The Evaluation of the Status of Disaster Areas by using Recovery Indicators (In the case of the Great Hanshin-Awaji Earthquake)

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Abstract

With large-scale earthquake disasters, long-term recovery programs come to be implemented over a wide area; hence, it should be necessary to conduct regular evaluations of the recovery status for each area and field. This study suggests that, based on various statistics data, the use of recovery indicators (R.I.) is effective for evaluating the recovery status in terms of objectivity and possible cross-sectional comparisons of varied fields.

The purpose of this study is to propose a method for evaluating the recovery status by using statistical data from the case study of the Great Hanshin-Awaji Earthquake, and to analyze, using such a method, the recovery status for the decade after the earthquake.

The method proposed in this study sets the R.I. for the following six fields: “population,” “housing,” “manufacturing,” “retailing,” “office,” and “tourism.” Here, these indicators are compared and analyzed using “the values before the earthquake,” “the average values in disaster areas,” “the average values in non-damaged areas of Hyogo prefecture,” or “the national/prefectural average values.”

The results reveal that the R.I. provide an effective method for comparing the recovery status of each different area and field and for evaluating effective recovery policies. For example, the results of the indicators analysis clarify that population, housing, and tourism have been recovering with time, while the gap caused by the earthquake in manufacturing and commerce is yet to be narrowed. This is because the businesses there have relocated to neighboring areas post-disaster, and more so because of the widening gap between manufacturing and commerce. In the future, it is necessary to clarify the effects on recovery, caused by the differences in the conditions of areas and days, by conducting further comparative studies with other disasters within and outside of Japan using these R.I.

Keywords: recovery indicator, the Great Hanshin-Awaji Earthquake, statistics, recovery process

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1. Introduction

1.1 Background

With large-scale earthquake disasters, long-term recovery programs come to be implemented over a wide area; hence, it should be necessary to conduct regular evaluations for the recovery status of each area and field. This study suggests that, based on various statistical data, the use of recovery indicators (R.I.) is effective for evaluating the recovery status in terms of objectivity and possible cross-sectional comparisons of varied fields.

After the Great Hanshin-Awaji Earthquake, several studies focused on the R.I. in certain specific fields such as housing and industry [1], with the exception of a few studies [2][3] that focused on a comprehensive analyses of regional recovery in multiple fields by using R.I. However, since these studies tended to use too many types of data and short term-data, like monthly statistics, their R.I. are rather complex for practical application.

1.2 Purpose

The purpose of this study is to propose a method for evaluating the recovery status for each area and field associated with the long-term implementation of recovery programs, using simple R.I. from the case of the Great Hanshin-Awaji Earthquake. Moreover, it uses the R.I. to analyze the recovery status for the decade following the Great Hanshin-Awaji Earthquake. Additionally, it aims to provide R.I. as the benchmark data needed to compare the recovery processes of other disasters with the recovery process of the Great Hanshin-Awaji Earthquake.

2. Method

This study considers ten cities and ten towns (as they existed back then) that were damaged by the Great Hanshin-Awaji Earthquake in 1995. These areas were eligible for the benefits received under the National Disaster Relief Act.

The method proposed in this study sets the R.I. for the following six fields: “population,” “housing,” “manufacturing,” “retailing,” “office,” and “tourism.” Here, these indicators are compared and analyzed using “the values before the Earthquake,” “the average values in disaster areas,” “the average values in non-damaged areas in Hyogo prefecture,” or “the national/prefectural average values.” Then, to investigate the differences in the recovery status of the damaged area, the author analyzed the radar charts of four fields in ten cities and nine wards of Kobe city. All indicators (except office vacancy rate) were converted according to the rule that the value just before the earthquake changes to 100.

Each R.I. should as far as possible satisfy the qualification that the indicators are stock or flow data that reflect stock conditions. Population and number of houses are types of stock
data. Manufacturing shipment value, retail sales, office vacancy rate, and number of tourists are types of flow data that reflect stock conditions. Since these indicators mainly depend on the preceding stock condition, they tend not to change suddenly or to a great extent. New housing starts represent, only the pure flow data for the housing field.

3. Time series analysis of the six fields in all the damaged areas

3.1 Population (Fig 1)

The earthquake resulted in a sudden drop of 4.0 points in population. An upturn in the population was noted in 1996. It took six years for the population to be recovered to the level that existed just before the earthquake. With regard to the pace of change in population, it took four years for the pace of change in population to be recovered to the pace that existed before the earthquake.

3.2 Housing (Fig 2)

In FY1995 and FY 1996 new housing starts increased to more than twice the level that preceded the earthquake. However, a sudden decrease was observed in FY1997 and FY1998. The impact of the earthquake was felt for three years.

3.3 Manufacturing (Fig 3)

Before the earthquake, three areas showed almost the same pace of change in terms of the manufacturing shipment value. However, the earthquake created a gap between the damaged and non-damaged areas. This gap had not been narrowed until 2005.

3.4 Retail (Fig 4)

Just like manufacturing, the earthquake created a gap between the damaged and non-damaged area in terms of retail sales. Even this gap continued until 2004.

