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The Importance of Quantitatively Comprehending the Advancement of Reconstruction following Disasters

: Practical Examples from the Great East Japan Earthquake*

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1. Introduction

This paper aims to discuss how important it is to quantitatively measure the severity of the damage caused by a serious natural disaster, and the status of restoration and reconstruction after this devastation has occurred. Three lessons generated after some disasters are introduced here in order to address the importance of quantitative measurements in these scenarios and include: recommendations arising from actual policy delivery experience following the Great Hanshin-Awaji Earthquake in 1995; the approach taken by the City of New Orleans in utilising statistical data to quantitatively grasp the state of restoration and reconstruction after Hurricane Katrina hit the city in 2005; and approaches taken by the Japanese central and local governments and a private research institute in attempting to measure the damage caused by the Great East Japan Earthquake that occurred in 2011, and the degree of restoration and reconstruction that were undertaken thereafter in the devastated areas. In addition, this paper examines the necessity of promptly revising the checklist of the statistics (indicators) that look at major concerns of the disaster victims, as well as how they change as restoration proceeds and governments' policy delivery become more focused on reconstruction of cities. This paper presents a possible direction for the revision of the existing method of measurement, and notes the remaining

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challenges that are faced in collecting data from the relevant governmental organisations, and the limitations that exists which prevent effective application of analysis results to actual policy formulation through a policy assessment scheme.

2. Importance of evidence-based policymaking for restoration and reconstruction following a disaster

1）Growing attention for evidence-based policymaking for restoration after devastation

When policymakers decide the order of priority for various policies, and the quantity and schedule of relevant projects to implement, timely objective evidence, such as information on the facts, statistics and other data, provides the rationale for these decisions. This form of policymaking is called 'evidence-based policymaking' (EBP), and all the policies including formulation of the restoration and reconstruction policies from disasters should follow this principle. The following considerations are required for effective EBP development:

First, the size of a government's budget that is allocated for restoration and reconstruction measures should be swiftly decided after a disaster has occurred. This requires governments and politicians to economically estimate the scale of damage caused by the disaster as accurately as possible. In the case of a government being unable to conduct an estimation without enough access to necessary statistics and data, or information that lacks accuracy, the estimate results might not present a true picture which could lead to inappropriate levels of policy delivery being implemented for devastated areas and to disaster victims.

Second, improvements to living conditions in the devastated areas should be measured quantitatively. In order for these measurements to be more effective, comparisons of the state of restoration of each area receiving policy intervention with one another and over time becomes important. This is because government policy delivery should be prioritised to those areas and regions that show slower improvement than other areas and/or those that require more intensive intervention through policy measures. Government policy planning may occasionally be affected by those groups who are able to amplify their agendas to politicians and the administration more loudly than other stakeholders, which may result in greater inputs of measures and projects being focused to those 'louder' sectors, which could lead to other groups receiving insufficient support. This will also cause inefficiency in the broader restoration policy.

Third, policy evaluation should be constituted by the measurement of restoration progress. The ultimate purpose of reconstruction policy is to improve the residents' satisfaction through the implementation of relevant policy delivery. This approach helps government and the public understand the effect that the current policy measures have had in improving the residents' living

conditions, from the perspective of disaster victims.

2) Recognition of the importance of quantitative measurement of devastation and state of restoration and reconstruction before the occurrence of the Great East Japan Earthquake

This chapter reviews two past lessons obtained from previous disasters in order to observe the importance of the quantitative measurements of damage resulting from disasters and subsequent restoration efforts: (1) the Great Hanshin-Awaji Earthquake (GHAE hereafter) that hit Kobe City in 1995 allowed civil servants and scholars to recognise that utilising statistics and data was inevitable in helping victims recover and in drafting restoration policy packages for the devastated areas; and (2) the City of New Orleans' practical approach of EBP in formulating the restoration and reconstruction policy package following Hurricane Katrina that devastated the city in 2005.

(1) Lessons learned from the GHAE[1)]

Regarding the lessons learned from the GHAE, Murakami (1999)[2)] notes that there was a high demand for statistics and data from both the public and private sectors just after the disaster occurred. This means that those sectors thought that consultation of statistical data was essential in considering the direction of the city reconstruction plan that would determine the future of Kobe City in the long term. In addition, a number of citizens and members of the private business sector, as well as governmental sector, asked the municipal government to provide them with post-disaster statistical information. However, the fact that only pre-earthquake data was available became a functional constraint for all parties concerned, including the municipal office. Kameda (1996)[3)] suggests that, from recollections of his experience in catastrophe response, the provision of disaster-related data should be rapid, and that the government and municipal offices should recognise that the circumstances are extraordinary and have specific requirements that go beyond the ordinary schedule of utilising existing statistics. In order to achieve this aim, speediness and flexibility are required for individuals and organisations whose duty it is to generate and provide statistics. Komori (1996) also states that a lack of specific guidelines for utilising existing statistics during a period of emergency resulted in reluctance from public administrators to provide detailed data.

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1) The references in this paragraph are noted by Saito (2012: 32-33).
2) He was an officer at Kobe municipal government when the GHAE occurred in 1995.
3) He was an officer at Hyogo prefectural government when the GHAE occurred in 1995.

