A Media Information Analysis for Implementing Effective Countermeasure against Harmful Rumor

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Abstract. When large scale earthquake occurred, the word of “harmful rumor” came to be frequently heard. The harmful rumor means an economic damage which is caused by the action that people regard actually safe foods or areas as dangerous and then abort consumption or sightseeing. In the case of harmful rumor caused by earthquake, especially, tourism industry receives massive economic damage. Currently, harmful rumor which gives substantial economic damage have become serious social issue which must be solved. In this paper, we propose a countermeasure method for harmful rumor on the basis of media trend in order to implement speedy recovery from harmful rumor. Here, we investigate the amount and content of information which is transmitted to the general public by the media when an earthquake occurred. In addition, the media information in three earthquakes is treated as instance. Finally, we discuss an effective countermeasure method for dispelling harmful rumor through these analysis results.

1. Introduction
Several large earthquakes have occurred in Japan for the past few years, and they have given serious damage to various regions. For example, the 2007 Chuetsu Offshore Earthquake is included as the earthquake which is fresh in one’s memory.

When large scale earthquake occurred, the word of “harmful rumor” came to be frequently heard. The harmful rumor means an economic damage which is caused by the action that people regard actually safe foods or areas as dangerous and then abort consumption or sightseeing [1]. In the case of earthquake, especially, the harmful rumor often arises in tourism industry. Currently, harmful rumor which gives substantial economic damage to neighboring tourism area which does not have physical damage around disaster-stricken area have become serious social issue which must be solved because harmful rumor gives bad influence to the revival of disaster-stricken area.

Despite this, the problem of harmful rumor is not supported by the laws or statutes of Japan government [2]. Moreover, academic studies on harmful rumor and its countermeasure are few. Therefore, the people who receives harmful rumor have to carry out the countermeasure through trial and error [3]. For this reason, the establishment of effective countermeasure for realizing early recovery from harmful rumor is required immediately.
It is obvious that the information transmitted to the general public by the media is included as one of major causes for the occurrence and expansion of harmful rumor. Immediately after the occurrence of earthquake, the biased information such as the earthquake magnitude and serious damage condition in disaster-stricken areas is transmitted to the general public. The biased information is reported by various media such as newspaper and web all the time. The general public misunderstand that neighboring sightseeing areas which do not actually receive damage have physical damages as serious as the disaster-stricken areas by looking at or hearing the biased coverage.

It is likely that the effect of countermeasure of harmful rumor depends on the media condition because the occurrence and expansion of harmful rumor relates to the media information. Therefore, the countermeasure for harmful rumor must be performed in consideration of the condition of media information [4]. Namely, sufficient effect of countermeasure may not be obtained event if the countermeasure is conducted in the biased condition that the media transmits only devastating damage aspects. It seems reasonable to suppose that the countermeasure should be performed when the media condition became appropriate condition that the coverage which give bad influence against sightseeing blows over. However, the studies on the countermeasure for harmful rumor based on the media trend have been not performed.

In this paper, we propose a countermeasure method for harmful rumor on the basis of media trend in order to implement speedy recovery from harmful rumor. In our research, first, we investigate the amount and contents of information which is transmitted to the general public by the media when an earthquake occurred. Here, we employ newspaper and web news as investigation target. Newspaper has a feature which can transmit the information to the wide range of age, while web news has a feature that the circulation of information is speedy. We also analyze the difference among two medium which have different character. Additionally, we perform classification of the information reported by each media. In this classification, the information is classified on the basis of whether the article gives bad influence to sightseeing or not. The temporal alterations in these analyses is examined.

These analyses are applied to three earthquake disasters which have recently occurred in Japan. Their earthquakes are “2007 Noto Earthquake”, “2007 Niigata Chuctsu Offshore Earthquake” and “2008 Iwate-Miyagi Nairiku Earthquake”. They were the earthquakes which gave serious physical damage to cities near seismic center. On the other hand, in these earthquakes, the sightseeing areas which are located comparatively near their disaster-stricken areas and do not almost have physical damage received harmful rumor. We reveal the relationship among media information, physical damage and harmful rumor through the analysis of media information in these earthquakes.

