていた。

もっとも、逆に当日人々が感じた地震は、まさに誰もが経験したことのない異様な揺れが長く続いた。まさに大変なことが起きていることを感じた人もいた。この異様な揺れは「避難しなくては」と考える人々が増えたと考える。

すなわち、東日本大震災では、海岸に住む多くの人が津波襲来を感じていた。しかし、未だかってない異様な揺れでも、「津波が襲うが、私は襲われない」と信じた人々が多くいたと考える。

8. 2014年御嶽山噴火災害はアチェ型被害

このように検討してくると、御嶽山では御嶽山が火山と知らずに登った登山者も少なからずいた。そして、その火山活動を監視する気象庁や噴火予知連絡会メンバーは、御嶽山では9月で多くの登山者がいることを知らずに監視していた。そのため、登山者は「御嶽山が噴火するなんて？」と思い、気象庁などは「御嶽山に登山者がいるなんて？」という現状認識のもとに63人が犠牲になってしまった。

そんな状況を知らないことから、長野県や岐阜県はさらに「恥の上塗り」対処で対応しようとした。長野県知事は噴火直後に「御嶽山に火山研究施設を政府に要望」とし、岐阜県は登山届けの義務化を直ちに条例とした。

御嶽山が火山と思わずに登る人に、火山研究施設を設けたところで、登山届けを義務化したところで、登山者を噴火災害から守れるわけでない。まず必要なことは「御嶽山は活火山、火山活動は日頃は静かながらも、時として活発化すること、噴火するとすればまずどの辺りか」といったことをきちんと登山者に伝えることである。

登山者は地元だけでなく、まさに全国から集まってくる。となれば、御嶽山の火山活動情報などをマスコミに期待することはできない。ならば、御嶽山に集まる登山者に対して、まさに「泥縄」ながらも、御嶽山が活火山であり、最近どのような噴火が起きているか、緊急時の対応などを短時間で伝えるしかない。

私はそのためには、登山口にビジターセンターを設け、登山者に伝えることがもっとも有効と考える。すでに国立公園やジオパークとなる活火山ではビジターセンターも設けられている。しかしながら、その主旨が環境保全などであり、そこに集まる登山者や観光客の命を守る観点が弱い。

その意味では、国立公園でもない御嶽山ながらも、戦後最大の火山噴火災害という負の遺産を背負い、亡くなった63人に応えるためにも、日本で登山する活火山としてもっとも安全

な火山を実現しなくてはならない。そのためにも、登山口に登山者が寄れるビジターセンターを設けることが重要である。

9. 現場軽視となる国の地方政策

加えて、私は今回の御嶽山噴火災害を通して、日本の災害対策を見直すべきと考える。それは、すべて国という中央が動くことによる災害対策になっていることである。

国の火山監視体制は1980年代に、現地測候所では人員不足で24時間監視もできない、火山監視には専門性が求められるとして、業務を地方気象台や測候所から外し、管区気象台と気象庁に集中してしまった。社会的にはいわゆる小さな政府をめざした中央集権化を行ってしまった。

確かに火山活動が24時間、切れ間なく監視されるようになった。しかし、現場を一度も訪れたことのないものが監視しても、現場事情が理解できるわけでない。「夏山が終われば御嶽山に登山者はいない」という認識である。

しかし、現地に命令すればそれでよしという体制が貫徹されている。御嶽山噴火ではまだ山頂に多くの登山者が残っていながらも、気象庁の職員は現地にはいなかった。村が気象庁に連絡を取り、下山させている。

アメリカで火山監視を担当するのはUSGS、そのUSGSがモデルとなり監修した火山噴火ビデオが「ダンティピーク」である。そこでは、USGSは活発になった火山の現地に観測班を出し、現地で火山活動が把握できるように取り組んでいる。2000年有珠山噴火でも、山麓に地割れが拡がったのを見つけたのは現地の観測班である。けっしてヘリコプターによる上空からの監視ではなかった。

逆に2015年口之永良部島噴火で、数時間で全島民が避難できた要因の一つに、現地に派遣された気象庁職員が集落を廻り、いざというときの避難について、住民とまさに膝をつき合わせて検討していた[11]。地方軽視、現場軽視という国の政策が、今回の御嶽山噴火災害でも確実に支配していたのは確かである。

[11] 宇平幸一・通山尚史「沖永良部島 2015 年 5 月 28 日の噴火に遭遇して」火山 60-4、487-490、2015 年。

Disaster-prevention Paradigms up to the Great East Japan Earthquake in Japan

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1. Introduction

Japan is a country beset by many natural disasters. According to its government's Fiscal Year 2013 White Paper on Disaster Prevention, "About two-tenths of earthquakes around the world over a magnitude of 6.0 occur around Japan; as far as we know, there are about 2,000 active faults *within the country*" (Cabinet Office, 2013: 1). Throughout its history, Japan has experienced numerous natural disasters and managed to recover each time. In the process, Japanese society has internalized responses to natural disasters, devising a range of countermeasures and changing its structure and lifestyle patterns to mitigate the impact of similar disasters in the future. In this way, through its experience of multiple disasters, Japanese society has strengthened its ability to resist them and has become a clear world leader in disaster-prevention measures.

In the first place, dealing with disasters (termed "disaster prevention" in this paper) is not confined to post-disaster emergency response and emergency relief; rather, it encompasses a long-term social process of precautions taken in normal non-emergency periods, emergency response when the disaster strikes, and subsequent reconstruction and recovery, all of which extend across successive generations. Furthermore, disaster prevention includes two kinds of infrastructure: a tangible infrastructure of disaster-prevention engineering — with earthquake-resistant structures and building processes, embankments, and the like — and an intangible infrastructure involving disaster-prevention education and preparedness.

Japan faced no major natural disasters between the Isewan Typhoon of 1959 and the Kōbe Earthquake of 1995. Prior to this period, however, a succession of disasters in the immediate postwar years led to the gradual development of a disaster-prevention system. This process culminated in the enactment in 1961 of the Disaster Countermeasures Basic Act, the urgency of which was intensified by the Isewan Typhoon.

It can be contended that Japanese society's disaster-prevention capabilities were developing even before its modern-day advances. This is because the society has internalized disaster, having confronted it throughout its history, resulting in a certain collective social stance toward disaster prevention. This process of increase in capability has been accompanied by a shift in the subject or the main protagonist of disaster prevention. Before the creation of the modern state in the late 19th century, the organs of the government bore minimal responsibility for disaster prevention; the only way for people to handle disasters was through self-help or mutual aid within the local community.

However, since the formation of the modern state, the protection of people's lives and livelihoods has come to be seen as a state function (albeit with differences in the degree of responsibility depending on the particular state), and a wide variety of governmental disaster-prevention policies and emergency response measures have come into being. Governmental disaster-prevention policy has witnessed concerted expansion since the advent of the welfare state during the years after World War II. This expansion has, however, resulted in a decline in the use of the traditional methods on which society previously relied. This decline in traditional capacities cannot simply be attributed to the expanding role of the government; it is also attributable to the broader forces of social change at work in modernization: drastic changes in the social environment, the weakening of local community ties, the rise in social mobility, and urbanization being the most prominent among them.

However, the limits of the government-centered approach to disaster prevention have become clear in Japan since the Kōbe Earthquake of 1995. The decision regarding the ideal disaster-prevention policy for the contemporary setting is at its watershed.

Despite all of Japan's longstanding efforts in the disaster-prevention field, the Tōhoku Earthquake and Tsunami produced casualties and fatalities on a mass scale. The total number of fatalities and missing persons from Hokkaidō through maritime Tōhoku to the Kantō region's coast and on to Kanagawa Prefecture reached 18,641 (15,872 fatalities and 2,769 missing persons) as of October 30, 2012. Almost all the fatalities were caused by the tsunami. Police reported that 92.4% of these fatalities resulted from drowning (Cabinet Office, 2011). Furthermore, if the 3,089 subsequent deaths related to the disaster (figures from the government's Reconstruction Agency as of March 31, 2014) is included, the total death toll climbs to 21,730. These massive mortality figures are unprecedented in the postwar disaster history of the entire developed world.

The general understanding of these events is that these massive losses were inflicted because of the massive scale of the earthquake and tsunami, rendering any human intervention futile. However, the impact cannot be assessed purely in terms of the scale of a disaster or the resulting damage. This fact is very aptly formularized by Ben Wisner through the equation "hazard × vulnerability = damage" (Wisner et al., 2004).

Analyzing the disaster from this viewpoint and recognizing that the degree of vulnerability is always a contributing factor in the impact of a disaster, the following questions arise. Why did such large-scale damages occur even though extensive policies had been developed? Were there fundamental flaws in the policies developed up to that point? Given the extent of the damage, what should be done in the future to minimize the number of casualties? We must identify and address the weaknesses in Japanese society's disaster-prevention methods.

In this chapter, we evaluate how Japan's disaster-prevention policy has developed in the years since the passage of the Disaster Countermeasures Basic Act, which forms the foundation of Japan's postwar disaster-prevention regime. In the second section, we examine the act's passage and main features. Next, we scrutinize the Large-Scale Earthquake Countermeasures Law (the Earthquake

Law for short) — a legislation widely considered to epitomize postwar Japan's disaster-prevention policy. After the passage of the Earthquake Law, Japan's disaster-prevention system coasted through the decades with no basic structural changes of any sort, until it was tested by the Tōhoku Earthquake and Tsunami. Reviewing the arguments above, the basic framework of postwar Japan's disaster-prevention policy is characterized in terms of a disaster-prevention paradigm in the fourth section.

2. The formation of postwar disaster-prevention policy

As the modern state came into being in Japan, a series of laws covering disasters was adopted. These laws included the Act Related to Flood Prevention of 1890, based on irrigation association regulations; the Act on Firefighting and Related Matters of 1894, stemming from fire-brigade regulations; the Waterways Act of 1896; and the Erosion Control Act of 1897, covering countermeasures against landslides. The legislative measures corresponding to today's Disaster Relief Act were the Act on Provision for Famine and Savings of 1880 (repealed in 1899) and its successor, the Calamity Relief Fund Act of 1899 (repealed in 1947). However, the laws covering disasters experienced piecemeal enactment; there was no overarching legislation.

Japanese society was confronted with a plethora of natural disasters in the years during and around World War II. Successive, large-scale water-related disasters occurred from 1945, i.e., the end of the war, into the 1950s (Takahashi, 1988). An exceptionally powerful typhoon of 916.6 mb made landfall at Makurazaki in Kagoshima Prefecture on September 17, 1945, crossing Kyūshū and Shikoku. Two years later, in September 1947, Tropical Storm Kathleen crossed over Kantō and Tōhoku, causing the Tonegawa and Kitagami Rivers to overflow and inflicting major damage. In September 1950, Tropical Storm Jane attacked, causing storm surges mainly around Osaka. Torrential rains centered on Kyūshū in June 1953 caused damage around the city of Kitakyūshū, flooding the Kanmon railway tunnel. In July of the same year, severe local downpours struck in the center of the Kii Peninsula, causing landslides and flooding the Kinokawa, Aritagawa, and Hidakagawa Rivers. Furthermore, in September 1953, Typhoon 13 attacked, causing major damage along the Pacific coast of Honshū (the Tōkai region). In 1954, the Tōya Maru, a train ferry, sank in a typhoon along the passage between Honshū and Hokkaidō, claiming over 1,000 lives. Torrential rains in July 1957 produced over 600 fatalities in Isehaya, Nagasaki Prefecture. In September 1958, the Kano River typhoon caused major flooding from the Izu Peninsula to Tokyo.

The impact of this succession of major typhoons and localized downpours during the immediate postwar years was intensified by the fact that erosion and flood-control works had been shelved during the war years, leading to degradation of land. The series of disasters reached its peak with the Isewan Typhoon of September 1959. The impact of the period between the end of the war and this particular tragedy dwarfs that of all the disasters that struck before it as far back as the Meiji Period, both in terms of estimated numbers of fatalities and missing persons and in total monetary losses

(Takahashi, 1988: 5).

In addition to these water-related disasters, this period around World War II also witnessed numerous large-scale earthquakes. Records of earthquakes with 1,000 or more fatalities since the 1940s (Central Disaster Management Council, 2011a) detail the following. First, the damage by the near-field Tottori Earthquake (M 7.2) of September 10, 1943, centered on Tottori City, where fires destroyed 7,485 buildings and 1,083 lives were lost. The major Tōnankai Earthquake of December 7, 1944 (M 7.9) had its epicenter in the Nankai Trough; damage was centered on Shizuoka, Aichi, and Mie, with 17,599 buildings destroyed, 3,129 buildings swept away, and 1,223 fatalities. A tsunami of 8 to 10 m accompanied this earthquake, striking Owase City in Mie Prefecture and causing 96 fatalities. On January 13, 1945, the Mikawa Earthquake occurred in southern Aichi Prefecture, destroying 7,221 buildings and resulting in 2,306 fatalities. On December 21, 1945, the major Nankai Earthquake (M 7.1), with its epicenter at the Nankai Trough, produced a tsunami that hit the Pacific coast from Shizuoka to Kyūshū. On the coasts of Kōchi, Tokushima, and Mie Prefectures, the tsunami approached at a height of 4 to 6 m, destroying 11,591 buildings and burning 2,598 buildings, sweeping away 1,451 buildings, and resulting in 1,330 fatalities. Finally, the Fukui Earthquake (M 7.1) of June 28, 1948, inflicted major damage because it was a near-field earthquake; 36,184 buildings were destroyed and 3,769 fatalities occurred, mainly on the Fukui Hirano plain.

Between this event and the Southern Hyogo prefecture (Great Hanshin-Awaji) Earthquake of January 17, 1995, there were 10 earthquakes of magnitude 7.0 and over in Japan and the seas around it, such as the 1964 Niigata Earthquake and the 1978 Miyagi Earthquake. However, only one of them, the 1983 Sea of Japan Earthquake, produced more than 100 fatalities (104 in this case). Accordingly, in terms of risk, it is evident that earthquakes with large magnitudes did not stop occurring; rather, no earthquake between 1948 and 1995 produced mass casualties because their epicenters were not located under major cities or on ocean trenches near heavily populated areas.

Therefore, both major earthquake and water-related disasters clustered between 1943 and 1948; after that, no tremor until the 1995 Kōbe Earthquake produced 1,000 casualties or more.

2.1. The Isewan Typhoon

The spate of major disasters during the 15 years after World War II reached its peak with the Isewan Typhoon of 1959. This massive Typhoon 15 formed on September 23, 1959, with a center pressure of 894 mb and top wind speeds of 75 m/s. It made landfall around 6:00 pm on September 26 near Shionomisaki Cape in Wakayama Prefecture, still at a strong reading of 929.5 mb. Passing over the vicinity of Suzukatōge in Mie Prefecture, it crossed into Toyama Prefecture. It had the strongest recorded center pressure of any typhoon ever to make landfall on the mainland. The heavily populated, coastal Tōkai region experienced the typhoon's strongest impact between 9:00 and 10:00 pm; around the same time (9:25 pm), a maximum wind gust of 45.7 m/s was recorded and tide levels in Nagoya Bay reached 5.81 m. Table 1 outlines the damage caused by this typhoon.

Table 1. Isewan Typhoon Damage

	Nationwide	Aichi Prefecture	Nagoya City
Casualties			
Fatalities	4,764	3,142	1,851
Missing persons	213	88	58
Injuries	38,838	31,514	—
Damage to buildings			
Totally destroyed	35,125	21,381	6,166
Damaged	105,344	62,995	43,249
Swept away	4,486	2,135	1,557
Flooded to above floor level	194,397	104,017	34,883
Flooded to below floor level	228,317	80,827	32,469
Total number of households affected	354,135	192,071	128,308
Total number of persons affected	1,615,804	878,900	—

Note: Because statistics were prepared using various methods, a blank line is placed in sections where applicable figures are unavailable. National and prefectural figures are drawn from a police survey of December 1, 1959; figures for Nagoya City are from a municipal government survey completed in 1960.

The final number of fatalities and missing persons nationwide due to this typhoon was 5,101; 350,000 households and more than 1.6 million people were affected; 190,000 households were inundated, with 220,000 more flooded to the foundations or in the basement level; 140,000 buildings were totally destroyed; and the total monetary damage was over 7 trillion yen. The damage was centered on Aichi Prefecture. The Isewan Typhoon caused this damage through a combination of strong winds, localized downpours, flooding and high tides; the greatest losses occurred in the large areas inundated by the high tide.

2.2. Japan's policy on disasters since the Isewan Typhoon: enactment of the Disaster Countermeasures Basic Act

The Isewan Typhoon's unprecedented damage exposed the deficiencies of Japan's disaster-prevention policy up to that point. In response to the perceived need for an overarching, planned administrative system for disaster prevention, the Disaster Countermeasures Basic Act was enacted in 1961. This measure established the foundations and direction of today's disaster-prevention system.

Over 150 disaster-related laws were in place before the Disaster Countermeasures Basic Act, but this body of legislation was uncoordinated, inconsistent, and incapable of developing a general policy for disasters. Before the Act was passed, state assistance was provided on an ad hoc basis every time a major disaster occurred, but the system was criticized for being too slow and prioritizing some regions over others.

The government's approach to monetary aid for reconstruction was also revised with the passage of the 1962 Act on Special Financial Support to Deal with Designated Disasters of Extreme

Severity as a complement to the Disaster Countermeasures Basic Act.