(2) Approach by the City of New Orleans

In contrast, the approach of the 'Katrina Index' (currently called the 'New Orleans Index') offers a good example of how to measure post-disaster situations objectively, and utilise relevant evidence for policymaking and business activities. The Brookings Institute, together with New Orleans Statistical Office, developed the Index as the set of 20 indicators four months after Hurricane Katrina hit the city (the number of indicators increased to 38 within two years after the initial Index was developed), and they began analysing post-disaster scenarios using the Index. For two years after the disaster, the Institute produced a monthly publication that detailed the state of restoration, measured by each indicator in four aspects: housing, services and infrastructure, workforce and economy, and emergency response[4].

The Brookings Institute (2007) identified, through the experience of developing and analysing the Index, that there is a high demand for the data itself and for the analysis of the data in both the public and private sectors, and therefore, establishing a system where a sole organisation can gather and analyse the statistical data as an entire service is integral to the smooth achievement of these aims. In this regard, the Brookings Institute noted that acquiring municipal-level data (or more fragmented data) was sometimes challenging, whereas countrywide data faced obstacles in the delays encountered in publishing this information. It also points out that close collaborations between the administration and a research institute was able to enhance the success of the approach of the Index. This means that the research institute developed the Index, analysed the various circumstances related to the disaster using the Index, assessed the efforts of relevant organisations, and requested the municipal statistical office to generate important statistics or survey results that had not been collected before. The municipal office generates such statistics, and utilises the Index and the results of the analysis in formulating its future policy framework and policy schedule.

3. Efforts undertaken to understand the extent of damage and state of restoration and reconstruction following the Great East Japan Earthquake in 2011

This chapter provides an overview of government and other organisational practices in developing a quantitative description of the damage caused by the Great East Japan Earthquake (GEJE hereafter), as well as the state of restoration following the devastation, with a focus on how the lessons identified through the previous chapter are made utilised.

4) As introduced later, the indicators adopted in the Index were totally changed two years after the disaster.

1) Responses of the central government to the GEJE

(1) Little collaboration in data collection

Scholars began discussing future improvements that could be made to the utilisation of the data, taking the experience of the Great Hanshin-Awaji Earthquake into consideration as a lesson, with particular focus being placed on the acquisition of the data. However, there had been no actual concrete collaborations observed between the government and scholars in the attempt to make these improvements. In addition, there had been no discussion on developing a measurement method that neatly captures the comprehensive situation of restoration and reconstruction. As a result, the government faced the same difficulties in emergency management just after the GEJE as had happened following the Great Hanshin-Awaji Earthquake. For example, there was urgent need for information on precise location of shelters, and the number of people evacuated to each site. However, until the Fire Defense Agency started collecting this information several days after the catastrophe, the government had no other option but to estimate these figures by counting the number of rice balls provided to each shelter. If the government could have gained the cooperation of the staff in the shelters, it could capture this information more easily and precisely[5].

(2) Reduction of the burden of statistical work

One particular government body was able to recognise the importance of collecting statistics and data. The Chairman of the Statistics Committee of the Cabinet Office commented that only one month after the occurrence of the GEJE, it was clear that statistical results would become important basic materials for future reconstruction, and therefore relevant central and local governmental organisations and private sectors were asked to co-operate in conducting appropriately regular surveys that were necessary for compiling statistics (Statistical Committee of Cabinet Office, 2011)[6]. However, many ministries allowed local authorities in the disaster-affected areas to temporarily suspend collection of relevant surveys, or to reduce the burden of statistical work and disclosure (e.g. reduction of frequency of administering the survey, temporary absence of data, postponement of responding to the requests of data disclosure) until the emergency response was concluded. Excusing local authorities in this way may be reasonable in certain conditions and should not induce accusations without any prior consideration, but, in reality, this lead to an absence of key statistical data for three severely devastated prefectures

5) Interview with a government officer in July 2012 who declined to reveal his name.

6) This chairman's comment was viewed as an assumption of the existing statistical surveys, but it could also be applied to the necessity of acquiring a wider range of statistics and data, and appropriately utilising them, considering the importance of quantifying the number of evacuees in each refuge immediately after the occurrence of catastrophes, for example.

(Iwate, Miyagi, and Fukushima) in Tohoku, both during the emergency period and for a few years after the disaster had occurred.

The reduction of the burden of statistical work constrained the availability of statistical data acquired in order to estimate the amount of damage to living and production infrastructure. In practice, the government faced difficulties in collecting necessary local authority-level data, as seen when the Directorate-General for Economic and Fiscal Policy of Cabinet Office (2011) conducted estimations two weeks after the occurrence of the disaster and the resulting amount widely ranged from 16-25 trillion yen. The Cabinet Office had no choice but to publish a wide range of estimate results during the emergency period. The claim that limited access to fragmented data that is available for analysis can be proved by the fact that, more than three months after the disaster, the Directorate-General for Disaster Prevention of Cabinet Office (2011) could publish another estimation result in June 2011, with a solid figure of 16.9 trillion yen being listed in this updated estimate.