Finally, we discuss an effective countermeasure method for dispelling harmful rumor through these analysis results.

2. Harmful Rumor
2.1. Outline of Harmful Rumor
When affair, trouble and disaster occurred, the fact is extensively reported by various media. The general public hears and sees the report, and then stop consumption or tourism because they regard the fundamentally safe product or area as dangerous. The word of "Harmful rumor" currently used indicates an economic damage which is caused by such behavior of the general public. Especially, inaccurate reports and exaggerated reports expands harmful rumor, and then the magnitude of damage of harmful rumor becomes huge. However, the report by media does not have all source of harmful rumor. Harmful rumor is also generated by the problem on the side of the receiver of information even if media transmitted accurate information. The trouble of Chinese-made poisoned frozen dumpling which occurred in Japan is included as such example.

A health hazard of food poisoning occurred on January 2008 in Chiba prefecture of Japan.
After investigation, the poison used for bug killer was detected from Chinese-made frozen meat dumpling which was eaten as a meal. Many patients complaining of food poisoning appeared on various region in Japan after the coverage of this food poisoning. However, there was no patients having a food poisoning caused by the poison which is used for the bug killer. Due to this coverage, not only Chinese-made other frozen food did receive harmful rumor, but also Japanese food maker treating frozen food, and the restaurant of Chinese food received economic damage.

In this affair, the report that a Chinese-made frozen meat dumpling is dangerous was transmitted to the general public. Ordinarily, the general public ought to understand that a meat dumpling made by a specific Chinese food maker is dangerous. However, the general public thought that all Chinese-made food and all meat dumpling which does not almost have the relationship is dangerous. Harmful rumor is generated by an extended interpretation by the receiver of information even if the media reports detailed information. It is actually impossible to prevent the occurrence of harmful rumor because it is difficult to completely remove the ambiguity from the information and coverage. Therefore, a risk management for harmful rumor is required.

2.2. Harmful Rumor by Earthquake
The same may be said of harmful rumor caused by earthquake. When earthquake happened, each media intensively perform the coverage about the area which received heavy damage. Therefore, it is likely that the general public misunderstands the scale of damage in the area. Namely, the scale of damage is recognized greater than actual situation. Moreover, the general public can guess the rough location of area which received damage. However, it is difficult to accurately guess the range of damage area from contents of coverage. Thus, the general public misunderstands that the damage area is wider than actual damage region. As these results, the general public misunderstand that earthquake gave immense damage to wide range.

Harmful rumor by earthquake gives immense economic damage to local economy. Enormous cost is required for the revival of the area which received physical damage. However, in the area which was saved from physical damage, tourism industry receives considerable economic damage. The income from tourism industry is cut off. As these results, the local economy is confused. The vicious circle is generated that the recovery of disaster-stricken area becomes sluggish and harmful rumor extend over a long period of time. However, the study on harmful rumor which is generated by earthquake has been few. Consequently, the countermeasure of harmful rumor has been performed through trial and error. Currently, the establishment of effective countermeasure for harmful rumor is demanded.

3. Countermeasure for Harmful Rumor on the basis of Media Trend
It is important to perform the countermeasure which can realize early recovery from harmful rumor because it is difficult to prevent harmful rumor from being generated. Therefore, it is required to perform public relations activities for attracting tourists by providing information to consumers.

The trend of the information transmitted by media should be checked when such countermeasure is performed. Tourists are easily influenced by the information transmitted by media. Namely, it is obvious that tourists restrain visiting to neighboring area around disaster-stricken area while the media transmits biased coverage of disaster related information such as damage condition. Even if the countermeasure for harmful rumor was performed in the period when the biased coverage is transmitted, enough effect can not be obtained. Moreover, it is likely that the general public has doubt about the countermeasure activity and the countermeasure has the opposite effect. As time advances, the number of disaster related information decreases, and the contents of coverage change from the situation of damage to the situation of restoration.
It is possible to get enough effect without the obstruction by disaster related information, if the countermeasure for harmful rumor is put into practice during such period.