The draft for the Disaster Countermeasures Basic Act was presented to the 39th plenary session of the National Diet's lower house in October 1961. At that time, the head of the Regional Administration Committee, Yazō Kōketsu, who had participated in debate on the bill, explained,

> Bearing in mind the present state of our policy with regard to disaster prevention, it was necessary to pass this law in order to clarify the respective responsibilities of the national government, regional public organizations, and other public bodies. We have also put organizations in place to engage in disaster-prevention planning, take precautions against future catastrophes, implement appropriate disaster-prevention measures, decide the basic points of fiscal and monetary measures for reconstruction and disaster prevention, and, in tandem with these actions, decide emergency measures to be taken in catastrophic emergency situations. It is necessary, then, to put in place and develop a general, planned administrative framework for disaster prevention.

2.3. The features of the Disaster Countermeasures Basic Act

The main features of the Disaster Countermeasures Basic Act are as follows: "(1) the clarification of where the responsibility of disaster prevention lies, (2) the establishment of national and local disaster-prevention systems, (3) disaster-prevention planning, (4) the strengthening of disaster-prevention measures, (5) the acceleration of emergency response measures in disasters, (6) the acceleration and improvement of reconstruction measures, (7) the appropriate apportionment of financial resources, and (8) the overall establishment of policies for all emergency and disaster-related measures" (Disaster-Prevention Bureau, National Land Agency, 1986: 38). The capabilities of the disaster-prevention administrative framework have indeed increased remarkably since the Disaster Countermeasures Basic Act was enacted; we have witnessed many advances: the establishment of a system of disaster precautions; the formulation of disaster-prevention plans; the creation and operation of emergency headquarters during disasters; the establishment of warning and other information systems; the coordination of medical treatment and evacuee facilities; the acceleration of post-disaster reconstruction and related activities; the creation of disaster-prevention policies for all major government agencies; and a host of technological improvements, such as in engineering and in the analysis and communication of information.

Of the Disaster Countermeasures Basic Act's many distinctive features, the most important are that it (1) gives an overarching character to disaster-prevention policy, (2) sets up disaster-prevention policy as a planned endeavor, (3) heightens emergency-response capabilities, and (4) places the government at the center of disaster-prevention policy. The activities conducted and policies implemented under this Act to achieve each of these items are discussed below.

First, the Act gave an overarching character to disaster-prevention policy. Disaster

countermeasures by nature involve central administration. Firefighting crews, the police, the Self-Defense Forces, medical teams, and many other entities all participate in delivering emergency support to disaster-stricken areas. Construction and engineering firms then join in rebuilding roads and other public infrastructure. Various bodies of government and administration are involved in recovery efforts, which encompass the following: sanitation measures for the affected area; farming, forestry, and fishery policy for the recovery of these industries; temporary housing to rehabilitate local residents; social welfare measures such as the distribution of daily necessities and disbursement of funds for living expenses; educational policy for the reconstruction of schools; and so on. An even wider range of agencies are involved in the pre-emptive disaster-prevention measures.

The overarching character of the Act's provisions is made possible primarily by appointing the Prime Minister as the head of the Central Disaster Management Council. This allows for centralized control of all the various government agencies' disaster-prevention initiatives. Under this system, the fundamental approach to disaster prevention is devised by the Central Disaster Management Council, and the government agencies then pursue initiatives on the basis of the approach so determined.

With regard to this point, in the debate on the bill in the House of Councilors' Regional Administration Committee (October 30, 1961), Ken Yasui, the Minister of Home Affairs, stated the following on how the Act enabled coordination among government agencies:

> The most important thing to note here is that every ministry and agency has done a splendid job up to now, creating outstanding policies and legislation. But all this work has been done piecemeal by the ministries and agencies acting separately, so now we are attempting to bring everything together under the Central Disaster Management Council. In this way, we intend to make progress in areas that are lacking in focus, are inconsistent with each other, or have already invited attention. From now on, any areas of policy that have become disjointed can be coordinated centrally — that is the main goal.

For this reason, the Central Disaster Management Council was also, Yasui said,

> … a place that I think will become a forum for discussion, the gathering point for the disparate responsibilities of the various ministries and agencies involved, and a place where we can gather to discuss and critique the approaches taken by each of the ministries and agencies in their respective areas of jurisdiction. We can challenge what people are doing and suggest better approaches on the real problems facing us — all from the standpoint of disaster prevention.

Importantly, this coordination of ministries and agencies was established with no change in their existing functions or jurisdictions. With regard to the administration of this coordination, Sadao

Fujii addressed the Regional Administration Committee as follows:

> The official stance as such of the Disaster Countermeasures Basic Act is to leave all ministries and agencies as they are. There is also no intention to radically alter any of the laws in force in each area of jurisdiction. The idea is to advance overall planning and unity of approach on this basic premise.

Thus, the Disaster Countermeasures Basic Act aimed to develop disaster-prevention policy through interagency cooperation and coordination, but it authorized no alteration whatsoever in the responsibilities or sphere of interest of any of the ministries and agencies involved.

Under the leadership of the Central Disaster Management Council, its local branches were set up to develop disaster-prevention measures in prefectures, local communities, and regions across the country. The Council also cemented its comprehensive approach by linking with other disaster-prevention groups and agencies throughout Japan. These bodies, though they did not come directly under the Council's purview, agreed to participate in the coordinating activities. They included officially designated agencies such as those involved in disaster-prevention broadcasting, transportation, electricity, and gas, as well as the Red Cross and other relief groups. All such bodies were subsumed in the new, overarching approach to disaster prevention, which constituted a generalized spread of central authority.

The Act's second distinctive feature was to set up disaster-prevention policy as a planned endeavor. This was the first time in Japan that an approach to planning disaster-prevention policy was incorporated into a piece of legislation. Planning was envisaged in three stages. The Act provided, first, that the Central Disaster Management Council would formulate a basic, overall disaster-prevention plan for the entire country. Next, disaster-prevention plans were prepared at the prefectural level, on the basis of the central government's overall plan, followed, in turn, by the formulation of plans at the community level. This maintained the consistency from the center to the periphery that the Act called for. Third, on the basis of the overall plan, specific disaster-prevention operational plans were formulated, unifying the government plan with those of the other related public bodies. These operational plans were prepared by the heads of designated government and public bodies for their respective jurisdictions and operations. In the same way the government and other public bodies were coordinated, the planning took place following a centralized, top-down architecture.

The Act's third distinctive feature — how it heightened emergency-response capabilities — was the outcome of the legislation's most concentrated set of initiatives. Minister of Home Affairs Ken Yasui, the cabinet minister in charge, when addressing the Regional Administration Committee, noted that the Act, "however you put it, works out in the greatest detail the measures that local groups on the front line will take in formulating policy for emergency disaster management."

Although the legislation covered all the phases of disaster management — from prevention to emergency response to recovery — response measures were at its very center.

When the Act was debated in the Diet, it came under fire for focusing too much on emergency response, lacking adequate provisions for disaster precautions, and having an incomplete approach to recovery. Diet member Gorō Takeuchi addressed the committee with the following criticism:

> I had a look at the Disaster Countermeasures Basic Act in the Diet — it only concerns the actions to be followed after a disaster. The only really important discussion in the Act is how you deploy people, how you get material into the area or, rather, how you set up the command system to get the material moving, how you organize the mechanism, and so forth. Pre-emptive prevention measures should really be the focus of the approach.

In fact, the head of the Regional Administration Committee, well-versed in the debate and concerned with the insufficient nature of the bill's provisions for prevention measures, added the following comments regarding the supplementary resolution when the bill was under discussion in the 39th plenary session of the Diet's lower house on October 27, 1961:

> The fundamental thing that has been lacking in disaster policy up to now is that no permanent disaster-prevention measures have been put in place. The government has to build the kind of flawless policy that reduces the causes of disasters. This requires setting up and developing an effective, long-term plan, as well as a fundamental rethinking of all the measures being taken to protect and preserve the nation's land: afforestation, flood control, stopping landslides, coastal subsidence and erosion, flood control during high tides, and so on.

Criticism of the proposed bill was not limited to its lack of prevention measures; it also came under fire for not adequately addressing post-disaster recovery. Discussions of post-disaster recovery centered on relief for individual cases. Speaking at the lower house's Special Committee on Disasters on October 31, 1961, Diet member Ryūichi Okamoto called the proposed legislation "what you might call a soulless basic law on disasters." Ryūichi provided the following justification for branding the legislation "soulless": "It only covers aid and relief after a disaster happens. … What needs to be added on to this is making sure that the same area does not suffer the same kind of disaster again in the future and that people who have sustained heavy damages receive the proper resources they need. This bill does not address these problems, and, in that sense, it is a soulless piece of legislation."

The fourth distinctive feature of this basic disaster-management policy law is that it positioned disaster-management policy as the government's responsibility. The legislation contained chapters

covering general provisions, disaster-management organizations, disaster-management planning, disaster prevention, emergency disaster-prevention and management measures, post-disaster reconstruction, fiscal and monetary measures, emergency disaster situations, miscellaneous provisions, and penalties. It stipulated that the measures involved were to be executed by the government.

Addressing the House of Councilors' Regional Administration Committee during the debate on the Disaster Countermeasures Basic Act on October 27, 1961, Minister of Home Affairs Ken Yasui stated:

> The ultimate responsibility for matters like disaster prevention and aid and relief rests with the state. Now, while I think we must conclude that political responsibility rests with the state, I also believe that to accomplish [the goals of the proposed legislation], we need to work in a trinity of the central government, the local government, and related bodies that also involves the residents of each locality in the decision making.

However, he went on to assert that the central government was to assume the role of the leading player in the process:

> Although I have referred to the ministries responsible for disaster policymaking and disaster prevention, the fact is that all of the organs of government will be involved … and each will bear responsibility for a part of the whole. The proposed legislation covers this allocation of responsibilities. It puts in place a Central Disaster Management Council headed by the Prime Minister, and the intention is to unify all of the government's disaster-management agencies into one coordinated whole to handle disaster prevention and post-disaster emergency aid and relief.

This statement concurs with the argument that disaster management is an issue to be handled strictly within the organs of government. The question of disaster management, in fact, involves the entire citizenry and, in that sense, is an "issue facing all equally"; it is thus a "public issue" in the Western European sense of the phrase. However, in the Diet debate, this public issue was mainly perceived as an administrative issue. The only concession that was made for it to be considered as a public issue was its consignation to the bureaucracy for management as a public service (Tanaka, 2010). For that reason, questions of disaster management would not be included on the agenda in the Diet, prefectural assemblies, or the local government meetings of cities, townships, or villages. Only brief notifications on policy would be given in the Diet on rare occasions.

The general provisions on disaster management stipulated the responsibilities of the central government, the prefectural governments, city, township and village assemblies, and designated

national and regional public organizations. There was also, indeed, an item on "the responsibilities of community residents," stipulating that local residents "must contribute to the disaster-prevention activities of the local government and other local public organizations." However, the term "community residents" appears only 10 times in the text of the Act, and the only organizations identified as participants in disaster prevention are government bodies and designated public organizations. References to community residents confine them to the role of passive objects of policy, mentioned, for example, as follows: "Each prefecture shall protect from disaster the lives, well-being, and property of the community residents of each area of such prefecture." The actors who undertake all measures are the public bodies described above; popular participation by community residents is restricted to the above-cited statement that they "must contribute to the disaster-prevention activities of local government and other local public organizations." Overall, the passed Disaster Countermeasures Basic Act prescribed government organizations and "designated public bodies" as the players that mattered in disaster prevention, and very little was mentioned about the role of non-governmental groups or private actors (Kazama, 1998: 4).

We have seen that an overarching approach to policymaking was an important, distinctive aspect of the Disaster Countermeasures Basic Act; this direction took place within a broader context. Postwar Japanese governments placed great emphasis on general nationwide planning, with the national economic development plan being the most prominent example. The formulation of nationwide disaster planning was in line with and part of this approach. However, this disaster-prevention initiative differed in character from the national economic development plan in one fundamental way. The formulation of the economic development plan (especially, the setting of targets under the plan) was a political issue, and it attracted broad popular interest and debate. In contrast, basic policy on disaster prevention never attracted comparably wide interest from society as a whole, nor was it extensively debated in the Diet. Furthermore, in terms of its operation as a system, the policy did not require the Diet's approval. The economic development plan, then, was widely viewed as a matter of broad public interest and social discourse, whereas the details of disaster-prevention policy received little attention, despite its undeniable importance. Instead, disaster prevention was seen as a "technical concern" for the central administration to work out as it saw fit. Consequently, disaster-prevention policymaking was effectively a public monopoly run by the bureaucracy, largely free from public scrutiny or debate. The failure of disaster-prevention policy to enter the stream of public discourse reflected the increasing deference being paid to the opinions of experts and specialists.

This bureaucratic monopoly did not escape criticism for long. Speaking to the House of Councilors' Regional Administration Committee on October 31, 1961, Diet member Chōzō Akiyama excoriated the Act's provision of a bureaucratic stranglehold on policy:

> So, we have Central Disaster Management Councils being set up at all levels: the national

> government's Central Disaster Management Council; the prefectural Central Disaster Management Councils in the provinces; and then city, township, and village Central Disaster Management Councils. And it seems that the main concern is how they relate to each other up and down the chain of command or what links they form with each other horizontally. You could say they are in the business of making organizations for disaster-prevention policy and of managing groups. But when you get down to the details of the planning for disaster-prevention policy, I have to honestly say that I do not see an awful lot there.

Akiyama went on to state that disaster-prevention policy should be regarded as an issue for society as a whole; better outcomes would be unachievable, he contended, if it were left as a matter to be settled within the bureaucracy. He then continued,

> What we need to do is to concentrate the people's intelligence and power in a truly comprehensive way and get both the bureaucracy and the people genuinely committed as one nation to devising a disaster-prevention policy and a disaster-prevention system. The thing is, we cannot achieve this by just assembling a lot of mayors and such together to talk things over and then patting ourselves on the back. We really need to get people with learning and experience from the community, along with ordinary people representing the local community, involved in the organization.

If this was not achieved, he said, voices of doubt would always be raised against a disaster-prevention plan drafted top-down from within the bureaucracy.

Akiyama had raised similar concerns on a separate occasion the previous day (October 30, 1961):

> What it boils down to is this. What we need in the text is a thoroughgoing [bottom-up] flow of information from the prefectures and local communities, working on their own behalf, to the Diet and the administration. And going the other way around, there needs to be a top-down link for the active cooperation of the community. If we do not have that, all we are going to end up with is a piece of paper — a plan made by paper-pushers.

However, the Act, as we have seen, contained no provisions allowing non-governmental actors (i.e., society) to become involved in disaster prevention. Currently, especially since the Kōbe Earthquake, the limits of the governmental approach to disaster prevention have become clear, as we can see in the ongoing debate over who should be responsible for rescue and assistance in a disaster: public bodies, mutual cooperative aid in the community, or individual self-help. The question of

what role the community should play in disaster prevention has now become an issue of concern, but the Disaster Countermeasures Basic Act betrayed no sign of awareness of this issue when it was passed.

2.4. The 1961 Disaster Countermeasures Basic Act as the foundation of postwar Japan's disaster-prevention system

After the 1959 Isewan Typhoon and the Chile Tsunami of 1960, a fortunate 35-year period passed without any major hazard until the Kōbe Earthquake of 1995. Disaster-prevention policy evolved steadily during this time. In the 15 years between 1963 and the passage of the Earthquake Special Measures Law in 1978, budgetary allocations for disaster prevention and related areas increased nearly tenfold, from 198 billion yen to 1.8594 trillion yen. This increase in the disaster-prevention budget, while par for the course, does indicate that a governmental disaster-prevention system was being put in place.

The composition of the disaster-prevention budget also saw great change. In the late 1960s, post-disaster reconstruction expenses exceeded 30% of the total disaster-prevention budget, reaching 41.5% in fiscal year 1968; however, in the 1970s, the proportion of the budget devoted to reconstruction — though the outlay varied from year to year depending on the frequency of disaster occurrences — slipped below 20%. The highest levels of reconstruction funding until the Tōhoku Earthquake and Tsunami were in fiscal years 1980 and 1982, at 20.9%, but the proportion was under 10% during most fiscal years. While the disaster-prevention budget saw sustained and substantial increases up to the first decade of the new millennium, the post-disaster reconstruction budget continued to decline as a proportion of the total. Allocations for disaster prevention and national land conservation, however, increased in both absolute and proportional terms. This means that spending on potential disasters went up, while spending on post-disaster reconstruction decreased. This trend can be attributed to the fact that, as mentioned above, there were no major disasters in this period.

3. The Large-Scale Earthquake Countermeasures Law as a classic example and changes in disaster prevention since its passage

The Large-Scale Earthquake Countermeasures Law (the Earthquake Act for short) was passed in 1978, with the Tōkai earthquake still fresh in people's memory. This piece of legislation heralded major changes in the system based on the Disaster Countermeasures Basic Act, ranging from precautionary measures to emergency response. In this sense, the Earthquake Act marks a major milestone in postwar Japanese disaster-prevention policy.

After the passage of the Disaster Countermeasures Basic Act established the foundation of Japan's disaster-prevention system, general policy was developed not only for post-disaster reconstruction but also for disaster prevention and national land conservation, helping to create a society strongly resistant to disasters. However, the Disaster Countermeasures Basic Act was

centered on emergency response, and its policy provisions for disaster prevention and post-disaster recovery were inadequate. Nevertheless, although no major disaster resulting in over 1,000 casualties, like the Isewan Typhoon, took place for several decades after 1959, the policy already in force was broadened to include emergency response and post-disaster reconstruction.