(3) Government's idleness in updating the estimation results on the damage

The problem is not only limited access to data during the catastrophe; the government's idleness in not revising the estimation results after publishing the second result is also concerning. The government may consult the first and second estimation results in formulating the supplementary budget bill for the fiscal year of 2011, and in establishing the special budget account with 19 trillion yen on restoration and reconstruction following devastation caused by the disaster. However, when the current leading parties won the election and took office in the beginning of 2013, the government increased the amount of the special budget account to 25 trillion yen, without updating the estimation of the quantity of the damage or providing an overview of the total situation of restoration and reconstruction in the devastated areas. This means that, in increasing the amount of the budget allocated for restoration and reconstruction, the government did not uphold an approach of EBP[7]. Indeed, the Ministry of Finance and the Reconstruction Agency jointly announced that forevery year since 2012, there have been many projects that were not implemented at all and, asaresult, a huge amount of the planned expenditures were not undertaken.

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7) Relevant to this point, Egawa and Mori (2013) note, by using annual official statistical data, how much of the infrastructure for living and production activities were lost by the disaster in various sectors. Considering that even the private sector could conduct such an analysis two years after the disaster, it can be said that the central government would be able to acquire necessary official statistical data for estimating the amount of damage more easily, at least from 2013 onwards.

(4) Efforts of the central government

The central government is at a great advantage when the effort to quantitatively understand the situation of restoration and reconstruction in the devastated areas is made, because the central government can concurrently use legislative frameworks to acquire necessary statistical data from local government and private sectors, and develop new statistical data by itself for the further improvement of the assessment. This will help with making decisions that are based on clearer and more accurate evidence. Having said this, the fact that data is collected and not analysed, aggregated, or assessed and is presented simply as statistical information also indicated further issues. Therefore, the agency conducting EBP must be entitled to a stronger status than ministries, and should assess the situation in terms of the statistics, data, and information it collects. Moreover, the agency is better able to select a method of assessing the situation with minimum figures available. Those figures should objectively present the extent of restoration and reconstruction that has been achieved, from the perspective of the victims of the GEJE.

So far, the Reconstruction Agency collects the statistical data and relevant information which line ministries generate or hold themselves, or is collected from local government. For the first few years following the devastation, this data has been published in monthly reports entitled 'the state of advancement of the measures for reconstruction'. Aside from this, it tries to study what kind of disaster-related data are available from line ministries and private business sectors (Reconstruction Agency, 2012). However, this statistical information tends to be input-based (e.g. the extent to which the relevant line ministries have been able to inject money for restoration) or output-based data (e.g. the extent of the repairs to the damaged economic infrastructures that have been undertaken through the government's efforts). Those data neither tell the fulfilment of the residents' need for such infrastructure, nor do they measure the satisfaction felt by the residents for the governments' projects (i.e. the data cannot be used for outcome-based policy assessment), but rather measures the proportion of the planned budget that has been spent so far. The Reconstruction Agency itself seems to not consider using this information for policy assessment, judging by the fact that it does not develop an outcome-based indicator which could describe the overall situation, and publishes the information incompletely and in a 'patchwork' manner.

2) NIRA's 'Indexes for Recovery and Reconstruction following the GEJE'

Governmental agencies are often aware of the state of restoration of 'damaged' living-related infrastructure. However, when we consider the degree of restoration and reconstruction, we also have to know how much of the infrastructure can be useful again, including those buildings and facilities that were not damaged. The overall status of economic activities should also be

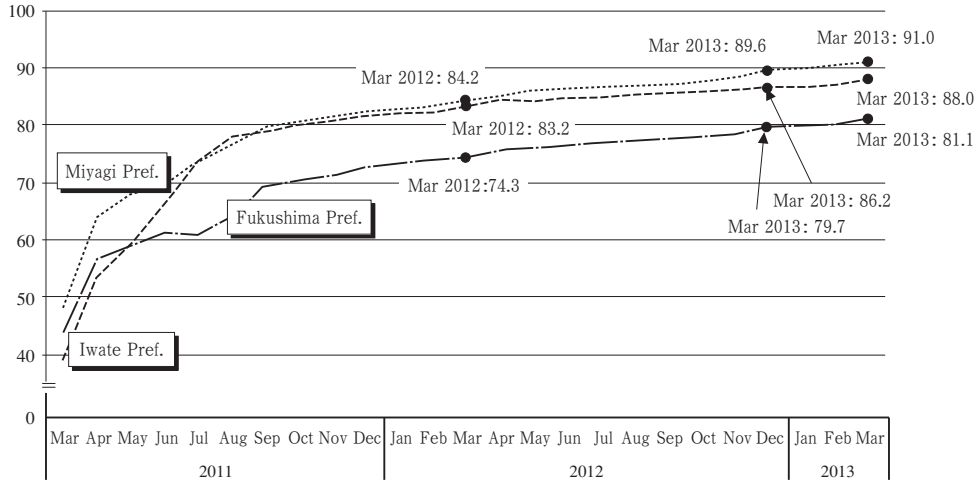
measured, which includes the combination of economic activities that were not affected by the disaster and those that were affected. When an index is developed and represents the overall situation of restoration and reconstruction with fewer figures, these considerations should be accounted for.