When the condition of media changed for the better, the enforcement of countermeasure for harmful rumor which utilize the media is effective. The appropriate countermeasure using the media in the period which biased condition in media blows over can promote tourism activity of consumer because consumer is easily influenced by the media.

So far, various countermeasures such as public relations activity on the street have been performed in order to wipe out harmful rumor. However, there were many countermeasures which had no effect because they were executed while the media extensively transmitted the biased information about the situation of disaster.

Therefore, firstly, it is necessary to grasp the trend of disaster related information transmitted by the media, and then clarify the period which can sufficiently obtain the effect of countermeasure. In addition, the discussion about the contents of effective countermeasure activity in such period is needed.

In this research, we investigate and analyze the coverage of the media in three earthquakes which recently occurred in Japan. In addition, we investigate the relationship between damage situation and media coverage, and grasp the trend of media. The contents and start period of countermeasure is discussed on the basis of the analysis results. From our achievement, the countermeasure based on the media trend can be implemented, and harmful rumor in the tourism area around disaster-stricken area can be effectively wiped out in comparison with the case that the countermeasure through trial and error is performed.

4. Target Earthquakes for Media Information Analysis

4.1. 2007 Noto Earthquake

The 2007 Noto Earthquake is a massive earthquake which occurred in 25th March, 2007. The Noto is a peninsula which is located on the side of Sea of Japan (See Figure 1). Almost whole area of peninsula belongs to the Ishikawa prefecture. The seismic center is the Sea of Japan near Noto peninsula. On the Richter scale, the magnitude of the earthquake was estimated at 6.9. The earthquake shook the city of Nanao and the town of Anamizu on the Ishikawa prefecture with a seismic intensity of 6 upper in Japan’s shindo scale. The earthquake brought down great damage to many cities and towns in the Ishikawa prefecture and the Toyama prefecture which is neighboring prefecture of Ishikawa prefecture. At least, 1 dead and 279 injured in the Ishikawa and the Toyama prefectures have been reported as human sufferings. As physical damage, 649 completely destroyed houses and 26,614 partly destroyed houses have been reported. The lifeline utilities, e.g., electricity, water, gas supplies and so on, were destroyed. In addition, all railways in this area stopped. In this earthquake, harmful rumor happened in many tourist resorts in Ishikawa prefecture. For instance, in the Wakura Hot-spring resort in Ishikawa prefecture, there were 66,413 lodging cancellations in hotels during a month from the earthquake occurrence. The Wajima City of Ishikawa prefecture had 15,526 lodging cancellations in hotels. Moreover, the sales related to tourism decreased 20% in Kaga Hot-spring resorts in Ishikawa prefecture which received almost no physical damage and is far from the seismic center.

4.2. 2007 Niitaga Chuetsu Offshore Earthquake

The 2007 Niitaga Chuetsu Offshore Earthquake (described as the 2007 Niitaga Earthquake) occurred in 16th July, 2007. Niigata prefecture is located on the side of the Sea of Japan (See Figure 1). Chuetsu is the center area in three areas of Niigata prefecture. The seismic center is the Sea of Japan off the coast of Chuetsu. The magnitude of the earthquake was estimated at 6.8. The city of Kashiwazaki and Nagaoka and the villages of Kariwa registered the highest seismic intensity of 6 upper on Japan’s shindo scale. Fifteen deaths and at least 2,315 injuries have been reported. In addition, 1,319 buildings were completely destroyed and 40,280 buildings
were partly destroyed. The lifeline utilities and various transport facilities have been broken down. Furthermore, a remarkable damage happened in this earthquake. It is Kashiwazaki-Kariya Nuclear Power Plant incidents. A fire broke out in an electrical transformer at the Kashiwazaki-Kariwa Nuclear Power Plant. A leak of radioactive gases happened by this. Many tourist resorts in the Niigata prefecture were hard hit by harmful rumor due to fears relating to the plant accident. For example, it was reported that the number of hotel guests in whole of hot spring resorts in the Niigata prefecture decreased 40%.