3.5 Office (Fig 5)

Prior to the earthquake, the office vacancy rate in Kobe was higher than that in Osaka and lower than that in Kyoto. There was a temporary fall in the office vacancy rate in Kobe
just after the earthquake in 1995, because many office buildings were damaged and rendered useless. However, there was an increase in the office vacancy rate in Kobe after 1996, because the damaged buildings had been rebuilt and had grown in size. Unfortunately, this gap between Kobe and the other two cities continued until 2005.

3.6 Tourism (Fig 6)

Tourism, too, suffered as a result of the earthquake, and a sudden drop was noted in the number of tourists. Fortunately though, this number increased after 1996 and exceeded the preceding level in 1998. Two events, the opening of the Akashi Kaikyo Ohashi bridge in 1998 and the International Garden and Greenery Expo in Awaji in 2000, helped the recovery of tourism in the damaged areas.

3.7 Differences in the recovery speed between the fields

There were great differences in the recovery speed between the fields. Although, the R.I. of housing, population, and tourism had recovered within about five years to the levels that existed before the earthquake, those of industrial fields, retail, manufacturing and office, had not recovered for over ten years. In the industrial field, it was difficult to relocate businesses to the previously damaged areas after they had moved post-disaster. Therefore, to avoid industrial decline after a disaster, it is important to devise measures such as BCP (business continuity plan) under disaster management programs.
4. Regional recovery status analyses using R.I.

A periodic PDCA cycle (Plan-Do-Check-Action) is an important process in improving the recovery programs. It is possible to estimate the recovery gap between districts using the R.I. I analyzed the four fields of population, housing, manufacturing, and retail in ten different cities and nine wards of Kobe city by using radar charts.

Figure 7 provides an example of the radar charts; this figure shows the recovery status of Nishinomiya city. Population and housing had been recovered to more than the pre-disaster level and average level in damaged areas. Retail sales remained at a level less than the pre-disaster level, but more than the average level in damaged areas. Manufacturing shipment value was less than the pre-disaster level and less than the average level in damaged areas.

Table 1 shows the outline of the recovery status in ten cities and nine wards. Manufacturing and retail had not recovered to the pre-disaster levels, except for certain wards of Kobe. In particular, Nagata ward continued to remain below the pre-disaster or average levels in all the fields. In contrast, Kita and Nishi ward, which were only slightly damaged, had exceeded the pre-disaster and average levels in all the fields.

<table>
<thead>
<tr>
<th>Name of City</th>
<th>Name of Wards in Kobe city</th>
<th>Nishinomiya</th>
<th>Amagasaki</th>
<th>Sumoto</th>
<th>Miki</th>
<th>Nishinomiya</th>
<th>Takada</th>
<th>Kawanishi</th>
<th>Ashiya</th>
<th>Itami</th>
<th>Akashi</th>
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<tbody>
<tr>
<td>Population (2005/1994)</td>
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<tr>
<td>Number of Houses (2003/1993)</td>
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<td>Retail Sales (2004/1994)</td>
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<table>
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<tr>
<th>Name of City</th>
<th>Name of Wards in Kobe city</th>
<th>Nago</th>
<th>Hyogo</th>
<th>Suma</th>
<th>Tarumi</th>
<th>Chuo</th>
<th>Nada</th>
<th>Hagashi-Nada</th>
<th>Kita</th>
<th>Nishi</th>
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<tr>
<td>Number of Houses (2003/1993)</td>
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<tr>
<td>Retail Sales (2004/1994)</td>
<td><img src="image15.png" alt="" /> &gt; <img src="image16.png" alt="" /></td>
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ços: More than the pre-disaster level and more than the average level in the damaged areas.
△: More than the pre-disaster level and less than the average level in damaged areas.
×: Less than the pre-disaster level and less than the average level in damaged areas.

5. Conclusion

There are great differences in the recovery speed between fields and between areas. Recovery speeds in industrial fields are slower than those in “population,” “housing,” or “tourism.” Heavily damaged wards located in the west of Kobe city have not yet recovered in
each field. The R.I. proposed in this study are useful for analyzing and estimating the recovery process in various fields and comparing it with different areas.

It is possible to compare one disaster to another by using R.I. as a benchmark. For example, Figs 8 and 9 present the comparison between the disaster caused by the Unzen-Fugen volcano and the Great Hanshin-Awaji Earthquake. These comparative analyses are issues for the future.

![Fig. 8 Comparison of change in population](image1)

The R.I. are useful only for long time series analyses because some statistics of the R.I. are reported once in several years and because there are time lags between their investigation and publication.

Furthermore, these R.I. are only objective data. Therefore, they cannot reflect the victims’ emotions such as satisfaction with their physical or social environments. For the practical use of discussions about recovery programs, it is necessary to examine not only objective but also subjective indicators such as a questionnaire survey of victims [11].

### Notes

The idea of the recovery indicators was based on the commissioned survey “Survey and analysis of the recovery result of 10 years by using recovery indicators,” which was analyzed by Shohei Beniya et al. in the UFJ Institute (at that time) and published and commissioned by Hyogo prefecture in FY2005.

### References


[6] Industrial Statistics


[10][4], [6], [7] and Housing and Land Survey