A practical approach undertaken by the National Institute for Research Advancement (NIRA) is worth observing. It developed two indices to measure the overall situation surrounding a disaster that it named 'Indexes for Recovery and Reconstruction following the Great East Japan Earthquake' ('NIRA's GEJE Indices' hereafter), and published the first index in September 2011, six months after disaster (NIRA, 2011a). NIRA's approach is advantageous for the following reasons: (1) one of the indices can measure the extent to which the living-related infrastructure can be useful again, rather than the extent to which the government has restored the damaged infrastructure. (2) The indices are synthetic, which means they go further than past attempts that include the Katrina Index or the government's publishing data which did not try to calculate a synthetic index. The index expresses the status of recovery of basic infrastructure in terms of NIRA's GEJE Indices, and measures the degree of residents' accessibility to living infrastructure. The status of activities index measures the degree of enjoyment of daily life in the areas that have been damaged by the disaster. Both of them express the degree of restoration achieved by a single score. The use of synthetic indices has a great advantage in the fact that the national public can easily understand the state of restoration and reconstruction through the use of simple numbers. This also enables them to know the improvements made to living status over time, and be able to compare the current situation in one severely affected prefecture with others, and with the national average (Figure 1). Comparability over time and among other prefectures contributes to the rationale of the assessment. (3) The indices assure objective measurement of the overall circumstances of the disaster in a way that can mitigate the influence of requests that emerge from subjective situations regarding policymaking, and reduce groundless subjective assessments. The approach can also improve efficiency in decision making of how much money should be injected and what the direction of the government's projects should be followed in the next fiscal year. Therefore, the indices can be used for policy assessment as outcome indicators. (4) Analysing the changes seen through individual component indicators can help with identifying the policy areas where little progress was made, or in the observations of living circumstances where residents were unable to gain access easily, which could, in turn, urge policymakers to amend their restoration and reconstruction policy frameworks.

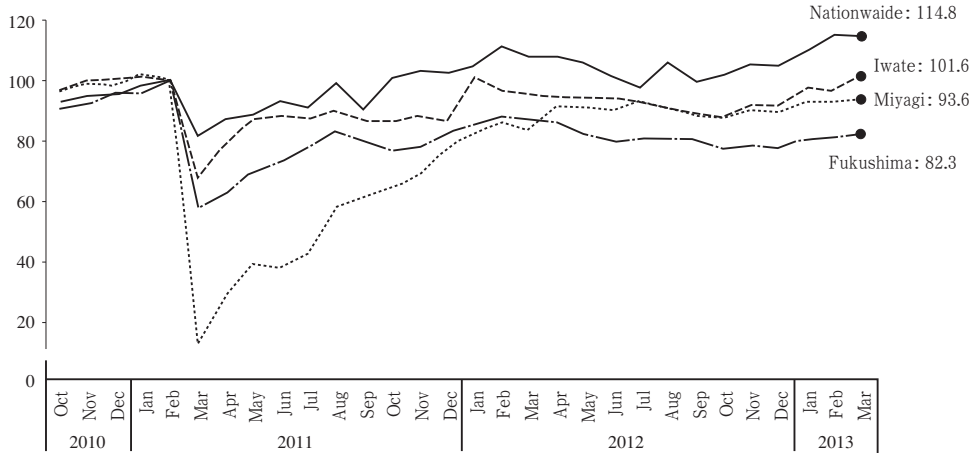
Having said this, unlike the development of the New Orleans Index, the approach of the NIRA to its GEJE Indices seems to have not involved any close or systematic collaboration with the administration. This may weaken the accuracy of the Indices by restricting the number and types

Figure 1: NIRA's GEJE Indices

(**1**) Index for the status of recovery of basic infrastructure (Feb. 2012=100)



(**2**) Index for status of people's activities (Feb. 2012=100)



Note:

1 "Index for status of recovery of basic infrastructure" measures how much of basic life infrastructure had been restored, through the comparison with the status in February 2012 (the level is set to 100). When the value of the index reaches 100, the prefecture is regarded as accomplishing full recovery. The index is generated by a simple average of the value of 17 indicators, each of whose value takes 0 to 100. As this index measures the stocks that exists in the disaster-affected areas, non-seasonally adjusted data are used.

2 "Index for status of people's activities" measures how active the people in the disaster-affected areas are, in comparison with pre-disaster periods. "Activities" include production, consumption, employment, construction and logistics. The index is generated by a weighted average of the values of 12 indicators, and each indicator takes zero or positive value which may exceed 100. Seasonally adjusted data are used, and, before the indicators are compiled into one index, the move of each indicator is statistically standardised. If an indicator exceeds 100 for three consecutive months, the value of the indicator concerned is fixed to 100 thereafter.

Source: NIRA (2013).

of data available to them.

4. The importance of timely revision of the Indices and associated constraints

It could be perceived that the Indices become gradually more useless and should be fundamentally revised alongside changes to the scope of the policy focus in the devastated areas as it moves from the emergent and quick-fix restoration effort towards fully-fledged reconstruction. This chapter and the ones that follow examine this trend by taking the practical approaches of the New Orleans Index and NIRA's GEJE Indices as examples. It assesses the desirable direction that revisions to the indices should take and the constraints involved in doing so. In particular, this chapter discusses what kind of aspects the measurement should take into account in the period of fully-fledged reconstruction, rather than those aspects that are focussed on in the period of emergent and quick-fix restoration.