4.3. 2008 Iwate-Miyagi Nairiku Earthquake
The 2008 Iwate-Miyagi Nairiku Earthquake (described as the 2008 Iwate Earthquake) occurred in 14th June, 2008. Iwate and Miyagi is one of prefectures in Japan, the seismic center was border between these prefectures. The magnitude of the earthquake was estimated at 7.2. The city of Oshu and Kurihara registered the highest seismic intensity of 6 upper on Japan’s shindo scale. Thirteen deaths and 448 injured have been reported as human sufferings. In addition, 23 buildings were completely destroyed and 1,155 buildings were partly destroyed. In this earthquake, massive landslide occurred around the seismic center. Some rivers were dammed by mudslide, and then some landslide dams were generated. There was a fear that secondary disaster happens by the collapse of landslide dams. On the other hand, urban area did not almost receive physical damage because the seismic center was mountain region.

Many reservations for tourism were canceled in many cities and tourist resorts in the prefectures around the seismic center although there was almost no damage in urban area. As one misfortune followed another, a big earthquake which was 6 upper on Japan’s shindo scale happened after one month. By this earthquake, tourism industry in the region around seismic center received extensive damage by harmful rumor.

Figure 1. Position where earthquakes occurred
5. Media Information Analysis

5.1. Analysis Method

We collected the information related to each earthquake in two kinds of media. One is newspaper and another is online news website (described as web news) which is managed by newspaper publishing company. In each earthquake, we collected the articles related to earthquake from five newspapers. They are four national newspapers which are Asahi Shinbun, Yomiuri Shinbun, Nihon Keizai Shinbun and Mainichi Shinbun, and a local newspaper which is Hokkaido Shinbun. In the analysis of web news, we used two websites for 2007 Noto Earthquake, three websites for 2007 Niigata Earthquake, and five websites for the 2008 Iwate Earthquake, respectively. We collected the articles from CHUNICHI Web (http://www.chunichi.co.jp/) and YOMIURI Online (http://www.yomiuri.co.jp/) in the 2007 Noto Earthquake. In the 2007 Niigata Earthquake, we collected the articles related to earthquake from MSN Sankei News (http://sankei.jp.msn.com/), Niigata-Nippo Online (http://www.niigata-nippo.co.jp/) and YOMIURI Online. Finally, in the 2008 Iwate Earthquake, the articles were collected from MSN Sankei, Mainichi JP, KAHOKU ONLINE NETWORK (http://www.kahoku.co.jp/), CHUNICHI Online and YOMIURI Online. YOMIURI Online, MSN Sankei News, Mainichi JP are online news website managed by national newspaper publishing company in Japan, and CHUNICHI Web, Niigata-Nippo Online and KAHOKU ONLINE NETWORK are online news website for local newspaper publishing company. In this collection, we treated the articles including the name of the earthquake as the disaster related information. The period to collect the articles was 50 days from the occurrence of each earthquake.

We investigated the information amount in newspaper and web news. Here, we used the area of articles as the information amount in newspaper. And, we used the number of articles as the information amount in web news. Moreover, we analyzed the contents of articles collected from both media. In this contents analysis, we classified the articles into three categories on the basis of whether it gives avoidance emotion to the general public against sightseeing or not. The articles giving avoidance emotion to the public are classified into “−” category. For example, the articles which the situation of damage and the number of deaths are reported are included in this category. The articles which alleviate avoidance emotion are classified into “+” category. This category include the articles about the public relations activity and the advance of revival. Finally, the articles which do not relate to avoidance emotion are classified into “0” category. The articles which report the movement of economy and politics related to the occurrence of earthquake are included in this category.

