Stakeholder Behavior in Disaster Risk Reduction at the Time of Rehabilitation and Reconstruction in Aceh

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Abstract. The Sendai Framework for Disaster Risk Reduction, which was adopted at the Third UN World Conference on Disaster Risk Reduction in March 2015, positions understanding disaster risk as one of the four priorities for action. Also, access to disaster risk information is regarded as one of its seven global targets. Furthermore, it is widely recognized that the enhancement of disaster preparedness has great significance for achieving what is termed as “build back better.” The key research question of this study is: how does stakeholder behavior in disaster risk reduction (DRR) differ at the time of rehabilitation and reconstruction in Aceh? Since many different types of stakeholders participated in the rehabilitation and reconstruction process, there might exist some gaps in their behaviors. This study adopts text mining analysis as the methodology to examine the content of publications issued by DRR stakeholders. The authors utilize KH Coder as the analysis software and examine the three major documents, all of which have described the situation of rehabilitation and reconstruction in Aceh during the period from 2005 to 2008. As a result, we found that the Executing Agency of Rehabilitation and Reconstruction for Aceh and Nias (BRR) and the ADB tended to stress similar words in their reports, whereas Oxfam International behaved in a different manner. This may stem from the nature of each organization and, thus, we considered that the existence of coordinators who are well acquainted with every aspect of reconstruction and rehabilitation is much needed.

1. Introduction
Aceh is one of the most devastated areas ravaged by the 2004 Indian Ocean Tsunami. Immediately after that event, the Executing Agency of Rehabilitation and Reconstruction for Aceh and Nias (BRR) was established in April 2005 for the purpose of rehabilitating and

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reconstructing the heavily affected areas. One of main tasks of BRR was coordinating the reconstruction program [1]. It was necessary for BRR to coordinate international and national agencies or NGOs because, during the rehabilitation and reconstruction process, there were several types of reconstruction programs; namely, these were donor-driven and community-driven reconstruction approaches [2]. A previous study examining the disaster risk reduction (DRR) policies and regulations in Aceh after the 2004 Indian Ocean Tsunami [3] states that there may be an issue regarding coordination among disaster stakeholders in Aceh. In addition, we can find other previous studies focusing on DRR stakeholder management and multi-level institutional arrangements [4-6]. Thus, we consider it worth investigating the stakeholder behavior in DRR at the time of the rehabilitation and reconstruction period in Aceh.

At the Third UN World Conference on Disaster Risk Reduction (UNWCDRR) held in March 2015 in Sendai City, Japan, the new framework referred to as the Sendai Framework for Disaster Risk Reduction 2015–2030 (SFDRR) was adopted by 187 UN member states [7]. Understanding disaster risk is positioned as one of the four priorities for action of the SFDRR (Priority 1). Also, access to disaster risk information is regarded as one of its seven global targets (Target G). In addition, it is widely recognized that the enhancement of disaster preparedness has great significance for achieving what is termed as “build back better,” which is also described in Priority 4 of the SFDRR. At the same time, Sasaki and Ono consider that the more objectively that SFDRR is installed, the more scientific analysis will be necessary to satisfy the request [8]. In the context of contributing to the progress of the SFDRR, this also has great significance in examining stakeholder behavior in DRR in a more scientific manner.

The key research question of this study is: how does stakeholder behavior in DRR differ at the time of rehabilitation and reconstruction in Aceh? Since many different types of stakeholders participated in the rehabilitation and reconstruction process, there might exist some gaps in their behaviors. The results of this study provide a clue for better coordination among DRR stakeholders.

2. Methodology

In this study, text mining analysis is conducted to examine the content of publications issued by DRR stakeholders. We can find several previous studies concerning DRR adopting the technique of text mining as methodology, such as [9,10]. Study [9] conducted a comparative analysis examining the three major UN documents regarding DRR; namely, the SFDRR, the Yokohama Strategy and Plan of Action for a Safer World, and the Hyogo Framework for Action 2005–2015, while study [10] analyzed the attitude within Asia-Pacific countries towards DRR through text mining of the official statements of the 2018 Asian Ministerial Conference on Disaster Risk Reduction (AMCDRR).