In tandem with this development, the hazards hypothesized in disaster prevention expanded from typhoons and flooding to include earthquakes. However, compared with typhoons and flooding, earthquakes are relatively difficult to respond to. They occur infrequently and unpredictably, but they are devastating over large areas when they do happen. If earthquake prediction could only be improved, earthquakes would become much easier to manage and fatalities would also be reduced. The Earthquake Act reflected this approach both by expanding the government's disaster-prevention policy and focusing on better earthquake prediction through the development of improved seismology. The Earthquake Act would have been unthinkable without advances in the science of earthquake prediction. Therefore, at this point we should take a brief look at the history of earthquake prediction (see Takemura, 2010, and Yamaoka's homepage).

3.1. The passage of the Earthquake Act: the history of earthquake prediction and the development of the Act

The history of seismology in Japan began with the foundation of the Seismological Society of Japan in 1880 after a medium-sized earthquake in Yokohama. On October 28 of the following year, the major inland Mino-Owari Earthquake (M 8.0) occurred. In response, the Ministry of Education created an Earthquake Prevention Survey Group in 1892. The first task that the Seismological Society faced was to determine whether predicting earthquakes was possible; this was a basic issue for earthquake research from its inception.

The extent to which research could make a contribution in the field of earthquake prediction remained a constantly present issue for seismology. This was true of the debate between seismologists Fusakichi Omori and Akitsune Imamura regarding the 1905 Kantō Earthquake and still more so after the Great Kantō Earthquake of 1923. Tokyo University's Earthquake Research Institute was subsequently established with the mission of "conducting research on earthquakes and earthquake damage prevention through a scientific basis."

Although it was forced to suspend its activities during World War II, seismology in Japan recovered after the war and received a major boost in 1961 with the publication of *Prediction of Earthquakes: Progress to Date* (popularly known as "the Blueprint"). This was a seismological research plan produced under the aegis of the specialists Chūji Tsuboi, Kiyoo Wadachi, and Takahiro Hagiwara, emphasizing the necessity of research in earthquake prediction and outlining an agenda to achieve it. The study concluded,

> Right now, there is no answer to the question of when earthquake prediction will become

> truly practicable, issuing warnings on a par with weather forecasts. However, if work on all the ideas outlined in this plan were started today, it should be possible [for seismologists] to answer this question 10 years from now with tolerable credibility.

The paper did not imply that earthquake prediction would become a reality in the next 10 years; rather, it suggested that it could be possible within the next decade to predict when earthquake prediction would become viable. The Ministry of Education endorsed the effort, and the minister recommended support for further research on earthquake prediction at an official panel of inquiry on geodesy in 1964. This, in turn, brought the Japan Science Council on board. The Council approved the funding of 200 million yen for an earthquake-prediction research program in 1965. The program continued until 1998, when it was wrapped up during its seventh five-year period.

The Tokachi-oki Earthquake (M 7.9) — which took place off Hokkaidō in 1968, three years after the initiation of earthquake-prediction research — bolstered arguments for the fledgling discipline's urgency. The Cabinet voted in favor of advancing earthquake prediction to the stage of practical application, and the research program's second-term plan was launched in 1969. From this point onward, the phrase "earthquake-prediction research plan" was shortened to "earthquake-prediction plan," implying that the discipline had moved from a purely theoretical basis toward practical application. In the same year, the head of the Geographical Survey Institute, acting on an independent budget, instituted the Coordinating Committee for Earthquake Prediction (CCEP). This body designated areas that were likely to experience earthquakes and conducted intensive investigations in those areas. In December 1969, the CCEP designated the Tōkai region as an "area of special observation"; in February 1970, it designated southern Kantō as an "area of intensified observation" and identified eastern Hokkaidō and six other locations as additional areas of special observation.

The year 1976, which saw the publication of earthquake predictions for Suruga Bay in Shizuoka Prefecture, proved to be a watershed year for earthquake prediction research and planning. Mogi, a seismologist, stated, "There had been predictions since 1969 that an earthquake was possible in the Tōkai region" (Mogi, 1998: 13); however, at a seismology conference in fall 1976, seismologist Katsuhiko Ishibashi publicly advocated the Suruga Bay earthquake scenario, setting off a media firestorm regarding the risk of an earthquake in the Tōkai region and causing considerable public panic.

The administrative system for earthquake prediction underwent major changes after the public release of the Suruga Bay earthquake hypothesis. In December 1976, the government panel of inquiry on geodesy, acting on a proposal for reconsideration of earthquake prediction planning, set up the Headquarters for Earthquake Research Promotion as a body directly answerable to the Cabinet. In 1977, the CCEP established the Tōkai Regional Adjudication Committee to estimate the likelihood of an earthquake occurring in the Tōkai region. Subsequent developments in the Tōkai

region reflected a major push toward setting up an earthquake-prediction system; among other measures, intensified monitoring by means of a continuous, real-time system was instituted, and monitoring organizations were strengthened. This initiative was crystallized in legislative form by the Earthquake Act.

Following the enactment of the Earthquake Act, the authorities in charge of disaster prevention exhibited a strong concern for ascertaining the timing of the next Tōkai earthquake. As evidenced in the section of the "1986 White Paper on Earthquake Prevention" (1986 Disaster-Prevention White Paper, May 1986.5: 69) entitled "The Next Tōkai Earthquake Could Happen Anytime," awareness of this issue was steadily growing in administrative circles.

The National Land Agency's Disaster-Prevention Bureau further stated,

> Taking these trends into consideration and as a result of the establishment of a focused observation system for the Tōkai Earthquake by the relevant organizations and bodies, including the universities, it is possible, by collating observation data and other information on this region, to perceive advance warning signs of the occurrence of a large-scale earthquake in this region. Through this information, it has become possible to predict the occurrence of such an earthquake (between a few hours and two to three days beforehand in general). Thus, in a case wherein such a prediction is to be issued, disaster-prevention-related organizations and bodies are now required to decide on communication systems and other necessary measures required to broadcast such a warning" (Disaster-Prevention Bureau, National Land Agency, 1986: 554).

3.2. The passage of the Large-Scale Earthquake Countermeasures Law (the Earthquake Act)

Against this background, the Diet enacted the Large-Scale Earthquake Countermeasures Law (the Earthquake Act) on June 7, 1978; it took effect on December 14 of the same year.

Regarding the Act, the government stated,

> The Earthquake Act is a piece of legislative planning with the aim of deploying earthquake prediction, for the first time in the world, in just-in-time disaster prevention. The intention of the bill is to make simultaneous, widespread earthquake disaster-prevention practice a reality through [issuing] warnings based on predictive information. The Act puts in place an advance disaster-prevention system in preparation for [disaster] predictions [that may be issued] immediately before an earthquake" (1981 Disaster-Prevention White Paper: 74).

For large-scale earthquakes, the disaster-prevention policy, in rather bureaucratic language, aimed to achieve the following:

> … strengthen observational surveying for the purpose of earthquake prediction and — while endeavoring to grasp the predicative phenomena immediately before [an earthquake] — establish an earthquake disaster-prevention plan governing, in advance, the response measures required in the event of warnings being issued. These steps are to be taken after it has been recognized that [the] occurrence [of an earthquake] may be imminent; therefore, a comprehensive earthquake disaster-prevention policy is devised in such a way that all endeavors shall be taken to avoid disorder and minimize damage" (ibid.: 74).

Today, however, these optimistic expectations regarding the potential of earthquake prediction are shared by few, as is approbation for the Act.

The Act also enshrined the basic thinking about earthquakes in seismology at the time: "If an earthquake is going to occur, we can try to lessen the damage through advance prediction in preparation for its occurrence" (Mogi, 1998: 158). The stance taken with regard to developing earthquake-prediction capacity was quite hopeful: "Even if the short-term prediction of other earthquakes is difficult, the stance of the Earthquake Act is that *advance prediction of the Tōkai Earthquake is achievable with almost complete certainty*" (ibid.: 158).

At the time of the Act's passage, Chubu Electric Power Company's No. 1 Reactor had just come online (two years earlier, in March 1976) at the Hamaoka Nuclear Power Plant in Shizuoka Prefecture. Although the Tōkai Earthquake hypothesis had become a publicly debated issue around the same time, provisions for earthquakes at nuclear power plants were studiously avoided in the text of the Earthquake Act. During parliamentary question time (at a lower-house ad hoc committee on disaster control, on April 12, 1978), in response to Diet member Hisao Ishino's statement that "there isn't anything about nuclear power anywhere at all" in the Act, Kazunori Tanaka, speaking on behalf of the government, answered: "In relation to nuclear power facilities, the Science and Technology Agency and the power company have their own [safety] enhancement plans as part of their ongoing operational programs, and these include the emergency plans that they have laid out." The discussion came to a close at this point.

3.3. The contents of the Earthquake Act

Let us take a closer look at the contents of the Earthquake Act. Its aim was stated as follows:

> In order to protect people's lives, well-being, and property from damage due to a large-scale earthquake, [the Earthquake Act] designates areas of earthquake disaster-prevention policy to be strengthened and stipulates provisions for the establishment of an earthquake observation system and other provisions related thereto, By stipulating provisions for the establishment of emergency earthquake disaster-prevention policy and other related special measures, the Act is intended to strengthen earthquake

> disaster-prevention policy and to thereby be instrumental in the maintenance of social order and in the protection of the public good (Article 1).

The specific provisions of the Act were as follows. (1) The Prime Minister designates areas thought to be at risk of especially large-scale earthquakes as "areas for the strengthening of earthquake disaster-prevention policy" and establishes observation systems there. (2) The Central Disaster Management Council prepares a basic earthquake disaster-prevention policy for each of such areas and promotes its implementation. (3) The local authorities in each of such areas determine a disaster-prevention work plan. (4) Hospitals, railways, companies handling hazardous materials, and other essential operations prepare emergency earthquake disaster-prevention enhancement plans. (5) These plans are to be reviewed and strengthened on a regular basis. (6) Upon being informed of an earthquake prediction, the Prime Minister assembles the Cabinet and issues a warning of earthquake damage. (7) Upon issuing such a warning, the Prime Minister sets up an Earthquake Response Center. (8) After a warning of earthquake damage has been issued, the relevant organizations and bodies that have created earthquake disaster-prevention enhancement plans implement emergency earthquake disaster-prevention measures in accordance with them.

Compared with the Disaster Countermeasures Basic Act, the Earthquake Act represented a departure in its provisions for designating areas for the strengthening of earthquake disaster-prevention policy and enforcing local authorities, hospitals, and other entities to draft disaster-prevention plans in line with the central government's directives. In addition, there were provisions for the Prime Minister to issue a warning of earthquake damage and for local authorities and other related parties in the designated area to take the necessary emergency measures in response.

The key point here is the flow of steps to be followed from the time an earthquake prediction is made to the time a warning of earthquake damage is issued. Up to this point, disaster-prevention policy had focused on responding after a hazard had occurred, and there was very little emphasis on precautionary measures to be taken before an earthquake happened.

In line with the Act, the Tōkai region, an area thought to be at risk of a large-scale earthquake, was designated as an "area for the strengthening of earthquake-disaster prevention policy." In addition, special government funds were allocated to designated areas to further develop their disaster-prevention plans. Additional areas such as the region from Shizuoka Prefecture to western Kanagawa Prefecture were designated. Acting on strongly worded appeals from these areas, in 1980, the government passed the Act on Special Governmental Financial Measures with Regard to Emergency Earthquake Operational Measures in Areas Designated for the Strengthening of Earthquake-Disaster Prevention Policy. This Act stated that it was

> … intended to develop earthquake disaster-prevention measures in areas designated for the

> strengthening of earthquake-disaster prevention policy; in order to do so, this Act stipulates the special financial measures to be taken [to apportion] the financial burden to be undertaken by the State and the proportion of costs to be covered (including exceptions, special cases, and other matters) in relation to the expenses incurred by local authorities and other relevant bodies in implementing emergency earthquake operational measures (Article 1).

Earthquake policy for the Tōkai region was carried out with this financial assistance from the state.

3.4. Official warning announcements

The most important aspect of this law was the process for issuing official warning announcements. Once an official warning announcement was issued, the series of actions to follow had already been put in place.

The premise underlying the official warning announcement system was that an observation system was already functioning (on a 24-hour basis) and being strengthened in the designated areas. Adjudication-panel committee meetings would have to be held to evaluate the information gleaned from the observation data and to decide whether the data indeed indicated a risk of a large-scale earthquake. In the Tōkai region, this had been the work of the CCEP's local organization. However, after the passage of the Earthquake Act, the Tōkai region was designated an area for the strengthening of earthquake disaster-prevention policy in August 1979. In line with this decision, the duties involved were assumed by the Adjudication Committee for Areas Designated for the Strengthening of Earthquake Disaster-Prevention Policy; this committee answered directly to the director of the Japanese Meteorological Agency.

Under this Act, upon inferring that a large-scale earthquake may take place, the Committee was to immediately inform the director of the Japanese Meteorological Agency, who, in turn, would inform the Prime Minister. The Prime Minister would then assemble the Cabinet and issue an official warning announcement as prescribed in the legislation.

3.5. The disaster-prevention system put in place by the Earthquake Act and a disaster-prevention policy predicated on earthquake prediction

Thus, a disaster-prevention system was further put in place with

> … a basic earthquake disaster-prevention policy based on the Earthquake Act and [the provisions of] the Tōkai Earthquake area for the strengthening of earthquake-disaster prevention policy; predicated on earthquake prediction, this policy was constructed to deal with (especially in the Tōkai region) a magnitude 8-class earthquake known as the Tōkai

> Earthquake (Fiscal 1997 White Paper: 80).

It should be pointed out here that the Earthquake Act did not address only the Tōkai Earthquake:

> At present, policy measures based on the Act on Special Measures [i.e., the Earthquake Act] are directed toward the Tōkai Earthquake, which is both of the greatest concern and possible to predict. However, the legislation is thought to be of a nature that will, in the future, allow it to be progressively applied to other earthquakes in succession as they too become possible to predict. In this sense, the set of countermeasures set in place by the Act and related legislation can be considered as policy on predictable earthquakes in [all of] Japan (National Land Agency, 1986: 545).

Let us here, then, take a brief look at earthquake prediction. "The three questions of *when*, *where***,** and *on what scale* an earthquake will occur are called the 'three component parts' of earthquake prediction; it is necessary to have an accurate working knowledge of them before an earthquake takes place" (Earthquake Prediction Investigation Committee of the Seismological Society of Japan, 2007: 20). Earthquake prediction is further divided into long-, medium-, and short-term (immediately antecedent) prediction. Long-term prediction focuses on a timescale of hundreds of years to decades before occurrence, making statistical forecasts based on records of past earthquakes; medium-term prediction covers timescales from decades to a few months, making forecasts using current observational data and physical models to perform simulations; and short-term prediction covers timescales from months to hours before occurrence, and "forecasting" is explained as being "based on premonitory phenomena" (ibid.: 24). The ultimate goal of earthquake prediction is this kind of short-term prediction.

Carrying out earthquake prediction, then, is the necessary *fons et origo* of all policy and countermeasures against predictable earthquakes. The Earthquake Act's provisions on the Tōkai Earthquake are based on the premise that short-term prediction is possible, going so far as to detail the *procedure* for issuing official warnings. However, short-term prediction is not the only important thing for undertaking disaster-prevention countermeasures. Long-term prediction is developed by setting up hypothetical earthquakes, estimating the damage under the set conditions, and developing disaster-prevention plans to forestall such damage. This approach has become widely adopted since the Earthquake Act was enacted. Hypothetical damage estimates and disaster-prevention planning have therefore started becoming interlocked since the Earthquake Act was passed. In Shizuoka Prefecture — an area designated for the strengthening of earthquake-disaster prevention policy in the Earthquake Act — the first hypothetical damage estimate was made in 1978, followed by three others in 1993, 2001, and 2013, all of which led to modifications to the regional disaster-prevention

plan (Ino and Ikeda, 2001). The first hypothetical damage estimate was undertaken for the South Kantō region (in and around Tokyo), as detailed in the *Research on Countermeasures against Major Earthquakes, March 1962*, jointly authored by the Security Section of the Police Department and the Eastern General Inspectorate of the Ground Self Defense Forces. Subsequently, the findings of a Fire Department commission of enquiry were released in March 1970 as the *Report on Countermeasures against a Major Earthquake and Conflagration in the Tokyo Region*. With regard to policy on earthquakes exclusively, after the 1964 Niigata Earthquake, an independent Earthquake Panel was set up in the Tokyo Metropolitan Administration's Central Disaster Management Council in July 1964 and started operations on earthquake countermeasures. However, hypothetical damage estimates were only publicly released from June 1978 with the publication of the first estimates by the city ward. In 1985, damage estimates were released only for the Tama area. The publication of hypothetical damage estimates for the entire metropolitan area was not released until September 1991 (Kumagai, 1999: 46-47).

3.6. Events since the Earthquake Act enactment

A succession of disaster-prevention laws based on and similar to the Earthquake Act have been enacted since it was passed.