5.2. Analysis Result

Figure 2 indicates the transition of information amount in newspaper for three earthquakes. In this figure, the x-axis means the number of days after the occurrence of earthquake, and the y-axis means the total size of articles published with five newspapers. As shown in this figure, the information amount in the 2007 Noto Earthquake remarkably decreased during 3 days from the occurrence of earthquake, and the amount did not increase after this. In the case of 2007 Noto Earthquake, property damage happened over wide range, but human suffering was few. It is likely that the amount of coverage decreased because of the lack of fresh information. In the case of 2007 Niigata Earthquake, the amount of information increased after one week and after one month of the earthquake occurrence, and the amount did not increase after this. The increase after 48 days is exception because the reason of this increase was caused by tourism public relations advertisement published by government. In this earthquake, the prolonged coverage was performed. We can be fairly certain that the prolonged coverage was performed because this earthquake had the characteristic damage, e.g., the accident in nuclear power plant and the stoppage of car manufacture which give also bad influence to other area. Finally, in the 2008 Iwate Earthquake, the information amount remarkably increased after one week of the
occurrence. The damage in this earthquake concentrated to narrow area of mountain-ringed region, and the neighboring urban area did not almost receive physical damage. However, human suffering was higher than the 2007 Noto Earthquake, and the rescue operation of the sufferers had hard going. The summary of situation of damage was reported after one week of the occurrence. As compared with three results, in the case where the coverage extends over a long period of time, it was found that the summary of earthquake disaster was reported. In addition, it was revealed that the continuity of coverage depends on the scale and feature of damage in earthquake.

We analyzed the appropriate period for performing the countermeasure for harmful rumor from the result of information amount. We regarded as calm state of media the situation that the information amount is adequately low value and does not rapidly increase again. From the results, we judged that the appropriate period was one week after the occurrence in the 2007 Noto Earthquake, the period in the 2007 Niigata Earthquake was after one month, and the period in 2008 Iwate Earthquake was after 10 days, respectively.

Results of contents analysis in newspaper for three earthquakes are represented in Figure 3, 4 and 5. These figures show the ratio of the information amount in each category. In Figure 3, the situation of contents of newspapers in the 2007 Noto Earthquake can be divided into three periods on the basis of the ratio on each category. First period is a time between the day of occurrence and one week after. Second period is a time between one week and about three weeks
after from the occurrence. Final period is after three weeks from the occurrence. In the first period, the ratio of “-” category was continuously high, and then the ratios except “+” category had large oscillation in second period. In final period, the ratios of all categories had large oscillation. As shown in Figure 4, the result of the contents analysis could be also divided into three periods in the 2007 Niigata Earthquake. In the first period, i.e., until after four weeks of the earthquake occurrence, the ratio of “-” category was high, and then the ratio of “0” category came high in second period, i.e., during two weeks after the end of first period. After this, the ratio of each category had large oscillation. In the 2008 Iwate Earthquake, the result can be divided into the five periods on the basis of the ratio on each category. The situation that the ratio of “-” was large continued during one week from the occurrence of earthquake. After this, the ratios except “+” had oscillation until after three weeks of the occurrence. The three ratios had oscillation until after four weeks, and then the ratio of “-” increased again. Finally, three ratios had oscillation again from after four weeks half of the occurrence. From these results, we judge calm period of the media information from the contents point of view. Here, we regarded as the calm period of contents in the disaster related information the situations that the ratio of “-” category is low and the ratio of “+” category emerges. In addition, this calm period is judged with the consideration of continuity of the ratio in each category. As this result, it was revealed that it was three weeks half after in the 2007 Noto Earthquake, six weeks later in the 2007
Figure 10. Summarized result of appropriate period for countermeasure

Niigata Earthquake, and four weeks half after in the 2008 Iwate Earthquake, respectively. As the appropriate period for countermeasure of harmful rumor, it is likely that the calm situation of media information needs to be confirmed in both aspects of amount and contents. Therefore, in the analysis results of newspaper, the appropriate period for countermeasure of harmful rumor corresponded with the calm period of contents.

Figure 6 shows the transition of information amount in web news. In this figure, the average number of articles per one website is represented. Although three earthquakes happened in the morning, the maximum value of information amount emerged on the day of occurrence in the 2008 Iwate Earthquake, and emerged on the next day of occurrence in other earthquakes. This difference depends on the time required to confirm whole of damage in earthquake. The 2007 Noto Earthquake and 2007 Niigata Earthquake caused damage over large areas. Therefore, the maximum value emerged on the next day of the occurrence because it took long time to investigate a whole of damage situation. On the other hand, in the 2008 Iwate Earthquake, the confirmation of damage situation was smoothly performed because damage area concentrated to narrow area of the mountain range. Thus, the maximum value was confirmed on the day of the occurrence. Although the trend of information amount in three earthquakes was different until two weeks after the occurrence of earthquake, the slow decrease trend could be found in all after this. This means that disaster related information on web news was calm by two weeks. Judging from information amount, the calm period for media information was after two weeks of the occurrence.