The authors utilize KH Coder (Version: 3.Alpha.13m) as the analysis software in this study. KH Coder adopts Stanford POS Tagger to extract words from English data, R for statistical analysis, and MySQL to organize and retrieve the data [11,12]. As with [10], we conduct four different methods of analyses, namely, word frequency list, hierarchical cluster analysis, co-occurrence network, and correspondence analysis. The word frequency list shows words in descending order of their frequencies. As a result of the list, we can see which words appear most frequently in the targeted text data. The hierarchical cluster analysis provides a figure called a “dendrogram”, indicating which classified group each word belongs to. The dendrogram implies the basic structure of words lying in the targeted text data. Meanwhile, the co-occurrence network visualizes the co-occurrence relations between words on a two-dimensional plane. The result is quite beneficial in that we can intuitively grasp the co-occurrence relations between words. The correspondence analysis helps us understand the appearance pattern of words. The words with a similar appearance pattern are supposed to be plotted in the same direction from the origin on a two-dimensional plane, where the tags of tabulating units representing each DRR stakeholder in this study are simultaneously plotted in a similar manner. More detailed explanations regarding the above four methods can be found in the KH Coder 3 Reference Manual [13].

The authors examine the following three major documents, all of which have described the situation of rehabilitation and reconstruction in Aceh during the period from 2005 to 2008, although the stance of each DRR stakeholder seems to be projected in the documents. The first one is the BRR book series published in 2009 by the BRR, which can be considered as the official body established for rehabilitation and reconstruction by the Indonesian government [1].
The second one is the completion report of the earthquake and tsunami emergency support project conducted by the ADB in 2011 [14]. Needless to say, the ADB can be regarded as a representative of international donor organizations. The third one is the tsunami evaluation series published by Oxfam International in 2009 [15]. In this study, the authors regard Oxfam International as an appropriate reference of non-governmental organizations (NGOs).

Eventually, the targeted text data are supposed to be converted from these three documents.

3. Results and Discussion

3.1. Word Frequency List

The top 20 words of each text data in descending order of their frequencies are listed in Table 1. A certain number of common words such as “reconstruction” and “house (housing)” appear in both the BRR book series and the ADB completion report, while different sorts of words such as “woman” and “gender” appear in the Oxfam tsunami evaluation series. This implies that the BRR and the ADB might move in a similar direction at the time of rehabilitation and reconstruction, whereas Oxfam might take a stance different from that of the above two DRR stakeholders. Thus, the word frequency list provides a good starting point for text mining; however, it should be noted that there is no information about the relationship between words in this list.

| Order | BRR book series       | ADB completion report | Oxfam tsunami evaluation series |
|-------|-----------------------|-----------------------|---------------------------------|
| 1     | ACEH                  | project               | Oxfam                           |
| 2     | BRR                   | component             | response                        |
| 3     | NIAS                  | ADB                   | evaluation                      |
| 4     | program               | Aceh                  | programme                       |
| 5     | government            | government            | International                    |
| 6     | community             | implementation        | tsunami                         |
| 7     | project               | provide               | partner                         |
| 8     | reconstruction        | community             | Review                          |
| 9     | local                 | BRR                   | woman                           |
| 10    | people                | support               | affiliate                        |
| 11    | disaster              | management            | Tsunami                         |
| 12    | development           | reconstruction        | staff                           |
| 13    | activity              | contract              | community                        |
| 14    | process               | agency                | gender                          |
| 15    | area                  | subproject            | country                         |
| 16    | village               | housing               | OI                              |
| 17    | house                 | service               | Fund                            |
| 18    | tsunami               | consultant            | livelihood                       |
| 19    | rehabilitation        | grant                 | shelter                         |
| 20    | construction          | road                  | provide                         |

3.2. Hierarchical Cluster Analysis

The result of the hierarchical cluster analysis is shown in Figure 1. As we can see, “ACEH” and
“NIAS” belong to the same cluster in the text data of the BRR book series. This indicates that the BRR focused on not only Aceh, but also Nias Island at the rehabilitation and reconstruction stage.