The Special Measure Law on Earthquake Disaster Prevention was enacted in 1995. Taking the lessons learned from the Kōbe Earthquake into account, the law is designed to respond to earthquakes wherever they may happen in the country. Based on this law, a five-year earthquake disaster-prevention emergency operations plan was created for implementation at the prefectural level, furthering the installation of earthquake disaster-prevention facilities etc. Starting in 1996, the plans reached full term in 2001, with 2006 marking the beginning of the third term of the project's development of earthquake disaster-prevention policy and countermeasures. The 29 types of facilities covered in the law include evacuation sites, evacuation routes, and firefighting facilities. Increases in the proportion of costs met by subsidies from the central government are stipulated for 9 types of facilities in particular, including firefighting facilities and earthquake proofing for public elementary and junior high schools.

In 2002, legislation was enacted to forward earthquake disaster-prevention policy and measures for the Tōnankai and Nankai earthquakes. The legislation (1) designated earthquake disaster-prevention enhancement zones for the projected Tōnankai and Nankai areas, (2) created basic Tōnankai and Nankai earthquake disaster-prevention plans etc. for designated areas, (3) put in place earthquake observation facilities etc., and (4) stipulated special measures on emergency earthquake disaster-prevention facilities etc. requiring installation/construction.

In 2004, legislation was passed covering earthquake disaster-prevention measures for a possible ocean-trench earthquake in and around the Japan Trench and Kurile Island Trench. This legislation stipulated the same range of measures (1) to (4) above passed for Tōnankai and Nankai.

As seen from the above, in the context of the expansion of disaster-prevention policy, the Earthquake Act constituted a high point after the enactment of the Disaster Countermeasures Basic Act in 1961. This was because of its superiority compared with previous legislation. First, it enhanced the Disaster Countermeasures Basic Act, which had focused on emergency response, by progressing toward disaster prevention and lengthening the disaster phase. Second, the Earthquake Act expanded disaster-prevention policy, which had hitherto focused on water-related damage, to include policy for large-scale earthquake hazard (although the text of the document does not state this explicitly). Third, compared with the three pieces of similar legislation passed after it, the Act explicitly positioned the possibility of short-term earthquake prediction as the premise underlying the development of earthquake disaster-prevention policy, laying down explicit regulations on official warning announcements. As we have already seen, the legislation covering large-scale earthquake damage that was passed after the Earthquake Act contained no provisions for earthquake prediction or official warning announcements; they had disappeared from the legal text. This point aside, what they did have in common with the Earthquake Act was an earthquake disaster-prevention policy framework for the designation of areas for policy-strengthening (development), the creation of disaster-prevention plans for the designated areas, the strengthening of earthquake observation systems, and the expansion of preventative measures. In these three senses, the Earthquake Act can be said to constitute a "high point" in postwar disaster-prevention policy.

4. The postwar disaster-prevention paradigm: drawing together a paradigm from the arguments above

Next, through our discussion of the special characteristics of the Earthquake Act, a picture is sketched of the fundamental paradigm governing postwar Japan's disaster-prevention policy. The word "paradigm" is used here in the sense given to it by the science historian Thomas Kuhn in his 1962 work *The Structure of Scientific Revolutions* (T.S. Kuhn, 1962). In its current sense, it refers to "the [prevailing] outlook on the dominant concepts of the age, and the common conceptual framework of the time" (as defined in the authoritative Japanese-language dictionary *Kōjien*). Here, we use "paradigm" in its sense as a commonly held fundamental policy-related and conceptual framework.

The fundamental framework for Japanese disaster policy was set in place by the Disaster Countermeasures Basic Act of 1961, reaching its apex in the Earthquake Act of 1978. It was subsequently further expanded, as this paper has explained.

From the standpoint of this approach, one of the founding pillars of the postwar disaster-prevention paradigm is the basic principle underlying the Disaster Countermeasures Basic Act's stipulation that disaster-prevention is to be developed with the central administration playing the dominant role. In the context of Japan's top-down administrative system, this simultaneously meant that disaster-prevention policy was to be developed on an authoritarian basis.

The second founding pillar is the Earthquake Act's more explicitly specific range of disaster countermeasures, founded on the planned nature of the countermeasures stipulated in the Disaster Countermeasures Basic Act. The countermeasures are more specific because the policy is predicated on disaster-prevention plans based on hypothetical damage estimates derived from earthquake simulations. For example, in the case of tsunami countermeasures, the Central Disaster Management Council states,

> Policy has become more developed than before; when earthquake and tsunami countermeasures are put together at the Central Disaster Management Council, we [now] make simulations of a given earthquake's movements and tsunami first, and then, based on that, we make a hypothetical damage estimate. Drawing on this data, we finally make an overall earthquake plan, including the essentials of any required earthquake disaster-prevention strategies, emergency response measures, etc. This plan brings together all of the disaster-prevention measures that the national government should carry out (Central Disaster Management Council, 2011b: 12).

The very first requirement for putting together this kind of disaster-prevention plan is to estimate the scale of the hazard. It is also necessary to ask when, where, and on what scale the hazard will occur, and it is important to do so on a scientific basis. It has become the norm to expect that science can give definite answers to these questions; indeed, the administration requires this to be the case to develop its own disaster-prevention policy.

Let us label this way of thinking (or this faith in science) as "scientism." In general, according to Kazuyoshi Abiko, we can understand scientism as "basically, a term criticizing the situation wherein a defined form of 'knowledge' is comprehended as 'science' and wherein, with this understanding as the premise, this form of 'knowledge' is applied beyond the realm of 'science' itself" (Abiko Kazuyoshi, 1998: 224). Scientism is primarily based on the idea that science is potentially omniscient and omnipotent, such that "even if we think something is impossible to do today, as science progresses, it will become doable in the future" (ibid.: 224). Moreover, transcending the boundaries of science as a discipline, scientism includes the idea that "the scientific method of knowledge and the findings of science can be applied to any and every area of society" and that, as a result, "basically, all problems can be solved through scientific means" (ibid.: 224).

Applying this to earthquake damage yields the point of view that "earthquake prediction will become possible in the future," along with the conviction that the damage suffered by society as a whole can definitely be lessened by means of scientific expertise on earthquakes. The idea that earthquake prediction is possible lies at the core of the Earthquake Act of 1978. The conviction that damage to society can be ameliorated through the application of scientific expertise underlies today's hypothetical disaster estimates and disaster-prevention planning, with their basis in scientism in its

current form.

In fact, when the Act was passed, this kind of faith in science or its future progress led people to surmise that it might be possible to render earthquakes harmless in the future:

> In the past, a large-scale earthquake used to be considered as an act of providence *par excellence* — a catastrophe brought about by nature itself releasing a colossal energy; now, wielding a form of "divination" made possible by science, it seems that human society is on the verge of bringing even this event within the range of human control. Could it not be that we are living at the dawn of a new scientific era wherein major earthquakes could be rendered harmless? It could be that this new age, wherein the natural event of large-scale earthquakes would no longer pose a mortal threat to society, is already close at hand. The [idea of] transition toward this age is supported by the general public's deep faith in science (Hirose, 1986: 212).

Today, earthquake prediction is not thought of as being so easily achievable; however, the fundamental approach of predicting hazard scientifically and developing disaster-prevention policy on this basis remains unchanged.

Summing up Japan's postwar disaster-prevention paradigm, we can first conclude that its first pillar consists of a top-down approach and an authoritarian system. Its second pillar is built on scientism, with the resultant formulation of plans based on simulations and estimates. The two pillars are mutually supportive. The authoritarian centrism of the first pillar bred the public-service character of the bureaucracy in its handling of disaster prevention. The bureaucracy's public-service character, formulated in the context of a political administration, was legitimized by the scientism that constitutes the paradigm's second pillar.

Seismology's confidence in the possibility of earthquake prediction was, in fact, not clearly expressed during the parliamentary debates. The seismologists called to testify at the discussions on the Earthquake Act did not assert that they could definitely predict the Tōkai Earthquake accurately. Choosing their words very carefully, they answered along the following lines:

> For this kind of large-scale earthquake, it is thought that if the current observational network is proactively enhanced to some extent, then there is a substantial possibility that the premonitory phenomena can be grasped and short-term prediction can be achieved (Seismologist Kiyoo Mogi, speaking as chair of a lower-house ad hoc committee on disaster control on October 19, 1978).

Another seismologist testified in a similar manner:

> In the event that a large-scale earthquake of the Magnitude-8 class occurs in an area designated for enhanced observation, I think that there is a good chance of the premonitory phenomena being observed quite clearly. However, that is not to say that a large-scale earthquake is definitely bound to happen if any major anomalies appear in the observations — there is ample possibility for us to be wide of the mark. Earthquake prediction is basically all about probabilities; it really is not as though one can simply decide — yes or no — as to whether a large-scale earthquake is going to happen (Seismologist Utsu Tokuji, speaking on the same occasion).

From the point of view of seismology, the science of earthquake prediction — still in its nascent stages — was being pressed forward toward practical application by the bureaucracy, acting in its character as a public service. In this way, authoritarian centralism and scientism worked together to mutually complement and promote each other.

Figure 1 visualizes the points above. As shown in the diagram, postwar Japan's disaster-prevention paradigm is a centralized, authoritarian system; constructed on this pillar, along with scientism and the simulation/estimate approach, it bore the weight of public expectations that disaster could be "subjugated."

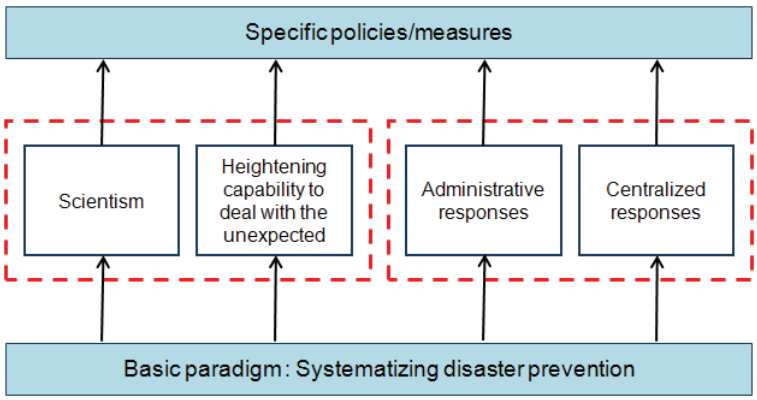

Fig.1. The disaster-prevention paradigm

These expectations were expressed candidly in relation to earthquake prediction. For example, during the 1978 ad hoc committee discussing the bill for the Earthquake Act (House of Representatives/Japan Science and Technology Corporation Ad Hoc Committee on Countermeasures, October 13, 1978), the Diet member Haramo addressed the meeting as follows:

> On the basis of [data from] our country's current observation system, assistant [seismologist] Ishibashi [Katsuhiko] has strongly emphasized that a Magnitude-8 class earthquake could easily occur today in the area of Suruga Bay. At any rate, there could be a [seismological] surprise attack; it could, indeed, be inevitable …. Earthquake prediction

> [must work] on the principle of avoiding damage before it happens if we want to respect human life and wish to lessen the [potential] damage, if only by a little degree. [There is no point in] thinking about it as someone else's responsibility and [idly] asking [things like], "Maybe I'm jumping the gun a bit here, but how long will this danger last? At the earliest, when and to what extent, more or less, will this danger be?" It is an earthquake after all, so in this job of prediction, I think it is really vital to adopt the stance of going one step back [to check earthquake history etc.] and two steps forward [to formulate and stand by one's forecasts].

Acting in response to this kind of expectation, a Committee member representing the government (the witness Suehiro) pressed ahead beyond the seismologists, explaining as follows (at the lower-house ad hoc committee on disaster control on April 18, 1978):

> Working on the historical facts and on observations from the Meiji period [1868-1912] onward, I have been able to establish that the next [earthquake] will be in the Tōkai region. So, I want to focus only on the prediction of this Magnitude-8 earthquake and combine prediction with disaster prevention.

Suehiro went on to state that because the observation system in the Tōkai region had been developed accordingly, "It is [now] possible to predict a large-scale earthquake, if only in the Tōkai region … for the Tōkai area at least, I would judge that we have reached the stage where disaster prediction can be combined with disaster prevention."

The 1995 Kōbe (Great Hanshin) Earthquake was the biggest disaster to strike Japan after the passage of the Disaster Countermeasures Basic Act. As such, a train of events following this earthquake spurred a critical rethink of disaster-management policy up to that point.

The first major issue that the Kōbe Earthquake raised was the limits of the administration's capability to respond to such an event. Yoshio Kumagai, for example, points out, "The Great Hanshin Earthquake exposed the limits of the administration's response" (Yoshio Kumagai, 1999: 45). Many other commentators have made similar arguments. Criticism has been directed, in particular, at the slow pace of initial emergency response immediately after the earthquake and at how the capacity to simultaneously tackle multiple fires was lacking, leading to widespread conflagration. There is also the point that over 80% of people pulled from collapsed buildings were rescued by civilians rather than the local administration, firefighters, or the Self Defense Force. Following the Kōbe Earthquake, as the administration's limitations in terms of disaster-prevention policy became apparent, discussion really took off on the relative roles of rescue and assistance by public bodies during disasters versus mutual cooperative aid in the community versus individual self-help. The question arising from this discussion is "how the community, volunteer groups, and

businesses can be positioned as the [active] subject of disaster prevention" (Kazama, 1998: 21). The print media also picked up on the emerging trend of increasing emphasis on individual self-help and the proliferation of local disaster-prevention regulations:

> An increasing number of local authorities are preparing regulations in preparation for disasters with set roles allocated to the community, businesses, and the local administration. All of these plans emphasize "individual self-help" and "mutual cooperative aid in the community" — the idea that people should first take care of themselves and the community they live in. While local administration has the obligation of providing "rescue and assistance by public bodies in time of disaster," what stands out in these new regulations is how they impose a broad range of obligations on the community and its residents (*Asahi Shimbun*, February 4, 2007).

Another point of controversy that should not be forgotten — though it did not attract as much attention as the issues above — was the low hypothetical damage estimations. Yoshio Kumagai criticized this practice too, stating that while the earthquake's strongest seismic intensity is, in fact, 7.0, "Kōbe City, which suffered egregious damage due to the Great Hanshin Earthquake, was operating under an area disaster-prevention plan that predicted seismic intensity in the upper 5.0 range" (Yoshio Kumagai, 1999: 54). Furthermore, Kumagai stated, "The Great Hanshin Earthquake produced wave after wave of earthquake damage that was unprecedented in nature …. The Great Hanshin Earthquake therefore made the revision of the simulation/estimate approach inevitable" (ibid: 54).

> One approach to diagnosing the cause of the major damage inflicted by the [Kōbe] earthquake this time around is ascribing it completely to the severity of the quake as a natural phenomenon, aptly explaining that '**the unforeseen happened**.' However, this is a one-sided view, as we can easily see by comparing Kōbe with the outcome of the Los Angeles [Northridge] earthquake that occurred a year before it. Even though both were near-field earthquakes of the same scale, fatalities in Los Angeles were held down to about 60, with about 10,000 buildings damaged; by contrast, fatalities reached roughly 6,000 in the Kōbe Earthquake, with about 200,000 buildings damaged. This clearly demonstrates that the damage cannot be simply explained in terms of the scale of the earthquake (Murosaki, 1996: 55).

These points did not receive the careful consideration they deserved.

With the Kōbe Earthquake as the case of reference, the Disaster Countermeasures Basic Act was extensively revised for the first time since its enactment. The main revisions were as follows:

(1) establishing an emergency disaster control headquarters under the central government, (2) strengthening the powers of the head of the emergency disaster control headquarters, (3) establishing a locally based disaster-control headquarters, and (4) granting SDF members powers to engage in rescue operations. Most of the provisions functioned to enhance the disaster-response capabilities of the central government and the SDF, but there were also amendments to provisions on local authorities providing mutual aid and making mutual assistance agreements (Agatsuma, 2007). Furthermore, an increasing number of disaster-prevention issues were brought within the mutual purview of central and local government. Explicit statements were included about provisions in areas such as the promotion of independent disaster-prevention organizations and the creation of an appropriate environment for volunteer disaster-prevention activities, along with the encouragement of other community-led disaster-prevention activities. There were also measures related to disaster prevention for the vulnerable, such as the elderly, those with special needs, and the very young. Again, we see here that there was no change to the fundamental top-down structure of disaster-prevention policy governing the Disaster Countermeasures Basic Act up to that point; independent disaster-prevention organizations and volunteer groups are to be "promoted" by the government. The revisions to the law mainly concerned the role of the state and the local government organizations.

There were, however, a few revisions on the question of the community's obligations. Specifically, while the original wording on "the responsibilities of community residents etc." merely stipulated that local residents "must endeavor to contribute to the disaster-prevention activities of local government and other local public organizations," this provision was expanded to "the residents of local public bodies, who, while taking steps to prepare for disasters themselves, must endeavor to contribute to disaster prevention by participating in voluntary disaster-prevention activities etc." It would appear that phrases such as "independent disaster-prevention organization," "volunteer[s]," and "independent disaster-prevention activities" demonstrate the influence of the debate on rescue and assistance by public bodies during disasters versus mutual cooperative aid in the community versus individual self-help. However, as before, there is no change to the fundamental principle that disaster-prevention policy is to be developed in a top-down manner.

I have further recast Ben Wisner's formulation (Ben Wisner et al., 2004) of hazard × vulnerability = damage (Tanaka, 2013: 279) to ask what form of social response takes place vis-à-vis the regional occurrence of hazard. I have also characterized damage as the outcome of this response. In this context, the "regional" aspect of hazard can be divided into (1) environmental conditions from the social viewpoint, including topography and ground conditions, and (2) the social structure.