1) Reasons why the Indices should be revised

Revision of indices should not be so frequent, because the revision also contains the risk of losing comparability. The best time to revise is when the phase of the policy changes from emergent and quick-fix restoration to fully-fledged reconstruction. Between these two periods, the indicators used for measuring the situation may be entirely different. In the period of restoration, the most important aspect is recovering ordinary living functions in disaster-affected areas to the same level as before the disaster. Therefore, the quantitative measurement method should include indicators on housing, electricity, water supply and gas, transportation, hospitals and relevant facilities, stores etc., as in seen NIRA's GEJE Indices. On the other hand, once the residents recognise that it is time to shift the policy framework towards fully-fledged reconstruction, the indicators measuring the degree of livelihood rehabilitation become more important. Those indicators are difficult to use in an emergency because many of them are constituted by annual data and are slow in being updated. However, as these could become more readily available a few years after the disaster, and may be able to provide more accurate information if the analysis of the situation is conducted annually.

In the five years since the GEJE, local governments and residents in the devastated areas (except those residing in or evacuated from the Fukushima prefecture) have shifted their focus to fully-fledged reconstruction, as shown by the move of NIRA's GEJE Indices for the first half of the fiscal year of 2014 (Mori, 2014: i.e., the indices' scores show small increases) and NIRA (2013). In this movement towards reconstruction rather than restoration, it is inevitable that either a comprehensive revision of NIRA's GEJE Indices or the development of a new index will occur. Indeed, the NIRA (2013: 22-23), having once attempted to establish a renewed Indices,

have yet to publish the revisions, and have consequently seemed to give up developing a new one[8].

2) Past experience and studies

Therefore, in the absence of this action, it is important to consider the aspects other organisations will use to construct new indices to measure the state of fully-fledged reconstruction. Taking into account that the index should have the characteristic of outcome indicators which can be used for policy assessment, it would be useful to adopt the statistics or survey results on the degree of satisfaction felt among the people in the disaster-affected areas. As there is no systematic study or survey on what aspects of life should be more focused in a reconstruction period, this chapter tries to identify what aspects should receive attention, based on previous studies on the state of the individual aspects of victims' lives in particular cities and towns.

(1) New Orleans Index

In examining how to rebuild the Indices in governmental sectors, the approach taken in the New Orleans Index (previously named the Katrina Index) offers a good practical example (also see Section 2. 2)). The current Index consists of 20 indicators that cover four aspects (Table 1), which was entirely revised two years after the disaster. The frequency of publishing the figures of indicators was reduced to a quarterly-basis in the third year of the approach, and then biannually from the fourth year onwards, and annually from the fifth year to the present day. The annual report on the current New Orleans Index is published in August every year, and explains the importance of measuring 20 indicators sequentially, and analyses their state in New Orleans by

Table 1: New Orleans Index

Areas	Indicators
Economic Growth	Job Growth, Drivers of the Economy, Wages, Productivity, Entrepreneurship, Innovation, Job Sprawl, Educated Workforce
Inclusion	Median Household Income, Affordable Housing, Educational Attainment by Race and Ethnicity, Size of City's Middle Class, Suburbanisation of Poverty
Quality of Life	Arts and Culture, Quality Public Education, Public Safety, Neighbourhood Quality and Blight
Sustainability	Commuting by Public Transit, Air Quality, Coastal Wetland

Source : "New Orleans Index at Ten", Published in August 2015.

8) It is unclear why this is the case, given the fact that the NIRA does not mention anything about the study on GEJE Indices in its Plan of Research Projects for the fiscal year 2015. In addition, according to the NIRA's list of research projects on its website, it had finished the project on GEJE Indices by October 2014, and it does not list any relevant or successive re- search projects to be conducted in the remaining fiscal year of 2014 or in 2015.

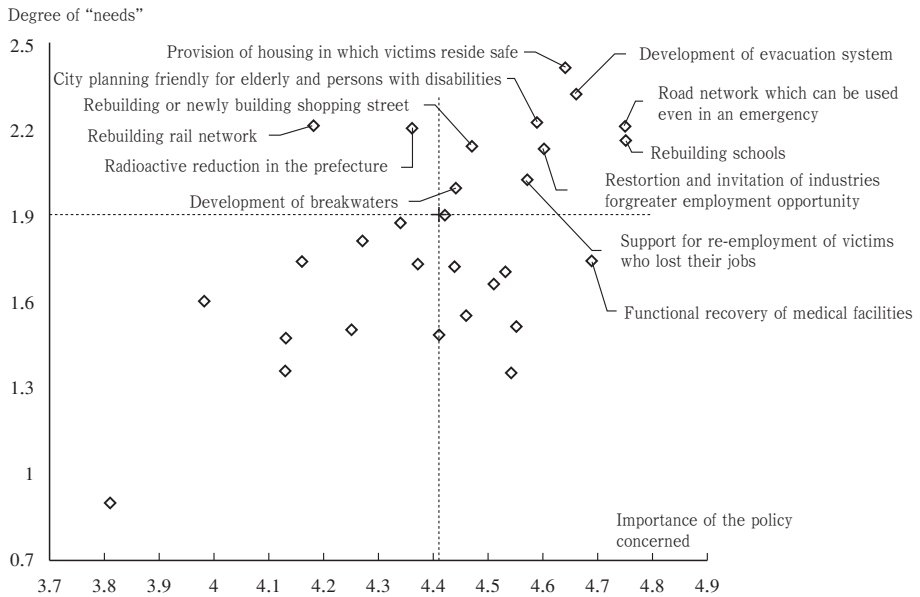
comparing it with the whole country, and is also able to capture time-series changes since 1980 with the use of graphs.