The bars on the left-hand side indicate the term frequency (TF) of each word [13].

Figure 1. Result of the hierarchical cluster analysis

Also, it should be noted that “ADB” and “BRR” compose a cluster in the text data of the ADB.
completion report. It is implied that the ADB was conscious of the BRR and, thus, there exist many descriptions regarding the BRR in their report. Meanwhile, a cluster is composed of “woman” and “livelihood” in the text data of the Oxfam tsunami evaluation series. We conjecture that Oxfam adopted a perspective of inclusion for their effort devoted to rehabilitation and reconstruction.

3.3. Co-occurrence Network

The result of the co-occurrence network is described in Figure 2. We can confirm that the BRR spotlighted Nias Island as well as Aceh at the rehabilitation and reconstruction stage when we look at the upper side in the figure of the BRR book series. Also, we found that “ADB” co-occurred with “BRR” as well as “project,” “management,” and “implementation.” This implies that the ADB was conscious of the BRR as the result of the hierarchical cluster analysis also indicates, and furthermore, these two DRR stakeholders, namely the BRR and the ADB, collaborated with each other to manage and implement the project concerning rehabilitation and reconstruction. In addition, we can also confirm that Oxfam might have a different perspective from the above two DRR stakeholders since several characteristic words such as “woman,” “gender,” “livelihood,” and “response” appear in its co-occurrence network.
3.4. Correspondence Analysis

The result of the correspondence analysis is displayed in Figure 3. In the correspondence analysis, all of the three text data that have been examined separately in the above analyses so far are merged into one text file tagged with the names of the three DRR stakeholders, namely, the BRR, the ADB, and Oxfam. In the output figure, each dimension is considered as a result of a dimension reduction procedure, which decreases the number of dimensions of text data while minimizing a loss of information. As already mentioned, the words with a similar appearance pattern are plotted in the same direction from the origin on a two-dimensional plane; however, the distance between words is not explicitly defined. When we look at the figure, we find that “BRR” is plotted near the origin, while the ADB (on the upper left) and Oxfam (on the lower right) are plotted apart from the origin and in a different direction. This implies that the word appearance clearly differed by text data. Furthermore, the words plotted in the same direction as “ADB” such as “component” and “implementation” can be considered to be characteristic of the ADB completion report. Similarly, those for “Oxfam” such as “response” and “gender” can be regarded as the featured words in the Oxfam tsunami evaluation series.
4. Conclusions
Based on the above results, we concluded that the BRR and the ADB tended to put stress on similar words in their reports, whereas Oxfam behaved in a different manner. More specifically, the BRR and the ADB seem to focus on tangible aspects represented by the related words such as “reconstruction” and “house (housing),” while Oxfam appears to have paid more attention to an intangible aspect such as “livelihood” and “gender.” This may stem from the nature of each organization and, thus, we think that the existence of coordinators well acquainted with every aspect of reconstruction and rehabilitation is much needed.

The future research will be two-fold: one is to examine more text data other than the official report published by the DRR stakeholder. That is to say, other sorts of publications such as newspapers and academic journals might have more information to be analyzed than official publications. Furthermore, publications in the Indonesian language should be investigated in the future. The other is to analyze who can be a good coordinator at the time of rehabilitation and reconstruction. Under the existing conditions, the UN Office for the Coordination of Humanitarian Affairs (OCHA) has a mandate to take action immediately after a disaster occurs. However, considering a finding of this study that each DRR stakeholder may behave from a different perspective at the time of rehabilitation and reconstruction, it is of great significance that there exist some local coordinators, such as the university in the affected area, which have a firm understanding of local conditions and can devote their resources to the rehabilitation and reconstruction process.

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