About half a century separates the passage of the 1961 Disaster Countermeasures Basic Act and the Tōhoku Earthquake and Tsunami of 2011. Japanese society's environment and structure both underwent major changes during this period. However, the disaster-prevention policy constructed around the Disaster Countermeasures Basic Act does not adequately incorporate this half-century of

social change. This indirectly shows that the Disaster Countermeasures Basic Act was created with a top-down approach at its core and the social dimension was not given enough thought.

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Spatial Restructuring of Shrimp and Fish Supply Chains in Post-tsunami Aceh Province

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1. Introduction

Indonesia, specifically Aceh Province, experienced significant damage due to the Indian Ocean earthquake and tsunami on 26 December 2004. Recovery efforts in Aceh Province extended over several years. Rebuilding the economic structure of this area is of fundamental concern. Managing post-tsunami community rehabilitation and empowerment in Aceh Province requires focus in two areas: first, regional reconstruction of productive sectors and infrastructure; and second, rebuilding supply chains to encourage the expansion of wider economic spaces. This approach facilitates an understanding of the rehabilitation mechanism. This study will discuss post-disaster economic reconstruction in Aceh Province, focusing on shrimp and fish farming systems. Particularly, attention will be paid to conditions in the two regions most heavily affected by the tsunami: Banda Aceh and Aceh Besar. First, I will discuss the features of the current shrimp and fish supply chains. Second, I will evaluate supply chain construction, focusing on spatial arrangement.

The investigation includes 7 aquaculture ponds and 2 hatcheries (seed production centers) from Aceh Province, and local markets in Banda Aceh. Data collection was conducted during 10-13 July 2012, 15 January 2014, 11-16 January 2015, and 27-30 July 2015 using field observation. This paper is organized as follows. Section 2 describes the structural features of shrimp and fish supply chains in Aceh Province; section 3 considers the spatial restructuring of these supply chains before and after the 2004 tsunami; section 4 discusses the social and political context of supply chain rehabilitation in Aceh Province. The final section provides recommendations for further research.

2. Shrimp and fish supply chains in Aceh province

2.1. Shrimp and fish farming in Aceh Province

Shrimp and fish farming is one of the largest industries in Aceh Province. According to Food and Agriculture Organization estimate, approximately 94,000 people are directly employed in brackish water farms (covering an area of 47,000 ha) and aquaculture supply chains (Padiyar et al. 2006). Shrimp and fish farming in Aceh Province underwent rapid expansion (geographically and economically) from the late 1970s through the 1980s, with production reaching its peak in the mid-1990s. Growth activity was influenced by the development of hatcheries and use of artificial fertilizers. However, disease outbreaks caused by productivist aquaculture (specifically the industrialization of shrimp cultivation) (Indra et al. 2007; Zainun et al. 2007) resulted in several

ponds being extinguished or replaced. According to Bandan Pusat Statistik (BPS), as at 2010, it was estimated that aquaculture pond areas in Aceh Province totaled 51,519ha, and the number of households engaged in shrimp and fish farming were 22,757.

Aquaculture ponds, generally constructed along the seacoast, did not escape the 2004 tsunami that destroyed dikes, ditch banks, water channels, water-gates, and other structures (UNEP 2007). In addition, the tsunami damaged aquaculture facilities and their related equipment, such as hatcheries[1] and water supply canals. Shrimp and fish ponds in Aceh Province were also lost along the coast – the estimated physical loss is recorded as 20,429 ha (42.9%), primarily in Banda Aceh and Aceh Besar (Phillips and Budhiman 2005). According to UNEP (2007) and Ardiansyah (2007), all the ponds in both Banda Aceh (724.3ha) and Aceh Besar (1,006ha) were destroyed. Domestic and foreign actors (including international and national non-government organizations, as well as UN agencies such as FAO), commenced work to assist in aquaculture rehabilitation (Padiyar et al. 2006). Though most ponds and related facilities have been restored, several ponds have not yet fully recovered.

2.2. Structural features of shrimp and fish supply chains in Aceh Province

The production methods of shrimp and fish farming are divided broadly into three categories: intensive, semi-intensive, and extensive.

Fig. 1. Intensive production of shrimp in Paroy, Aceh Besar

Fig. 2. Semi-intensive production of shrimp in Lampulo, Banda Aceh

The intensive method involves advanced technologies, such as air pumps, paddlewheel aerators, and automatic feeding machines and utilizes an extensive range of chemical inputs, including fertilizers and pesticides to achieve year-round high-density production (Fig. 1; see also Table 1). The intensive method was developed through the industrialization of food production processes (also known as appropriationism[2]) in the shrimp and fish farming industry. The semi-intensive method also uses chemical inputs for shrimp and fish cultivation, albeit with a lower quantity (Fig. 2).

[1] 193 of the 223 shrimp hatcheries in Aceh Province were hit by the tsunami (Phillips and Budhiman 2005).
[2] Appropriationism is the process whereby agribusiness firms remove processes dictated by natural events, and replace them with industrial activities using large-scale, intensive, factory-farming methods (Goodman et al. 1987).

Finally, the extensive method cultivates shrimp and fish through traditional production activities without relying on advanced technologies; rather, it harnesses operations embedded in the natural environment surrounding the production area (Fig. 3). For instance, the water exchange system operates depending on the natural rise and fall of the sea level, with the main shrimp feed originating from the sea. The following describes the structural features of shrimp and fish supply chains in Aceh Province using data from the field survey. Fig. 4 and Table 2 show the study area and their characteristics.

Fig. 3. Extensive production of shrimp in Deah Raya, Banda Aceh

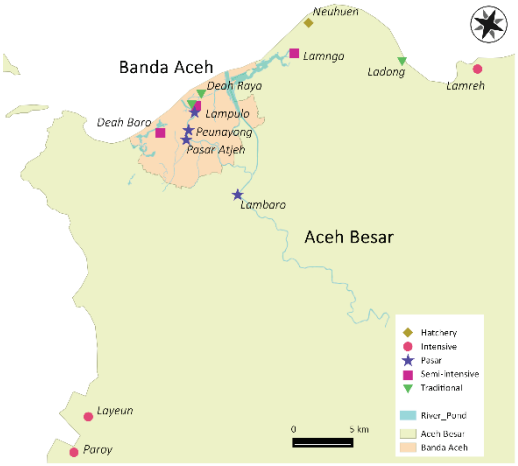

Fig. 4. Outline of the study area

Table 1. Production methods of shrimp (Litopenaeus Vannamei)

	Intensive and super intensive shrimp cultivation	Traditional extensive shrimp cultivation
Input, equipment	Pesticide, CaCO3, aquaculture paddle wheel aerators, automatic feeding machines (Feeding at 6 times per 24 hours), concrete walls	Pesticide, bank
Production density (pieces per square meter)	100-500	1-2
Production cycle (months)	3-4	4-6
Shrimp size (pieces per kg)	40-70	25
Total income (million IDR per a cycle)	1,100-3,000	10-40
Operational cost (million IDR per a cycle)	350-2,100	13

There are only three intensive aquaculture ponds in the study area, and the combined quantity of intensive and semi-intensive production systems operating in Aceh Province is less than 25% of all aquaculture ponds (Zainun et al. 2007; Phillips and Budhiman 2005). Therefore, shrimp and fish farming in Aceh Province are mainly conducted using the extensive method, whereby requirements

for production inputs are low. Most of the ponds located in the study area (Banda Aceh and Aceh Besar) are predominantly small-scale, generating low productivity. These ponds mainly cultivate black tiger shrimp, white leg shrimp, milkfish, tiger fish, and bream. They also achieve simultaneous production of shrimp and fish commodities (polyculture) to reduce the risk of shrimp harvest failure (Zainun et al. 2007). Pond owners usually purchase baby shrimp and fish from hatcheries in Ujung Batee, Krueng Raya, Sigli, Bireuen, and Lhokseumawe. Following a breeding period of 3-4 months, the shrimp and fish are typically sold into local Banda Aceh markets, including destinations such as Lampulo and Peunayong (Fig. 5). By comparison, the intensive farm (Layeun, Paroy and Lamreh) and the extensive farm in Lampulo supply their products to global markets (such as Taiwan and Japan) via the Port of Medan, Indonesia (Fig. 6). From the above, extensive method aquacultures are the dominant shrimp and fish cultivation systems found in the study area. Consequently, the study area focuses on local supply chains (that is, those confined to Aceh Province) that are unsophisticated with simple structures of production and distribution. Intensive production systems connected to complex global commodity chains are rare.

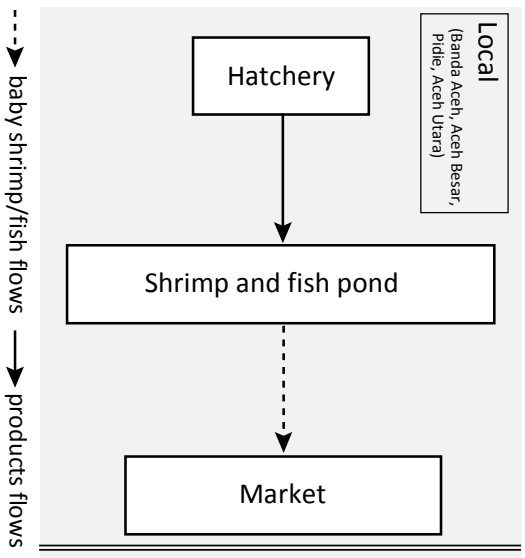

Fig. 5. Shrimp and fish supply chain of the extensive and semi-intensive farming in the study area

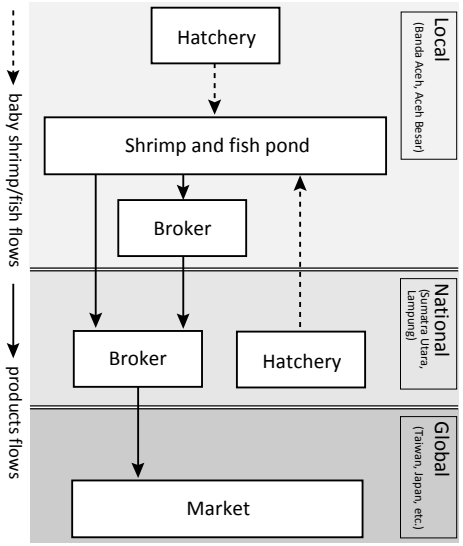

Fig. 6. Shrimp and fish supply chain of the intensive farm in Lamreh, Layeun, and Paroy and the extensive farm in Lampulo

3. Spatial change of shrimp and fish supply chains

Given that the 2004 tsunami damaged the majority of aquaculture ponds in Aceh Province, an important question is: how has the current structure of supply chain activities in the study area been created through the spatial process? This section discusses the spatial change of shrimp and fish supply chains using data from the field survey.

Patterns in spatial alternations of supply chains caused by natural disasters can be divided into four categories (Fig. 7). The first is 'local-local' – this involves reconstruction of supply chains

through utilization of the same local space established prior to disaster. The second is 'local-global' – this covers structural change of supply chains, whereby process elements previously embedded in the local space are extended to a global environment with supports by donor organizations. The third is 'global-global' – this represents reconstruction of supply chains that were globally extended before the disaster. The fourth is 'global-local' – this involves structural change of supply chains operating at a global level before the disaster being transformed to processes with strong local market connections. These categories represent idealistic notions of supply chains and are closely related to each other.

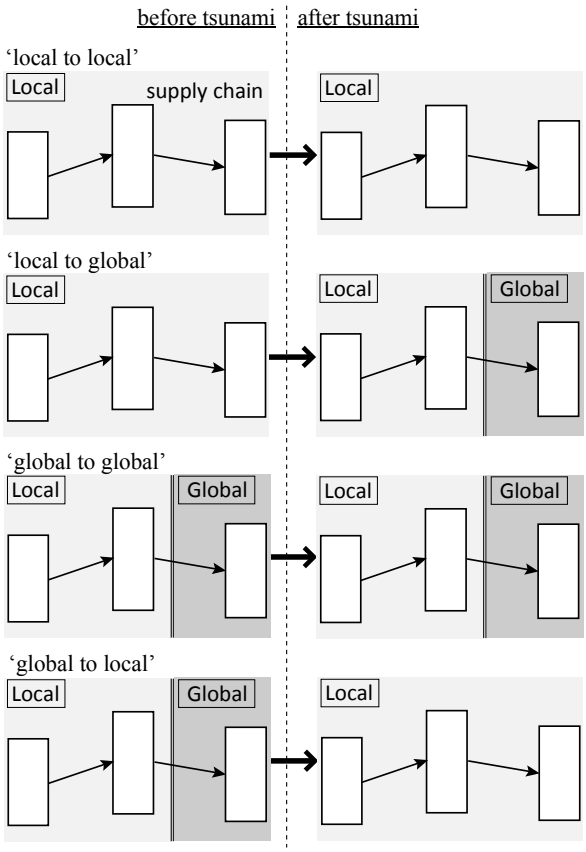

Fig. 7. Patterns in spatial alternations of supply chains caused by natural disasters.

Regarding the spatial structure of, and changes in, shrimp and fish supply chains before and after the tsunami in Aceh Province, the majority were reconstructed through the 'local-local' pattern (this is the expected outcome for supply chains operating under conditions of extensive farming). There is no 'local-global' pattern in the study area. This might indicate that the reconstruction support projects by domestic and international donor organizations were not designed to prioritize expansion of shrimp and fish distribution systems. Rather, reconstruction support projects have been aimed at achieving infrastructure development (such as development of ponds and their related facilities). In terms of 'global-global' patterns, this methodology is typically associated with intensive and some semi-intensive farming. In the intensive farming, the supply chain might have

been reconstructed being disembedded from local community owing to vertical integration of supply chain by Medan-based investor[3]. Regarding 'global-local' patterns, there are two examples where product distribution was shifted from a global market (via the Medan port) to a local market (Banda Aceh). The first is the case of a producer in Lampulo (Banda Aceh). Following an increase in the market demand and prices for shrimp and fish[4], the producer switched distribution after the 2004 tsunami to the local market. The change in market conditions is a result of the influx of donor organizations and tourists (regarded as disaster tourism). The second is the case of a producer in Deah Baro (Banda Aceh). In this instance, product distribution was shifted from a global market to a local market after the tsunami due to decreased productivity.

With reference to the recovery period for shrimp and fish farming in Aceh Province (Table 2), it can be seen that most ponds in the study area (Ladon, Lamnga, Lamreh, Layeun, Deah Baro, and Deah Raya) were reconstructed between 2006 and 2009[5]. Thus, it can be said that the reconstruction of shrimp and fish supply chains was achieved over a relatively short period of time.

4. The context of shrimp and fish supply chains in Aceh province

As mentioned above, the characteristics of the shrimp and fish farming industry of the study area may be described as follows: 1) extensive farming supply chains are the dominant type of shrimp and fish supply, 2) changes to the spatial structure of supply chains as influenced by the 2004 tsunami were not drastic – only reconstruction of local supply chains was required, 3) the majority of supply chains were recovered after the tsunami in a short period of time. These features indicate that the supply chain for shrimp and fish farming in Aceh Province is relatively resilient. The strength of supply chain activities in Aceh Province is largely a result of diversification – operations were diversified into a number of small-scale and simple supply chains. These conditions differ from the norm in developed countries, where risk is typically concentrated to a specific large-scale process forming part of a complicated supply chain[6]. This raises the question: what were the conditions that led to Aceh Province supply chains operating at a comparatively low level of sophistication? The following are some of the reasons why supply chains in Aceh Province have not been developed to high levels of sophistication: 1) stagnation of direct investment by domestic and foreign agribusinesses (potentially affected by the Aceh conflict), 2) lack of radical innovation owing to weak ties between shrimp and fish cultivators in Aceh Province.

[3] Intensive aquaculture ponds in Aceh Province do not offer any benefit to the local community. Most of the investors brought well-trained labor from outside the village (Zainun et al. 2007).
[4] The current producer price of shrimp in Banda Aceh (35,000-45,000 IDR/kg) is 5-10 times higher than the mid-1980s producer price (350-6,000 IDR/kg) in Aceh Province (Aceh Tengah and Aceh Utara) (Diederen 1985).
[5] The beginning of pond reconstruction in Lampulo was delayed because the area was under local government control.
[6] The high resilience of Aceh Province supply chains may be measured in comparison to the lower resilience of Japanese supply chains, whose structure is very complex.

4.1. The stagnation of direct investments by domestic and foreign agribusinesses

Beginning in the 1970s, a conflict commenced between the Government and the GAM (free Aceh movement) in Aceh Province. According to the Australian Agency for International Development, the impact of 30 years of civil conflict left Aceh Province as one of Indonesia's poorest provinces (AusAID 2008). Farming businesses and their associated supply chains were also negatively impacted by the conflict. That is, shrimp and fish farming industries were unable to develop due to vulnerable infrastructure, economical backwardness, and socio-political isolation (Padiyar 2006).

During the 1980s and early 1990s, intensive farming ponds were known to be operating in Aceh Province. However, when security issues related to the conflict situation were raised, these intensive farming ponds were discontinued and business activity was relocated outside the province (Zainun et al. 2007). There are several cases of domestic and foreign investment operations (agribusiness') running intensive farming ponds in other regions of Sumatra Island that were not affected by the conflict (Murai 2007). Hence, the escalation of risk management associated with the conflict in Aceh Province is considered one of the primary factors contributing to the stagnation of both domestic and foreign direct investment in the region. The ultimate outcome: the disassociation of Aceh supply chains from global commodity chains, and a fish and shrimp farming industry that is comparatively unsophisticated according to international standards.