(2) Survey on reconstruction needs of local people

Regarding the needs of the people in the areas affected by disasters, there is no survey that assesses people in three prefectures, with the same question asked at the same time. In contrast, the approach taken by Iwate prefecture in investigating the residents' needs in reconstruction from the disaster offers a good approximation of what aspects become important in terms of reconstruction measures and projects. It conducts an annual survey named the 'Survey on reconstruction from the Great East Japan Earthquake and Tsunami in Iwate prefecture' (Iwate Prefecture, various years). In this survey, 'Importance of individual policy delivery for reconstr uction' and 'Reconstruction needs to be promoted intensively (i.e., a gap between the importance and advancement of individual policy delivery)' can illuminate the schedule of policy measures and projects for reconstruction that should be undertaken in order to maximise satisfaction for those living in the disaster-affected areas using a limited budget.

By reviewing the latest results of the survey published in April 2015, it was apparent that the most important policy deliverables for those living in the southern coastal area (the area most severely damaged by the tsunami in the prefecture) are 'development of road networks that can

Figure 2: Policy areas which have higher priority among disaster victims and those whose delivery is still considered as insufficient for victims in Iwate Prefecture



Source: Iwate prefecture (2015).

be used in an emergency', 'restoration of damaged school facilities', 'recovery of the function of medical institutions and social welfare facilities etc.', 'development of evacuation routes which assure smooth evacuation in the event of disaster', and 'provision of residence and residential land where the victims can live in with peace in mind' (Figure 2). In contrast, the top five considerations for the residents in Iwate prefecture include the items related to support for employment rather than development of road networks or evacuation routes. These results imply that the residents give greater priority to reinforcing physical infrastructures. Considering the reconstruction needs, the top five items for residents in the prefecture are 'provision of residence and residential land', 'support for re-employment', 'maintenance of the amount of workplaces', 'counteraction against radioactive emission', with 'support for the elderly and persons with disabilities' ranking higher. In contrast, the top five items for those in the southern coastal area are the same as the five most important items for those in other areas, except the items regarding development of medical institutes and so on. This result implies that the residents there have not been satisfied with the amount of life-related physical infrastructure and public service provision that they are able to access so far.

3) Studies of the living conditions of the victims following the GEJE

Considering these two reference cases discussed above, it can be said that a move was undertaken towards community planning that aimed to rebuild the towns with new and more efficient city-centre functions becomes more important, although there were many requests for particular types of living infrastructures to receive full restoration. In terms of software policy support, the need for employment, development of new industries, peaceful living for the elderly and persons with disabilities, safe and easier living circumstances, and measures against pollution, all received higher priority among the implementation of reconstruction policy.

Therefore, a new index should include indicators which can measure the following, in order to be utilised for comprehensively and accurately measuring the state of fully-fledged reconstruction.

(1) **Restoration of industrial bases as input indicators**. The state of restoration of farmlands and facilities for fishery, establishment and retirement of business, provision of residences, recovery of school and medical facilities, and so on.

(2) **Provision system of public services as output indicators.** The state of provisions for education, health-care, nursing care for elderly, employment support, security-related services, shopping support services, and so on.

(3) **Outcome indicators on living conditions**. Crime rate, average income level of the residents in the prefecture, level of consumption, degree of pollution, and so on.

(4) In addition, **measuring the quality of living conditions** for the elderly, women, persons with disabilities, and children may become more important if the local administrations are operating within inclusion policy.

Relevant research and studies have been conducted by many scholars in various research disciplines[9]. Most of them do not intend to identify the type of reconstruction that is needed or is objectively prioritised in the devastated areas, either entirely or in the individual administrative jurisdictions. Rather these studies clarify the characteristics of a particular imperative that the scholar feels are important, without checking its relative priority within the broader reconstruction policy.

Moreover, these studies are conducted in a few communities or in temporary dwellings and therefore do not cover all the administrative constituencies across the three prefectures. This generates the appearance that important research and survey results were scattered among the three prefectures, without any attempt being made to rank the importance of the research, and without any coordination being attempted in administrating the survey questions. As a result, these surveys do not provide comparability of living conditions across the administrative constituencies, and are thus difficult to use in a new index, even though they detail useful information.