Figure 7, 8 and 9 indicates the result of contents analysis in web news for three earthquakes. When the calm period of contents in media information is regarded as the situations that the ratio of “-” category is low and the ratio of “+” category emerges, it was found that the period was after three weeks of the occurrence in the 2007 Noto Earthquake. For remaining two earthquakes, it was four weeks later. The appropriate timing for the countermeasure of harmful rumor corresponded with the calm period of content as in the result of newspaper, because the biased condition in both of amount and contents must be blown over.

Figure 10 shows the summarized result of appropriate period for countermeasure of harmful rumor in three earthquake.

6. Discussion
We discuss the countermeasure method using each media for harmful rumor on the basis of the analysis results.

The newspaper has the characteristics that the article having large area attracts
someone’s attention, and it is difficult for article to be published if it does not have high topicality. Therefore, as the countermeasure using newspaper, the insertion of public relations advertisement which has enough wide area to attract a great deal of attention in the calm period of media which enough effect of the countermeasure is expected is one of effective methods. The advertising activity can be imprinted to the general public without being obstructed by news which give bad influence to sightseeing. Such countermeasure can remove negative impression of visiting the tourism spot around disaster-stricken area and can give positive impression for tourism to the general public. Moreover, the effect to the people of all ages is expected because newspaper is read by various people.

In web news, it is likely that events and affairs are published as the articles for news website even if they do not have high topicality. In addition, they are reported promptly on the website. Therefore, the enforcement of lively public relations activity after calm period of media information is effective method as the countermeasure using web news. By performing such countermeasure, the effect of public relations activity can be obtained firstly, and then the ripple effect by the publication of the article to news website can be expected.

Moreover, the harmful rumor by earthquake is concerned to the factor of hesitating to go sightseeing near disaster-stricken area even if the tourism area is safe. Therefore, it is required to clarify to the general public that sightseeing to the tourism area contributes to smooth rehabilitation of the disaster-stricken area.

7. Conclusion

In this paper, we proposed a countermeasure method for harmful rumor on the basis of the trend of disaster related information in order to realize early recovery from harmful rumor. To implement our countermeasure method, we analyzed the disaster related information of newspaper and web news in three earthquakes, from the information amount and content points of view. From the analysis results of disaster related information on newspaper, the calm period of media which is suitable for starting the countermeasure for harmful rumor could be confirmed after 3 weeks from the occurrence of earthquake in early case. The calm period was after 6 weeks in late case. On the other hand, from the analysis results of web news, it was revealed that the calm period of media was after 3 weeks in early case and it was 5 weeks in late case. The analysis results indicated that the result of contents analysis was more important to the starting period of countermeasure. However, the content analysis requires higher cost in comparison with the amount analysis. Therefore, in order to realize a low cost and real time analysis for the countermeasure of harmful rumor, the relationship between amount and content must be clarified. In addition, the implementation of the prediction of media trend based on the scale and feature of physical damage is required in order to realize the effective countermeasure for harmful rumor.

In the contents analysis, the disaster related information was classified by the criteria which we decided in advance. Namely, it was not completely objective classification. Therefore, we plan to implement completely objective analysis by employing text-mining approach for contents analysis.

Moreover, in this research, we discussed the countermeasure method of harmful rumor using the media. We judged that publishing public relations advertisement having a lot of space is effective as the countermeasure method using newspaper because newspaper has limitation for publishing space. As the countermeasure using web news, the enforcement of many public relations activities is effective because web news posts report about an event even if it is not impactful. We plan to investigate more detailed contents and effect of public relations activity by performing the hearing investigation in the area which received harmful rumor generated by earthquake. These are our future work.
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