4.2. Lack of radical innovation owing to weak ties between farming businesses

According to data from the field survey, shrimp and fish cultivators in the study area are not well organized, with little collaboration existing between suppliers. Each pond operator typically makes decisions concerning production and distribution activities independently of other suppliers. That is, mutual relationships among shrimp and fish cultivators are not strong, and production initiatives in Aceh Province are decentralized. Thus, horizontal networks among economic actors are unlikely to have an important role in shrimp and fish farming in Aceh Province. Shrimp and fish producer of the Deah Raya pond have highlighted that production and distribution activities exclusively depend on the decision making of each pond producer. From the standpoint of innovation, absence of horizontal/open networks among cultivators limits what are considered the two key sources of radical innovation: 'opportunities to gain new knowledge' and 'places to connect knowledge'. Therefore, the possibility of radical innovation, such as the creation of new production and distribution methods, is diminishing in Aceh Province. In addition, the current situation may result in obstacles to enhanced sophistication of supply chain processes and infrastructures in the region.

5. Conclusion

Efforts towards recovery of the Sumatra-Andaman tsunami affected regions in Aceh Province

have been progressing over a number of years. The process of rebuilding the economic structure of this area is a recognized priority. To examine the stages of rehabilitation in the region, this study discussed post-disaster economic reconstruction, with a focus on shrimp and fish farming (one of the major industries in Aceh Province). First, the specific features of the current shrimp and fish supply chains were illustrated. Second, a detailed analysis of the construction and spatial orientation of these supply chains was presented.

Results of the study indicate that most of the shrimp and fish supply chains in Aceh Province operate with infrastructure of limited sophistication, including simple structures of production and distribution. The dominant shrimp and fish farming system in Aceh Province is the traditional extensive method, which is strongly integrated with local ecological structures. No intensive aquaculture farms exist, except for three shrimp farms operated by private investors in the west or north of Aceh Besar (Layeun, Lamreh and Paroy). These particular farms operate with the use of multiple chemical inputs, fertilizers, and pesticides to achieve year-round high density production. Again, this is an anomaly for Aceh Province where supply chain activity predominantly hinges on more organic processes. The spatial structures of most of the supply chains in Aceh Province were not found to have changed after the tsunami – the majority trend of 'local-local' patterns of spatial orientation were present both before and after the tsunami.

Data collected in the field studies also confirmed that supply chains in Aceh Province have achieved recovery over a short time period – most fish and shrimp ponds were reconstructed 2-5 years after the tsunami. The success of recovery is attributed to the diversification of supply chain operations (a feature unique to less developed aquaculture infrastructure). Thus, shrimp and fish supply chains can be seen as having higher levels of resilience when compared with the sophisticated supply chains (global commodity chains) operating in developed countries. Aceh Province operates what are regarded as unsophisticated supply chains owing to the following factors: 1) stagnation of direct investment by foreign agribusinesses (potentially influenced by the Aceh conflict), 2) lack of radical innovation owing to weak ties among shrimp and fish cultivators.

To further understand the economic rehabilitation process in Aceh Province, it is important to investigate the factors contributing to the absence of horizontal networks in the aquaculture industry. It is also necessary to analyze how this particular weakness of horizontal networks relates to general production organization in Aceh Province. This may include assessment of: network quality, analysis of supply chain routines, and understanding the institutions related to production activities in Aceh Province.

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Table 2. Characteristics of shrimp ponds in the study area

Location	Kab. Aceh Besar					Kota Banda Aceh			
	Ladong	**Lamnga**	**Lamreh**	**Layeun**	**Paroy**	**Deah Baro**	**Deah Raya**	**Lampulo**	**Lampulo**
Production method	**Extensive**	**Semi-intensive**	**Intensive**	**Intensive**	**Intensive**	**Semi-intensive**	**Extensive**	**Extensive**	**Extensive**
Establish year	Long time ago (before tsunami)		2012	Long time ago (before tsunami)	Before tsunami (during conflict)	-	1951	-	1950
Labor	3	2	-	8	5	3	1 (owner)	-	2
Scale of pond	3.5 ha	1 ha	28 blocks	13 units	8 units	2 ha	2 ha (4 units)	-	3 ha (4 blocks)
Equipment	-	-	Pomp, aquaculture paddle wheel aerator	Generator, pomp, aquaculture paddle wheel aerator	Generator, pomp, aquaculture paddle wheel aerator	Water from sea	-	-	Water from sea
Products	Shrimp, fish (milk fish)	Shrimp, fish (milk fish, grouper, star snapper)	White shrimp	Shrimp (white shrimp)	Shrimp (white shrimp)	Shrimp, fish (tiger fish)	Shrimp, fish (milk fish), crab	Shrimp (tiger shrimp, white shrimp), fish (milk fish)	Shrimp (tiger shrimp), fish (milk fish, star snapper)
Yield	300-350 (fish)	-	2.0-3.0t/pond	2.0t/pond (shrimp)	-	15-20 kg/pond	500 kg/pond (fish), 800 kg/pond (shrimp)	-	3.0t/cycle (fish)
Production cycle	4 months	20 days	3 months	3 months	-	4 months	-	-	3 months
Input	Nothing	Fertilizer	Feed	Fertilizer (Ca, KCL), chemicals, feed	Feed	Chemical, feed for poultry farming	Organic fertilizer, organic medicine (coconuts)	Feed (no chemical)	Feed, fertilizer, pesticide
Baby shrimp/fish supplier	River, local market	Hatchery (Lhokseumawe)	Hatchery (Thailand)	Hatchery (Banyuwangi, Lampung, Situbondo, Makasar)	Agribusiness (Medan)	Hatchery (Sigli)	Hatchery (Krueng Raya, Ujung Batee)	Hatchery (Ujung Batee)	Hatchery (Ujung Batee, Bireuen)
Destination	Local market	Local market	Global market (Japan, Taiwan and US), local market	Global market (Taiwan and Japan, etc.)	Global market, local market	Local market	Local market (Lampulo, Peunayong)	-	Global market, local market (throgh local broker; muge)
Tsunami impact on production	Complete collapse	Collapse		Collapse	Heavily collapse	Collapse, decline in shrimp production	Collapse	Heavily collapse	Heavily collapse
Reconstruction (finished)	2008	Unknown	-	2007	2012	2009	2006	2014	2011
Support for reconstruction	-	BRR	-	-	-	Japanese Red Cross	BRR (pond), INGO and University (mangrove planting project)	-	-

Toward International Comparative Research on Mega-Earthquake Disasters: the Sumatra Earthquake Reconsidered

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1. Introduction

The discussion is structured as follows. First, prior to the review of research into the Sumatra earthquake, I discuss briefly the paradigm of disaster sociology and the fundamental topics covered in research into large-scale earthquakes in Japan. Second, based on that discussion, I investigate previous research into the Sumatra earthquake in terms of the characteristics of damage and vulnerability (section 2), the disaster reconstruction process and its determinants (section 3), and risk reduction after a disaster (section 4). Finally, in the light of the previous discussion, I reconsider the research tasks for a comparative study between the Sumatra earthquake and the Great East Japan earthquake.

2. Fundamental topics in the sociological study of disaster

2.1. Paradigm shift

It is said that the "sociology of disaster" originated in America in the 1930s, and its basic theoretical framework was established in the 1950s and 1960s. American sociology at that time was strongly influenced by the paradigm of functionalism and disaster research was no exception. Disasters were regarded as occurring when the "normal" social order was disturbed temporarily by natural hazards. Therefore, research focused on an empirical and nomothetic understanding of the coping mechanisms of human actors and groups in such abnormal circumstances and of the process of returning to the normal social order.

However, such a functional paradigm has been criticized since the 1980s. The question "what is the 'normality' of the normal social order?" has been asked. Consequently, in contrast to the functional approach, the causes of disasters have been explored "within" the normal social structure. "What is a disaster," and "why does a disaster occur," have become the central problems of disaster research, as well as "how to cope in a disaster" (Quarantelli 1998). "Vulnerability" is the key word in this new paradigm. Disasters are regarded as social constructs, not as given incidents. Thus the elucidation of the socioeconomic conditions that transform hazards into disasters (in this sense, vulnerability) is pursued as a focus of disaster research. This paradigm shift promoted the integration of sociology and the study of disasters, and should be judged as a positive change.

The conceptual framework of disaster prevention is also changing, along with the change in the

understanding of disaster. The concept of "resilience" attracts attention as a key concept in disaster prevention nowadays. Although a common understanding of "resilience" is not necessarily established, it appears that the idea of "resilience" is somewhat different from the conventional understanding of disaster prevention. In this respect, I introduce Tanaka and Takahashi's perspective (Tanaka and Takahashi 2008; Takahashi 2009). Tanaka and Takahashi roughly classify studies of disaster prevention into the disaster management approach and the vulnerability approach (Table 1). According to them, the disaster management approach comprises disaster prevention policies that aim to use science and technology to control natural hazards and to mitigate the damage. In contrast, the vulnerability approach emphasizes elucidating and coping with the social-structural causes of disaster, rather than taking a technical approach. The former is disaster prevention in the narrow sense; the latter is disaster prevention in the broad sense. The distinction between "top-down" and "bottom-up" concerns the agent involved in disaster prevention, whether state-driven policies or community-driven activities. Although these approaches are independent of each other in principle, in practice the disaster management approach has a close relationship with the top-down approach, and the vulnerability approach has an affinity with the bottom-up approach. Therefore, the former approach is commonly called the "top-down" approach, and the latter the "bottom-up" approach. It is important that "resilience" as a means of disaster prevention is understood not solely as the responsibility of the state's public policies but also as influenced by wider issues such as vulnerability and the bottom-up approach. The two approaches should be understood as complementary to each other, not as mutually exclusive.

Table 1. Framework and topics of disaster research（illustrative examples）

	To-down	Bottom-up
Disaster management	・ Tsunami-warning system ・ International emergency relief ・ National law relating disaster prevention	・ Regional disaster prevention plan ・ Evacuation drill ・ Collaboration in affected area
Vulnerability	・ Low development, poverty ・ Industrial structure, standard of living ・ Instability of political situation	・ Culture and value of local community ・ Disaster culture ・ Community embedded mutual support system

(Takahashi 2009: 198)

2.2. Disaster prevention paradigm in Japan

The disaster prevention system in Japan is characterized by its remarkable "top-down" nature. The basic pattern of the administration of disaster prevention is that the Central Disaster Prevention Council forcibly promotes civil engineering policies such as the construction of various facilities and equipment for disaster mitigation through centralized administrative mechanisms (Tanaka 2013). In addition, the salient feature of Japan's disaster prevention policies is its emphasis on emergency response. The Disaster Countermeasures Basic Act was enacted to improve the government's emergency response by integrating various compartmentalized disaster prevention measures (Maki

2010).

Certainly, these “top-down” policies have produced many achievements. In Japan, the number of people dead and missing after a natural disaster has decreased dramatically since Typhoon Vera in 1959. It is clear that this achievement is a consequence of the development of disaster prevention administration, in particular countermeasures for erosion and flood control, as well as a decrease in frequencies of large-scale disasters since then. The Countermeasures Basic Act should be judged as successful in improving the conventional compartmentalized disaster coping measures and introducing a systematic planning administration.

On the other hand, the limitations of such “top-down” systems have been frequently noted. The increase in “top-down” disaster administration tends to have negative, rather than positive, impacts on community-based disaster reduction. The more initiative the government takes, the more local residents tend to depend on the government, and consequently, the disaster culture that is embedded in communities tends to weaken (Tanaka 1986). The effectiveness of the Regional Plans for Disaster Prevention is often regarded as dubious because the plan does not have sufficient linkages with communities compared with its strong linkage with central government. Civil engineering disaster mitigation policies also have limitations because of their weak linkages with comprehensive land-use planning and development policies, as well as the rationality of the techno-scientific reliability of disaster prevention facilities (Maki 2010; Ishii 2007). For example, the fact that heavy damages were concentrated in the inner-city area in the Great Hanshin Earthquake in 1995 resulted from inadequate development policies and land-use planning that gave priority to economic efficiency, as well as inadequate civil engineering countermeasures. Existing technological disaster countermeasures have a varying relationship with the “vulnerability” approach, and tend to accompany act against countermeasures for socioeconomic vulnerabilities.

Policies that overemphasize emergency relief also have limitations. The Great Hanshin Earthquake in 1995 revealed that disaster processes include long-term reconstruction that often causes contradictory actions. Speedy political responses are required once an enormous disaster occurs, however, the reconstruction plan must be properly authorized, because it involves significant public funds. That is, community participation and consensus building are required at the same time as disaster reconstruction planning, but in practice it is difficult to combine these in a situation where people are exhausted and dispersed (Hayashi 2010). Research into the Great Hanshin Earthquake often demonstrates that such a dilemma led to delays in the rebuilding of victims’ lives compared with the reconstruction of urban infrastructure (Iwasaki 1999; Edington 2010).

2.3. Disaster prevention after the Great East Japan Earthquake

What changes in the disaster prevention paradigm resulted from the Great East Japan Earthquake of 2011? On the one hand, existing “top-down” policies were strengthened further. Many expert examination committees were created under the Central Disaster Prevention Council and the

expert-led disaster management system was reinforced. Technological disaster mitigation policies were also promoted forcibly. Unprecedented large-scale public works such as the construction of large-scale disaster prevention facilities, increasing the height of protective banks, and the creation of relocation sites were underway throughout the affected area. On the other hand, critics have noted that the lack of any provision for public participation in the Law on Special Great East Japan Earthquake Reconstruction Areas that provides the legal basis for reconstruction led to delays in the rebuilding of victims' lives (Yamashita 2014; Kaneko 2014). In addition, the estimates of the damage from future large-scale disasters (such as the Nankai Trough quake, the Tokyo metropolitan earthquake and so on) were revised upward drastically after the 2011 disaster, and the revision shocked many local governments and communities. Since the Basic Act for National Resilience was enacted in 2013, very significant public investment for disaster prevention has been made in many disaster-prone areas in Japan. Although the purpose of the Basic Act for National Resilience is to avoid dysfunctional government in the event of a large-scale disaster, it is often criticized as a resurgence of the "civil engineering state" because of its vast financial expenditure and the limited discretion of local government (see, for example, Igarashi 2013).

There are, however, some symptoms of change in the existing paradigm. Ideas such as "disaster mitigation" and "resilience" have been emphasized in the wake of the upward revision of the estimates of the damage from future disasters. The conventional idea of disaster prevention as actions that prevent disasters through the use of science and technology has been questioned and criticized, a new perspective that seeks not to prevent disasters, but to mitigate damage and achieve flexible recovery has become popular, and "soft" measures such as evacuation drills have been emphasized. This change requires voluntary action by local residents, thus the government has encouraged "bottom-up" disaster prevention. Internationally also, community-based disaster reduction is endorsed as a fundamental ideal by the UN (United Nations Sendai Framework for Disaster Risk Reduction 2015-2030). In 2014, a new instrument, the Community Management Disaster Plan, was introduced as part of the revision of the Disaster Countermeasure Basic Act. New law relating to post-disaster reconstruction was also enacted in 2013 (the Act on Reconstruction from Large-Scale Disaster). This new law is different from previous laws in that it takes the recovery of community life and the local economy into consideration, as well as civil engineering, and opens the way for community-based reconstruction.

In summary, while the Great East Japan earthquake had an enormous impact on the national and regional disaster prevention systems, the direction of change is not clear. Under these circumstances, even though 4 years have passed since the disaster, nearly 140,000 people still remain in temporary houses. In general, the rebuilding of victims' everyday lives is much delayed. What is Indonesia's experience of the 2004 Sumatra earthquake with respect to damage and disaster reconstruction in comparison with Japan? In the following section, I review previous research, especially research that focuses on the most seriously damaged area, the Aceh province in Indonesia.

3. Characteristics of damage and vulnerability

3.1. "Natural" disaster

The Sumatra earthquake is reasonably similar to the Great East Japan Earthquake in terms of the characteristics of the hazard, but quite different in terms of characteristics of damage. Such differences derive primarily from the differences in the socioeconomic structure of the two nations. This is the first issue discussed below.

First, the most remarkable characteristic of the Sumatra earthquake is the enormous impact on people. The number of dead and missing totaled 237,000 in Aceh, more than ten times as many as in the Great East Japan Earthquake. The primary cause of the number of dead and missing is the lack of disaster prevention policies. Prior to the disaster, basic law about disaster prevention did not exist, nor was there a warning system or facilities such as tidal banks. Except a few mosques, there were few tall buildings that could be used for evacuation purposes. Therefore, the spatial distribution of the impact on people was determined largely by their distance from the coast, with the exception of minor deviations because of micro-topography, and the borderline between damaged areas and un-damaged areas was relatively clear. Because of the lack of disaster prevention, the scale and spatial gradation of the damage was determined largely by natural hazards. In this sense, the earthquake and tsunami in Aceh were a relatively pure "natural" disaster (Umitsu 2011).