Even so, concerning quantitative measurement of the living conditions of residents in disaster-affected areas, there are several studies on the state of physical and mental health conditions, the surrounding circumstances on the purchase of daily necessities, planning of future evacuation routes, restoration of local businesses and provision of permanent dwellings for those who currently live in temporary dwellings. For example, in the Miyagi prefecture (2012a, 2012b), surveys were conducted, assessing people's health conditions in temporary dwellings, and Fukushima prefecture and Fukushima Medical University (2012) conducted a medical and health survey on the effect of radioactive emissions at that site. Scholars conduct various health surveys which occasionally receive financial support from the Ministry of Education, Culture, Sports, Science and Technology[10]. In contrast to this, there are fewer studies on residents' living conditions, other than assessments of health conditions; however, there are groups of scholars from various disciplines who systematically conducted a series of studies from various aspects of

9) The researchers in NIRA also conducted studies; Egawa (2012) lists the challenges in terms of living circumstances, which the Indices do not capture. The reason given for this is limited availability of statistics or lower priority in the period of restoration. Egawa and Mori (ibid.) try to grasp the severity of damage found at industrial bases and the state of their recovery with officially published data. Egawa and Tsuji (2013) focus on the vulnerable in the event of a disaster and make an attempt to grasp their living condition by assessing relevant data.

10) For example, Hayashi (2012), Tsuji (2013).

11) For example, the Study Group on rebuilding the devastated areas in Tohoku Society of Geographical Studies focuses on the restoration and reconstruction of life-related facilities, re- sulting improvements of living conditions, and side effects of inappropriate policy planning on reconstruction. More specifically,

living, although some surveys only focus on particular coastal cities[11].

5. Remaining constraints

As examined in the previous section, the approach of quantitative measurement should focus less on the extent of restoration of physical infrastructure that can be used again, and more on people's living conditions, when the focus of policy responses to disasters moves from restoration to reconstruction. In this case, then, an ideal index should include the measurement of the aspects of health conditions, stress, security, and reliability of the communities, ease of daily life, and so on. There are remaining challenges, however, which are discussed in this section.

1) Implementation of cross-prefecture surveys

The first consideration assesses how the comparability of indices can be guaranteed. As noted above, many scholars and administrations have conducted a variety of surveys so far, but almost all of these studies lack comparability among themselves (i.e., the surveys did not cover all the cities and towns in the three prefectures). Failing to resolve this problem would render the survey results unusable for a new index. In improving the availability of comparable statistical data from private research institutes and scholars, one option that exists for the central government is work co-operatively with the investigating scholar who is conducting the government-sponsored survey projects. This co-operation could extend to including a few common questions, taking into account the site of the survey, and being careful of retaining the independence of academic research from the government's intention itself.

2) Appropriateness of utilising subjective data and qualitative data

When considering a new index that could capture people's satisfaction with their living conditions, it is natural to consider the possibility of using subjective survey results and qualitative data. However, subjective data and qualitative data have lower and upper limits (usually 0–100%). This makes the generation of synthetic indices difficult, because a one percentage point of improvement (for instance) is hard for the administration to achieve, if the relevant subjective

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Iwafune (2013a) and Iwafune and Shirai (2013) identify the relationship between the residents' physical strength during (forced) living in temporary dwell- ings, and the residents' activities of buying goods, chatting with other people, methods of go- ing to and from hospitals etc. Hasegawa et al. (2013) surveys the residents' appetite for meals and the state of food intake in the disaster-affected areas. Iwafune (2013b) surveys clothing and living circumstances of the citizens living in temporary dwellings. Tanaka (2014, 2015) analyses the accessibility of the residents in the devastated area to public transportation. Takano's (2013, 2014) studies are on the process of restoration of fishery and other occupations. Others include studies on the circumstances of disaster reduction (Iwafune, 2014, Shimazu, 2013), and the possibility of becoming a so-called food desert (Iwama et al., 2012, 2014).

data shows higher scores as their baseline. In addition, this cannot necessarily guarantee cross-prefectural or cross-community comparability, because the residents assess their current living conditions in their location only, without drawing comparison to other communities and prefectures (i.e., there is not a standard of 'feeling' that could effectively be set in all the communities). The New Orleans Index gave the guideline that no qualitative data should be employed in the establishment of an index during reconstruction periods (Brookings Institute, ibid.). Another example is the People's Life Indicators (PLI), which the former Economic Planning Agency (EPA), Japan previously established. The PLI consisted of 60 individual indicators and was compiled into 8 indices that measured the individual aspects of people's lives. The EPA used the qualitative data in a multivariate analysis, and identified a set of important aspects of life through this analysis; however, they later did not include qualitative data in the PLI at all.

3) Efficiency in developing, improving and utilising official statistical data

The other challenge is the collaboration between the government and research institutes when there is a need for new statistics, or for the compilation of raw data, as seen in the lessons of the GHAE. The largest weakness in the approach of NIRA's GEJE Indices was that it could not receive sufficient support from the central and local governments in collecting and utilising official data, and in the request for government to utilise the findings of the Indices as a policy recommendation. The NIRA itself mentions that governments' decision of non-disclosure of statistical data and relevant information restricted the quality of the Indices during development of the measures, or when updating their figures (NIRA, 2012a, 2012b). The government had to have been aware that requests to provide the most updated statistical data would surge in an emergency period, having learned from the GHAE, though provision of this data may have only been recognised while it was being utilised for purposes other than what it is intended for.

Private research institutes are not able to solely solve this problem or drastically improve the situation through their efforts alone. Even in the case of the local government being willing to provide such data, they eventually stop providing this information as they are not able to monitor whether or not utilising the data for purposes other than their intended use is acceptable[12].