In contrast, it is noticeable that the spatial distribution of the impact of the Great East Japan Earthquake on people appears to be independent of their distance from the sea. Many commentators think that the peculiar distribution of the impact was caused by delays in evacuation, as well as the mitigation effect of disaster prevention measures. The invisibility of the sea because of the high seawall and overconfidence in disaster facilities created unexpected confusion and evacuation delays (Tanaka 2013). In Japan, critics have urged a revision of the methods of disaster prevention; they have not said they are lacking.

Second, while the Sumatra earthquake had an enormous impact on human lives, the economic impact was relatively limited. Aceh's GDP in 2003 was approximately 4.5 billion dollars, 2.3% of Indonesia's national economy. Although the total economic impact of the disaster in Aceh was estimated at 4.5 billion dollars, Indonesia's GDP decreased by only 0.1-0.4% in 2005. There was limited amplification of the economic impact through the supply chain and thus the disaster's impact on the global economy was negligible (Athukorala and Resosudarmo 2006; Togu and Kidokoro 2013; Myers 2011; United Nations Development Programme 2010).

Aceh province has the lowest income per capita in Indonesia and has limited links with the regional and national economies. The main industries in Aceh are oil, gas, and primary industries, which were worth 43% (for oil and gas) and 32.2% (for primary industries) of the provincial economy in 2003. The oil and gas industries, although they were unaffected by the disaster, function as a so-called "enclave economy" which is almost entirely managed by large foreign companies, and hence is virtually independent of the local economy. Economic damage was concentrated in the

primary industries, especially fisheries. Approximately 69,000 fishermen and their families died or were missing after the disaster, and many fishponds and fisheries were destroyed. However, Aceh's local economy is highly self-sufficient, with nearly 70% of products consumed in the province, and only 10% of production materials used for exported goods in 2000 (Athukorala and Resosudarmo 2006). Furthermore, Aceh had been in conflict with the Indonesian government about natural resources since 1976, and had been excluded from the market economy for many years. Therefore, although Aceh suffered heavy economic losses, the disaster had limited impact outside the province. It is often said that about the Southeast Asian economy in general that, while the population and industry are over-concentrated in the primary city that has direct linkages with developed countries, other provincial cities lack such economic linkages and tend to remain as distribution centers for the local market (Kitahara 1989). Such local economic characteristics, which are peculiar to developing countries, were reflected in the economic damage in Aceh.

In contrast, the Great East Japan Earthquake, though its impact on people was much less, caused unprecedented economic damage amounting to 160-250 billion dollars. Although the Tohoku region is somewhat peripheral to Japan's economy, it is, unlike the case in developing countries, a large-scale and complicated economic system. The tsunami struck coastal areas where there are fisheries, and seafood-processing industries suffered direct damage. Manufacturing industries, which were spread across Tohoku and the north Kanto region, suffered a range of indirect damages though corruption of supply chains. Furthermore, the earthquake and tsunami led to the accidents at the Fukushima nuclear power plants, which had significant impacts on electricity companies and the supply of electricity in Japan. Impacts on financial markets were also heavy, and the stock market and exchange market became unstable immediately after the disaster (Suzuki 2011; Wakasugi and Tanaka 2013). The economic damage from the Great East Japan earthquake characteristically extended nationally and internationally through large-scale interconnected restrictions on supply chains. It remains to be seen what impact these structural differences make to the recovery of the two regional economies.

3.2. Vulnerabilities

Although the Sumatra earthquake was a relatively "natural" disaster, as noted above, a number of articles have argued that in some sense social factors caused the disaster.

First, development policies during the Suharto regime had some influence. Although Aceh is a province in a remote area where the proportion of forested land is the highest in Indonesia, illegal logging has occurred since the development of the gas field on the eastern coast in the 1970s. Since the middle of the 1990s, the export of palm oil has been encouraged and deforestation has accelerated. As a result, the proportion of forested land decreased from 68.5% in 1989 to 48.5% in 2000, the highest deforestation rate in Indonesia for the period (Koninck et al. 2012). Land-use in coastal areas has also changed. Shrimp aquaculture has been promoted by the government's

economic development policy, and tidal flats and mangrove forests have been turned into fishponds and farmland. Urban sprawl has accelerated in the marshlands around the coastal areas, and the population of Aceh province has increased twofold in thirty years, from two million in 1971 to four million in 2000. The Sumatra earthquake occurred in these conditions, so development policies and urban sprawl led to the functional decline of coastal areas in terms of disaster prevention and this may have increased the damage caused by the disaster (DasGupta et al. 2014; Takahashi et al. 2014).

These concerns have prompted Non-Government Organizations (NGOs) to promote mangrove rehabilitation in coastal areas in the wake of the disaster. However, such activity, which relates to the UN risk reduction action framework, does not necessarily correspond to the needs of people in the affected areas. They consider employment and the recovery of industry and employment as the most important issues (DasGupta et al. 2014). Moreover, deforestation has increased the risk of flooding and sediment disasters in Aceh. Landslides and tsunami are different in nature, but they have similar relationships with development policies. Some critics have noted that the reconstruction projects after the Sumatra earthquake, which created an enormous demand for wood as a housing material, accelerated deforestation and led to the large-scale landslide disaster in 2006 (Koninck et al. 2012). An important topic for future research is an investigation of how governments and communities assimilate the experience of disasters from an environmental perspective, and how such experiences are reflected in land-use in forests and coastal areas in the future.

A number of researchers have noted that affected areas were vulnerable because they had no "disaster culture." Although the island of Sumatra is disaster-prone and has experienced repeated large-scale earthquakes, local residents had little knowledge of tsunami (Tanaka 2014; Miranda 2011). The lack of disaster prevention administration and the lack of an embedded disaster culture in the community led to delays in evacuation and a consequent increase in the loss of human life.

Some articles discuss the possible reasons for the lack of a disaster culture. For example, Yamamoto points out that the high mobility of the population in Indonesia makes the accumulation of local knowledge about disaster preparedness difficult (Yamamoto 2014). Some articles suggest that the Islamic view that accepts disaster as destiny hinders the scientific understanding of disaster and disaster preparedness. Other researchers assert the situation is different from community to community. For example, Simeulue Island was struck directly by the tsunami and 5,500 houses were destroyed, but the number of deaths was only seven. The mangrove forest remains untouched on Simeulue Island and may have acted as a seawall. Further, local residents have inherited folklore about tsunami and this may have helped them to evacuate to higher ground just before the tsunami struck (Athukorala and Resosudarmo 2006). Other articles have commented on the influence of the political reform of local administration during the Suharto regime on local subcultures about disasters (Husin and Alvishahrin 2013). According to these articles, local customary laws existed about disaster prevention in Aceh. "Community members who live along the coast and rivers have traditions of mitigating tidal waves, river bank erosion, and floods by planting mangroves in the

coastal areas and jaloh trees (*Salix tetrasperma Roxb)* along the river" (ibid., p. 71).

Folklore about preparedness for tsunami also existed, according to these researchers. However, the traditional method of community organization has been forcibly changed by the administration and customary law has been repressed. In addition, violent military intervention and the inflow of displaced persons from the conflict has had a destructive impact on community organization and on local knowledge about disaster prevention (Husin and Alvishahrin 2013).

An investigation of the actual condition of embedded disaster culture in the community, the influence of development policies, and more importantly, the interrelationship between post-disaster government-driven countermeasures and embedded disaster culture are significant topics for future research.

4. Process and agents for post-disaster reconstruction

4.1. "Top-down" or "bottom-up"

The Indonesian government released "Reconstruction and Rehabilitation for the Tsunami-ravaged Province of Aceh," commonly known as the "blue print," in April 2005. It demonstrated the government's basic political orientation to reconstruction. This plan was created with the support of international aid organizations and greatly influenced by the UN Hyogo Framework for Action of 2005. Its content is relatively sophisticated. Under the slogan of "Build Back Better," it emphasizes inclusive recovery, protection of vulnerable groups, community participation, the political integration of disaster countermeasures and environment policy, and so on. As local government was destroyed by the disaster, Badan Rehabilitasi dan Rekonstruksi (BRR), an Indonesian government agency, has taken the initiative in the implementation of reconstruction policies since April 2005.

Many international NGOs took part in the reconstruction. The Sumatra earthquake attracted international aid as well as attention because of the scale of the damage. NGOs kept in touch with affected local communities, and therefore community-based action figured prominently in disaster reconstruction. According to Tanaka and Takahashi's classification, the government-driven (BRR) reconstruction work is "top-down," and the community-based reconstruction is "bottom-up."

In general, previous studies of the Sumatra earthquake focused much more on "bottom-up" than "top-down" reconstruction, because the "bottom-up" activities substantially determined the development of reconstruction. This is exemplified by the implementation of the land-use plan in coastal areas. The plan prohibits dwelling in coastal areas within two km of the sea. However, local residents resisted the plan, and housing reconstruction has occurred spontaneously with no regard for the regulation. The BRR could not restrict such activities because of its endorsement of community participation, and this forced a change to the land-use plan to bring it into line with reality. This process is quite different from Japan, and highly suggestive in relation to research into the Great East Japan earthquake.

However, “bottom-up” reconstruction may occur by government decision. In a sovereign state, whether international aid is accepted or not depends upon the government’s judgment. Where there is internal conflict, even if the state lacks the capacity to cope with the disaster, it is not uncommon for it to reject support from international organizations (Cho 2012). Although Indonesia was unstable at the time of the tsunami, the government participated in the world conference about the disaster in February 2005, and accepted international aid. Furthermore, the Indonesian government and GAM (Gerakan Aceh Merdeka) signed a peace agreement in August 2005 and the long term conflict eventually ended. The disaster recovery process in Indonesia was very different in this respect from Sri Lanka, which experienced a similar conflict. The agreement was necessarily a compromise among complex political interests, but it should be judged a democratic achievement of the post-Suharto era.

4.2. Grass-roots coping mechanisms

Many studies of the Sumatra earthquake investigate the supportive role of international society. Conversely, there have been insufficient studies that investigate the grass-roots activities of affected people over the long term (Samuel 2012). Such studies are very important for a realistic understanding of the ideal of “community participation” proposed by the reconstruction plan.

In this context, I wish to draw attention to studies of victims’ high rates of remarriage and strong orientation of returning to their previous community. Through his analysis of the disaster’s impact on the victim’s family life, Tanaka showed that, although the disaster seriously damaged families, which shrank and even disappeared altogether in some cases, many victims remarried in the early phases after the disaster. According to Tanaka, “To be sure, the tsunami brought about many “family deaths,” but at the same time, our research found that many victims, especially widowers, remarried and created new families. This regeneration and creation of families meant the construction of new family relationships and these old and new family networks played significant roles in victims’ rebuilding of their lives” (Takahashi et al. 2014: 181).

In developing countries, the market and public services are not well developed, and therefore the family and the kinship system play greater roles than in developed countries. The high rate of remarriage in Aceh demonstrates the great importance of the family in its provision of security and active restoration of victims.

Victims’ orientation to family and kinship systems is closely interconnected with the orientation to their previous communities. According to Takahashi, who conducted research into victims’ movements, they followed two routes in general, to the houses of relatives and friends or to refugee camps to obtain relief supplies, and after a period almost all victims returned to their previous community (Takahashi et al. 2014). Gray conducted similar research, and he found also that most victims tended to move to relatives’ houses rather than refugee camps or temporary houses, and after some time returned to their previous places or neighboring areas within the same “desa” (Gray et al.

2014).

It is evident that these movements are also related to victims' occupations. As Gray demonstrated, the proportion of fishermen and farmers who return is proportionally higher than for other occupations. It can be said that many victims chose to return to their previous communities primarily because they needed to rebuild their livelihood. However, it is not the case that occupation was the sole cause. The mutual aid system embedded in communities had a considerable impact. Indonesia is a homogeneous country in terms of its low living standard, and this "shared poverty" (Geertz 1963) tends to promote mutual aid (gotong royong) in communities. Furthermore, neighbor relationships in communities tend to overlap with kinship relationships, and therefore the community is a cultural and spiritual basis as well as a practical necessity for local residents (Mahdi 2012). The strong tendency for victims to return to their previous homeland comes from a profound attachment to their community. The active promotion of housing and community reconstruction in coastal areas regardless of government restrictions should be judged as grass-roots resilience in Aceh.

Given the serious damage and economic difficulties in Aceh, it was virtually impossible for victims to carry out all the reconstruction unaided. International aid played a significant role. However, victims were by no means passively dependent on aid, but active agents who tried to cope with the disaster in the ways described above. Samuel's view that it is more rational for Indonesians not to resist but to accept disasters and to use existing social capital to achieve flexible recovery rather than investing large sums in disaster prevention (Samuel 2012) seems to have meaningful suggestion for disaster reconstruction in Japan also.

4.3. Aid from NGOs

The governance of reconstruction in Aceh was basically composed of three actors, the community, the government (BRR) and international aid organizations, especially international NGOs. In the opinion of many researchers, NGOs in particular took the initiative in implementing reconstruction work. The BRR certainly carried out reconstruction projects in an unprecedented democratic manner to prevent political corruption, but the BRR's primary role was the coordination of central government and NGOs (World Bank 2005). The distrust of government caused by many years of conflict had a significant influence on victims' negative attitude toward the BRR (Mardhatilah 2010). On the other hand, NGOs worked directly with communities, and independently promoted unique reconstruction projects. A characteristic of reconstruction in Aceh is the close collaboration between international NGOs and local communities and the importance of "bottom-up" reconstruction. International NGOs are professional organizations with considerable financial power and expert skills. They are therefore often able to substitute for the government when the government is not functioning well after a disaster. The reconstruction model initiated by NGOs is quite different from the Japanese model where reconstruction is initiated primarily by central government and the work of the NPOs tends to be restricted to supplementing the government's

activities (Yamamoto 2014).

NGOs played significant roles in Aceh's reconstruction. Funds for reconstruction works totaled 5 billion dollars, and 80% was supplied by financial aid from international aid organizations including NGOs (World Bank 2005). Nearly 6000 of the approximately reconstruction works were carried out by approximately 600 NGOs (JICA 2011). Victims judged NGO activities very highly. Research conducted by Nagoya University found that victims' evaluation of international NGOs' achievements in financial aid for community rebuilding was significantly higher than for other donors (Takahashi et al. 2014).

On the other hand, NGO assistance had a number of limitations and problems. First, an NGO's activities were likely to be constrained by its financial base. NGOs depend heavily on financial donations, and they tend to emphasize activities that are visible and achievable in the short term, so-called "media-friendly" projects. As a result, aids competition between NGOs which was driven primarily by donors' interests rather than the needs of affected communities was intensified (Older 2015; Telford 2012; Yamamoto 2014). Second, NGOs have organizational constraints. In addition to the separation of NGOs' head offices from the affected area, aid activities were severely restricted by poor transportation and IT equipment. Consequently, liaison and coordination among NGOs often did not function well and there was confusion about task responsibility and the division of labor (Clark and Murray 2010). Third, while aid from NGOs contributed to speedy and flexible reconstruction, no system existed to coordinate aid among NGOs. The relationships among NGOs tended to be competitive rather than collaborative and aid disparity among communities emerged (Schreurs 2012; Takahashi et al. 2014). Fourth, although NGOs emphasized collaboration with communities, they tended in fact to be indifferent to community participation because of time constraints, underestimation of victims' capacities, ignorance of the local culture, especially Islam, and so on (Kenny 2010). Even when NGOs collaborated with communities, the collaborations tended to be nominal rather than substantial, and the NGOs often treated the community as supplementary assistants rather than equal partners (Kenny 2010). Fifth, aid projects by NGOs could have negative effects on traditional local culture and the solidarity of communities (gampong). For example, while cash-for-work, promoted to encourage clearing debris and provide victims with an income, was useful for community rebuilding, such projects could foster a type of "money worship" among victims and weaken communities' mutual aid customs (Mahdi 2009). The long-term effects of NGO aid projects on affected communities, which are controversial topics as noted above, warrant investigation.

The discussion above is about aid providers, and some improvement appears to be needed. However, it is not necessarily the case that more aid leads to better reconstruction (Aldrich 2012: 12). The effectiveness of aid is determined partially by the recipients' response, and the social capital of communities has a significant impact on this. In the following section, therefore, I review studies of the roles that communities played in Aceh's reconstruction.

4.4. Community responses

Communities played various roles in providing for residents' needs and in negotiating with NGOs. In particular, communities played a significant role in the organization of land ownership.

Victims were provided with houses at no cost after the disaster, but this presupposed clarity about the ownership of the land. As discussed above, most victims hoped to rebuild their houses where they had lived before the disaster, and this required clarity about who owned the land. However, this was difficult for a number of reasons, i.e. registration papers had been washed away by the tsunami, the land registration system itself was not in place across all rural areas, land had been distorted or flooded by the tsunami, landowners were dead or missing, and so on. Community leaders coped with these problems, and community customary law played a considerable role in the determination of the borders between properties and land ownership.

The community also played a significant role in the negotiations with NGOs, that is, community leaders attempted to coordinate residents' needs and inform NGOs of the residents' collective needs (Takahashi et al. 2014). Communities managed the negotiations because they had sufficient cohesion and local government had lost its administrative capacity. The tsunami worsened the already poor administrative capacities of local government, so it had great difficulty in implementing reconstruction works (World Bank 2005). Communities alone mediated between victims and NGOs.