12) According to the actual responses from the local government officers, the reasons given for the decision of non-disclosure at the local government levels were, that (1) they could not judge if the utilisation of data for reasons other than intended purposes was acceptable or not be- cause the statistics concerned were not their own, but rather they were developed on behalf of the central government, (2) they did not have any guidelines on disclosure of statistical data when the disclosure is the case of the utilisation other than intended purposes, and therefore (3) an official procedure for the request of disclosure of information should be taken if the sta- tistics and data are necessary. In addition to these explanations, such organisations existed as discussed, and the provision of relevant data or statistics may crease a conflict between the du- ty of confidentiality of the civil servants and the obligation of protecting personal information and public welfare.

Therefore, the central government should establish an emergent guideline for generating, providing and sharing statistical data and information. This should include prior specification of statistical information to be generated or provided with priority, and the rules for doing so as a business continuation plan for the statistical departments of the government. It should be noted that the collection of such data and information must be centralised, and guidelines should be assessed and improved through a drill regularly in times of peace and before next severe disaster occurs. As Hayashi (2001) says, as the lessons from the GHAE show that, 'in an emergency, you can do what you have done in times of peace only'. In this process of consideration, the organisation and scholars responsible for nation-wide research on the damage of disaster and degree of restoration and reconstruction should be identified, as well as how the government should link research results to actual policy planning in line with the concept of EBP.

6. Conclusion

The importance of EBP in times of peace and also during an emergency was already recognised among scholars and in the governmental sectors as the lessons of the GHAE. Nonetheless, the efforts for assessing the policy and improving upon it with objective data or information could not be observed, even once the GEJE had occurred. Even though the NIRA established and updated its GEJE Indices regularly until March 2013 (with one ad-hoc and informal release in September 2014), there was no visible evidence that the Reconstruction Agency had utilised them for policymaking or for policy assessment. Moreover, the NIRA itself suspended its efforts of updating data or re-establishing new Indices suitable for the measurement of the degree of reconstruction in three disaster-devastated prefectures. If policy making and delivery for restoration and reconstruction stops being based on evidence and instead is driven by subjective feelings, thoughts, and the petitions of disaster victims, policy delivery will subsequently lead to an oversupply of measures and projects being implemented for those who are able to amplify their agendas through petitions at the expense of necessary policy delivery for other parties and in other policy areas. Furthermore, this means that there may be less allocation of policy resources to those who are truly in need of help but who are also unable to project their voice to the administration and politicians. As a result, restoration and reconstruction policies may become unbalanced in their focus and more inefficient.

The areas affected by the GEJE should receive further long-lasting efforts for reconstruction. This paper identifies three strategies of improvement for the government's policymaking methods in order to make it more efficient, and these are presented from the perspective of the utilisation of data. First, a new index suitable for measuring the state of reconstruction at a prefectural level will need to be created in the current stage. Second, the government's policy

framework of utilising the index should be systematically established as a practice of the EBP. In particular, the government should analyse the objective circumstances of reconstruction in each prefecture by using the index and then utilise the results in deciding the policy schedule. Further, amendments should be regularly made to the index in line with the concept of EBP. This paper also argued that the new index should be developed for the use of outcome-based policy assessment, and so that comparisons of the situation between the three prefectures, and nation-wide assessments can be conducted. Third, the government should make a business continuation plan for statistical work, and develop guidelines for the treatment and generation of necessary statistics before the next severe disaster occurs. The experience of government and scholars, including the NIRA, during the restoration period of GEJE should be used in drawing out lessons. In particular, the NIRA reported that it faced challenges in collecting data from central and local governmental agencies, which constrained improvements that could have been made to the quality of the Indices. In other words, the government agencies did not provide the necessary statistical information as requested from the private sectors for various reasons, some of which cannot be solved solely by them. The government must not let relevant research institutes and private business sectors face the same difficulties in making policy when the next disaster occurs. Policy delivery for restoration and reconstruction based on EBP will make the reconstruction policy more efficient and productive, and could also reduce the burdens faced by other policy areas. The provision of data should therefore be rapid and smooth. In addition, government agencies should recognise that in times of peace, the statistics and data that they hold belong to the public and should be provided more readily for public benefit.

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The Importance of Quantitatively Comprehending the Advancement of Reconstruction following Disasters

: Practical Examples from the Great East Japan Earthquake

EGAWA Akio

This paper discusses how important it is to quantitatively measure the severity of the damage caused by a serious natural disaster, and the state of restoration and reconstruction after the devastation has occurred. Efforts for quantitatively understanding the state of restoration were not observed in the government sector, even after the Great East Japan Earthquake had occurred. A private research institute established its indices measuring the state of restoration, but there was no visible evidence that government agencies had utilised them for policymaking or for policy assessment.

Promptly revising the checklist of statistics that look at the major concerns of disaster victims is necessary as restoration proceeds and government policy delivery becomes more focused on the reconstruction of cities. This paper presents a possible direction for the revision of existing methods of measurement. Three strategies for improvement of the government's policymaking methods can be identified. (1) A new index suitable for measuring the state of reconstruction at a prefectural level will need to be created in the current stage. (2) A government policy framework for utilising the index should be systematically established as a practice of the EBP. (3) The government should make a business continuation plan for statistical work, and develop guidelines for the treatment and generation of necessary statistics before the next severe disaster occurs, to ensure that the provision of data is therefore rapid and smooth.

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