Although communities functioned quite usefully in the crisis, it also revealed their limitations and contradictions. As noted above, assistance from the government and NGOs for house rebuilding presupposed clarity about the ownership of the land. This requirement exposed women's disadvantaged position, because community customary law did not necessarily guarantee the rights of women (Takahashi et al. 2014). Residents' attitudes to community participation were not necessarily the same: some victims supported NGO initiatives rather than community participation because traditional Aceh culture contained authoritarian elements (Kenny 2010). Furthermore, people who did not own the land at their previous dwelling were excluded from assistance with housing reconstruction. Many tenants and squatters in urban areas were excluded from community rebuilding projects and the relocation policy for them emerged as a new political issue (Takahashi et al. 2014).

4.5. Determinant factors for community reconstruction

4.5.1. Rebuilding the pre-existing community

According to several studies, there were quite remarkable differences between communities in terms of housing reconstruction. Why did some communities achieve good results while other communities did not? What are the conditions in communities after housing reconstruction? In the next section, I consider the determinant factors for community reconstruction through a review of previous studies of housing reconstruction and resettlement conditions after reconstruction.

Community reconstruction can be classified into rebuilding the pre-existing community and building a new community in a different location. Most victims chose the former, as noted above.

Several commentators have noted that the factors that determine the achievement of rebuilding the pre-existing community are building consensus among residents and active community participation in the reconstruction process. Communities that were able to build consensus among residents and negotiate actively with NGOs during the reconstruction process was more likely to get good results. The question to be resolved is what the factors are that foster consensus and participation. In this context, I discuss the case study conducted by Mahdi (2009; 2012).

Mahdi demonstrated through his field research that two affected communities (gampong) in the sub-district of Meuraxa, Banda Aceh, experienced quite different reconstruction processes. These gampong, Al-Mukarramah and Lambung, were both severely damaged, and 80% of their populations were killed by the tsunami. Survivors from Al-Mukarramah, after living together in a refugee shelter for some time, split into two groups, with one group remaining at the shelter because of the convenience for acquiring aid, and the other group returned to their previous home. The relief goods from aid organizations created jealousy and suspicion among the residents, and the community leader was forced to resign his position because he could not bear the friction. In contrast, survivors from Lambung, after living in the refugee camp for a short period, all moved to a neighboring area where their common kin lived, rented land, and lived there together. As soon as the roads were restored, they returned to their former place of residence and constructed barracks using “gotong royong.” They made efforts to build community consensus and to achieve a fair distribution of relief goods. They took an active part in the negotiations with the NGO about community rebuilding, and the reconstructed Lambung was subsequently commended as a model of village community rebuilding by the BRR.

According to Mahdi, the factors that determine the disparity between the two communities are related to the differences in their social structure in the pre-disaster period. First, the two gampong had clear differences in the composition of their residents. Lambung residents were mostly farmers and fishermen who had rich kinship relationships in the community, while Al-Mukarramah residents had more diverse occupations, including merchants, and had limited kinship relationships in the community. In addition, local policy and conflicts during the Suharto regime had a significant impact. After the corruption of the Suharto regime, the conflict with government intensified in Aceh, and the number of displaced people increased. More displaced people moved into Al-Mukarramah compared with Lamburg, and this increased the community’s fluidity and heterogeneity. Further, Lamburg’s community leader was elected. Al-Mukarramah’s community leader was appointed by local government and therefore was unable to exercise sufficient leadership in the community. Mahdi states that such pre-disaster differences in social structure and political influence between the communities strongly influenced the differences in the post-disaster reconstruction process.

Other researchers share these views. For example, Takahashi, through comparative research

into two gampong in the Ulee Lheue district of Banda Aceh, identified clear differences in their reconstruction. He states that the determinant factors are related to differences in the legitimacy of the community organization for receiving aid. The influence of conflict and policy on community governance during the Suharto era is relevant to this issue (Takahashi et al. 2014). Nishi and Fanany hold similar opinions about community participation in the reconstruction process. Their research in the Lampuuk district of Banda Aceh identified the following. Community leaders created a community-rebuilding plan which included not only housing reconstruction, but also rearrangement of street and infrastructure, and took action to build consensus about the plan among residents. Donors also accepted the plan positively and responded to the community, for example, by employing residents as observers of construction works. Although these processes took longer than usual, satisfaction with the rebuilt community was reasonably high, because they had been able to participate substantially in the reconstruction. Democratization after the corruption of Suharto regime encouraged community participation (Nishi 2014; Fanany 2012).

What about resettlement conditions after housing reconstruction is finished? There continues to be insufficient evidence to reach a firm conclusion, but the number of empty houses is increasing and the heterogeneity of residents in communities has increased. The mechanism for deciding how many houses were needed varied among communities. In many cases, many more houses were built than were needed for the actual number of residents because house ownership could be transferred to relatives or successors even if the owner had perished in the disaster. Many surplus empty houses became rental-housing stock, and the proportion of newcomers to native residents increased.

Most newcomers were tenants. Unlike the majority of victims, who were rehoused where they had lived before the disaster, tenants were forced to relocate, either to rented houses or to newly created housing areas for group relocation, discussed below. Maki and Yamamoto state that “houses for tenants were not constructed until August 2007, and one third of residents, whether in central city areas or suburban coastal areas, are tenants, therefore many permanent houses are used as rented houses independently of their original purpose” (Maki and Yamamoto 2013: 351).

Deyah Raya in Banda Aceh is an example of such a mixed community. Deyah Raya is an old fishing village where Teungku Syiah Kuala once dwelled. The village suffered significant damage in the disaster; however, survivors returned to the village and encouraged housing reconstruction regardless of the BRR’s restrictions. Approximately 90% of the original residents died in the disaster, and there were many empty houses in the reconstructed area. Initially, only relatives of residents were permitted to live in the empty houses, but gradually such houses were rented and the number of newcomers increased. Approximately 70% of the 400 households in this area were newcomers in August 2014. Some residents say that most tenants gain employment in the informal sector in the central district, and therefore they rarely have everyday contact with the original residents who are largely fishermen and farmers. In addition, employment in the informal sector is relatively unstable, tenant mobility is relatively high, and they cannot settle well in the village. The current situation in

Deyah Raya is quite different from the earlier old fishing village with its close kinship relationships. It is likely that similar situations exist in many other reconstructed communities.

4.5.2. Resettlement communities for tenants

As mentioned above, restoration housing was granted only to victims who owned land, which excluded tenants and squatters from the housing reconstruction plan. The BRR finally decided to provide financial assistance for the resettlement of tenants in June 2006, i.e. more than 18 months since the disaster. Tenants were forced to live in temporary houses for a long time. The financial assistance was ineffective as inflation pushed rents up after the disaster, forcing the BRR to change the policy and provide tenants with free land and houses in February 2007 (Fitzpatrick 2008). The delays and disadvantages experienced by tenants are a general problem with the reconstruction policy.

Tenants were forced to relocate to acquire new houses, and several new housing complexes were constructed, in addition to rented houses in affected areas. Two housing complexes illustrate this policy: one was constructed with the support of the Chinese government and the other with the support of Tzu Chi (the Buddhist Compassion Relief Tzu Chi Foundation). The discussion below provides an overview of their current situation. Both are typical of the large-scale housing complexes that were constructed for tenants, but their current situations are quite different.

The resettlement community constructed by the Chinese government is commonly known as “Jackie Chan Village” because the movie star Jackie Chan once visited. It is on a hillside and has a fine view, but its geographical position is relatively difficult, as it is 30 minutes by car from central Banda Aceh. There around 1000 houses clustered on the steep slope, and there are few shops in the village. Public transportation is limited, which makes everyday life difficult. Water is the most serious problem. The water supply is unreliable, and residents must purchase water from mobile tankers.

Nishi’s research (2014) found that many fishermen moved in “Jackie Chan Village,” but several had to change their occupation because of their distance from the sea. New jobs were relatively limited, and tended to be in the informal sector in the central district, public work in reconstruction, empowerment projects provided by NGOs, and so on. These jobs are intrinsically unstable, and after the end of the temporary boom from reconstruction work, the inflow and outflow of the population has increased (Nishi 2014). In my personal observation, approximately 30% of the houses were empty in 2015. As tenants have moved out, an increasing number of newcomers who are not necessarily victims have moved in to the resettlement community. Although the community’s location is poor, the area’s fine prospect and landscaping have made it popular in the property market, especially among middle class people who can afford to own their own cars. It appears that although “Jackie Chan Village” was initially constructed as a resettlement community, today it has been incorporated into the general property market.

In contrast, the resettlement community constructed by Tzu Chi is relatively close to central Banda Aceh, which is convenient for everyday living, e.g. commuting to work, school, hospital and so on. In addition, there are several small shops in the village. The village gardens, streets, and mosque are well cared for. There were no empty houses among the 750 in the village in 2015. Resident resettlement has proceeded relatively well in this village. Geographic location, and its consequences for everyday living, may be the primary cause of the differences between the two communities. However, the actual situation in the communities is unclear. Further research is necessary to understand the attributes of the residents, the process of population allocation, social capital, community activities, and so on.

The summary of community rebuilding below is based on the preceding analysis. First, the process of reconstruction, especially the presence or absence of substantial community participation, perhaps determines the differences and disparities in community reconstruction. This finding is significant for reconstruction policy in Japan, which has many limitations in community participation. Second, traditional community organization and customary law played a significant role in building consensus about reconstruction among residents. Conversely, the influence of political reform and conflict on traditional community governance during the Suharto regime became tangible in the reconstruction process. Third, although housing reconstruction was completed in the affected area, the composition of the population in the communities has changed since that time, and it appears that community governance has become unstable. Today, local government in Aceh has re-evaluated traditional community governance in the light of the decentralization of the post-Suharto era and the experience of the tsunami. However, the situation in communities has changed considerably. Fourth, tenants are clearly disadvantaged in the reconstruction process and cannot resettle successfully on the whole. The housing reconstruction policy that required landownership as a prerequisite may have expanded the existing disparity between social classes. Further, there are considerable differences among relocated communities. Further research is necessary to identify the determinant factors of the difference in reconstruction outcomes among communities.

5. Post-disaster risk reduction

The Indonesian government enacted the Disaster Management Law in 2007, after the large-scale Sumatra earthquake in 2004 and the Central Java earthquake in 2006. This is the first permanent basic law concerning disaster management in Indonesia. A related ministry was established the following year, and disaster management systems have advanced considerably. Various measures in the law emphasize inclusiveness, the administrative and financial independence of local government, long-term political support for the reconstruction phase and so on, all of which should be judged as achievements of decentralization in the post-Suharto era (Shimada 2012).

The technological management of disasters has also advanced. Since the Flores Island earthquake and tsunami in 1992, the Indonesian government has encouraged earthquake research with support from international organizations. However, financial reasons prevented the introduction of a tsunami warning system, and the research results were not used effectively for coping with the Sumatra earthquake. Subsequently, the tsunami warning system was introduced and seawall construction encouraged after the disaster. Facilities for disaster prevention such as evacuation buildings were also constructed. The government promotes disaster prevention education through, for example, the establishment of a research center for tsunami disaster prevention, and a new department for disaster prevention study at Syiah Kuala University in Aceh and so on.

However, disaster prevention has not been a priority in the reconstruction process overall. There has been much more emphasis put on housing and infrastructure and the disaster prevention perspective has not been incorporated into these works. Although there was considerable interest in disaster prevention immediately after the disaster, priority is now given to other reconstruction related tasks, and risk awareness has disappeared gradually with the passage of time (Sakamorto et al. 2008; Pribadi et al. 2012). In contrast, while very large public works for disaster prevention have been forcefully promoted in the case of the Great East Japan Earthquake, victims' housing reconstruction has stagnated. Whether it is good or bad, we can see a remarkable contrast between Indonesia and Japan in terms of the reconstruction process.

The following points summarize the difficulties with disaster prevention in Indonesia. First, the interrelationship between the government-driven disaster management policy and the culture for coping with disasters that is embedded in the community is unclear and insufficient. Hidayati notes that while the Indonesian government proposes the promotion of community-initiated disaster prevention, its policy in fact gives priority to science and technology for disaster management, and has no active engagement with the community. For example, newly constructed tsunami evacuation facilities are managed exclusively by international organizations, quite external to the everyday life of the community. Even if earthquake prediction research and the introduction of tsunami warning system are encouraged, they may not work effectively without social coordination mechanisms that connect them to real-life evacuation activities. An important task to be tackled is the construction of something akin to a mediating system that makes adequate interaction possible between scientific and local knowledge (Hidayati 2012; Shimada 2012).

Many issues about the capacity of community in terms of disaster prevention remain. As noted above, many researchers have identified the absence of a disaster culture in Aceh, but its status is still unclear. Any investigation of the reasons for the lack of a disaster culture should consider history, and the political influence of the Suharto regime (Husin and Alvishahrin 2013). In addition, we should pay thoughtful attention to the complicated situation of communities during the post-disaster period. On the one hand, the role played by the community in the process of disaster reconstruction has been re-evaluated by government, and hence community-initiated disaster prevention based on

customary law was prescribed in the disaster management ordinance introduced in the Aceh province in 2010 (Kaneko 2014). On the other hand, the composition of the population in reconstructed communities has changed drastically and traditional community governance has been destabilized to some degree. We should investigate and clarify the social basis of community-driven risk reduction in such a contradictory situation.

The second topic for consideration is the relationship between disaster prevention and the land-use plan. The damage from the disaster is connected, in general, with the affected area's pre-existing land use. There were calls after the Sumatra earthquake for an investigation into the relationships between development and damage in coastal areas. The disaster prevention policy that restricted peoples' right to live in coastal areas, discussed above, ran counter to the land-use needs of victims that gave priority to community rebuilding, and consequently they were ineffective. Therefore, a number of studies identify the importance of the land-use plan for disaster prevention.

For example, Fitzpatrick states that land-use regulation for disaster mitigation should consider the overall conditions needed for residents to maintain their normal lives, as well as safety. This suggests that community participation and consensus are indispensable for adequate planning decisions (Fitzpatrick & Jaap 2008). Mardianto state that disaster prevention policy and inclusive land-use planning are inseparable, and from that perspective, it is important to create a hazard map, a "vulnerability map," and a "capacity map" based on an adequate analysis of the socioeconomic conditions of communities (Mardianto 2010). Pardede and Kidokoro also state that, although many community-rebuilding plans were created after the disaster, most did not include a disaster prevention perspective. In addition, the interrelationships between community planning and local government's land-use plan were quite unclear. Therefore, it is important to rebuild the linkages between segmented community rebuilding plans and the broader-scale land-use plan, which is based on a political perspective, to integrate "sustainable development" and disaster mitigation (Pardede and Kidokoro 2013).

Topics such as the relationship between disaster mitigation and land-use restrictions, the relationship between urban planning and development policy, and so on are also popular and important in Japan, and their investigation in Indonesia will be meaningful in comparison with Japan.

6. Research issues for the future

In conclusion, I propose several research issues for the future.

Studies that focus on the pre-disaster period, i.e. the social factors that affected the outcome of the disaster, are relatively few compared with studies that focus on the reconstruction process. In other words, studies about "why the disaster occurred" are insufficient compared with studies about "how to cope with the disaster." Certainly, it is difficult to obtain historical documents in remoter areas such as Aceh. However, an elucidation of social contexts in the pre-disaster period is

indispensable for a deep understanding of reconstruction. In particular, an elucidation of influences of development policies during the Suharto era on disaster culture and community land use is a significant research issue.

There are already sufficient studies of housing reconstruction that have yielded valuable insights, and new research does not appear necessary. However, findings about the roles played by NGOs and communities in housing reconstruction will have new significance in terms of comparative studies between Japan and Indonesia. Future reconstruction studies need to have an emphasis on the fact that reconstruction progress in Aceh is closely interconnected with general political and economic changes such as the end of conflict, democratization, decentralization, the penetration of the market economy, consumer culture etc., as well as reconstruction policies. We also need to deal with research issues such as the interaction between the indigenous local culture and western culture in the reconstruction process, the disparity in reconstruction outcomes in terms of social stratification, region, industries and so on, while considering the complicated and fluid background.

Study on disaster risk reduction after the huge disaster are not progressed compared to disaster reconstruction studies, but it will have growing importance especially from the viewpoint of international comparative study. Comparative investigation of possible linkage between community embedded disaster prevention and state initiated disaster prevention, of disaster prevention policies in relation to disaster reconstruction policies and environmental policies and so on will be important research topics. In Indonesia, disaster prevention policies are relatively poor in general, and in this respect, Japan is often regarded as advanced model to be learned. To be sure, Japan is much advanced especially in terms of technological disaster prevention. But, on the other hand, it seems that Japan can learn from Aceh conversely in terms of, for example, close relationship between everyday life and natural environment which is thought to be prerequisite for disaster prevention, flexible disaster reconstruction process by making active use of existing social capital (resilience in this sense) and so on.

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PHOTOGRAPHS

Front cover／表紙

Ulee Lheue, Banda Aceh, Indonesia バンダアチェ市ウレレ海岸 (2005/2/8)
Destroyed Beichuan, Sichuan Province, China 北川老県城地震遺址 (2014/10/12)
Onagawa Town, Miyagi Prefecture, Japan 宮城県女川町 (2011/4/13)

Back cover／裏表紙

Ulee Lheue, Banda Aceh, Indonesia バンダアチェ市ウレレ海岸 (2011/12/23)
Relocated Beichuan, Sichuan Province, China 北川羌族自治県新城 (2014/10/12)
Onagawa Town, Miyagi Prefecture, Japan 宮城県女川町 (2016/3/12)

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