

Analyzing Disaster Mitigation Policies in Japan and China from an Eco-DRR Perspective: A Comparative Study of Shanghai and Tokyo

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Abstract: Global climate change-induced natural disasters require international efforts and the adoption of Eco-Disaster Risk Reduction (Eco-DRR) policies for sustainable development. This study examines the status of Eco-DRR in disaster prevention policies through word cloud analysis, providing insights for policymakers to enhance disaster prevention amid increasing climate-related challenges. Tokyo and Japan prioritize soft aspects, while Shanghai and China emphasize engineering for flood prevention, revealing a gap in Eco-DRR application. Despite these differing approaches, the shared focus on water-related disasters indicates a shift towards urban resilience. Future research should assess policy effectiveness and the impact of Eco-DRR on disaster risk reduction and ecosystem protection.

Keywords: Disaster; Policy; Eco-DRR; Word-cloud

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1. Introduction

In recent years, the frequency of natural disasters has increased due to global climate change, with significant impacts on human health, including outbreaks of pandemics and infectious diseases^[1]. Extreme weather events, such as tropical cyclones, winter blizzards, heat waves, tornadoes, floods, and droughts, have resulted in numerous fatalities and substantial property damage^[2]. The negative impact on economic growth, particularly in developing countries, emphasizes the urgent need for mitigation and adaptation policies^[3]. Climate change-induced disasters occur more frequently and with greater intensity, amplifying social challenges^[4].

Large cities, especially those affected by heavy rainfall and flooding, have experienced a surge in natural disasters due to global climate change. The substantial impacts on urban areas and resident safety necessitate comprehensive research. Studies have indicated that urban flood disasters caused by heavy rain pose significant threats, leading to disruptions in traffic and jeopardizing life and property safety^[5]. Various countries have introduced countermeasures against natural disasters, and international efforts, such as the International Decade for Natural Disaster Reduction (IDNDR) and the International Strategy for Disaster Reduction (ISDR), aim to

reduce disaster-related risks ^[6].

In recent years, various countries have gradually implemented Eco-Disaster Risk Reduction (Eco-DRR) policies to address the adverse effects of climate change and promote sustainable development. African nations like Mozambique, South Africa, and Zimbabwe have introduced Renewable Energy (RE) policies as alternatives to conventional energy sources, which contribute to high carbon emissions ^[7]. Additionally, Asian countries, including leaders like Japan and followers like China, have established and implemented eco-innovation policies to foster sustainable development and eco-innovation ^[8]. Furthermore, international lenders have assisted Eurozone governments in economic difficulty, specifying conditions in Memoranda of Understanding (MoU) that focus on economic adjustment policies, which have been largely implemented and resilient across all countries ^[9].

Despite these advancements, there is a scarcity of research on the status of Eco-DRR within existing disaster policies. This study aims to conduct an in-depth word cloud analysis of the Eco-DRR component within existing disaster policies. The objective is twofold: first, to determine the direction of Eco-DRR implementation in each country and to identify the disaster prevention concerns of China and Japan, and second, to use policy text analysis to highlight the gaps in academic research concerning current disaster prevention strategies. Word clouds will be generated by visualizing the keywords and phrases extracted from policy documents using word cloud analysis. In seeking to achieve more effective and sustainable disaster prevention management, this study hopes to serve as a valuable resource for those involved in developing and implementing disaster prevention policies, urging them to prioritize Eco-DRR in their endeavors.

2. Method

This study focuses on representative large cities of similar size that face the threats of disasters, along with national disaster prevention policy documents in China and Japan. The selected cities for this study are Shanghai and Tokyo, with a combined major urban area of approximately 600 square kilometers for Shanghai and Tokyo's 23 wards. The most recent national policy documents, namely the "Fourteenth Five-Year Plan for Comprehensive Disaster Prevention and Reduction" published by China's National Disaster Prevention and Reduction Agency, and the "Basic Plan for Disaster Prevention" issued by Japan's Central Conference on Disaster Prevention, are utilized in this study.

Data sources for this study include the 2011 Shanghai Municipal Flood Control Regulations and the 2011 Tokyo Metropolitan Disaster Countermeasures Guidelines issued by the Tokyo Metropolitan Government, representing the region. Employing the R analysis method and drawing on prior studies on word frequency analysis of policies ^[10,11], various R language tools, such as "word-cloud", "tm", and "tidy-text", were used to extract word frequencies from these documents and analyze the resulting word cloud. Through the use of these diverse data sources and specialized techniques, an in-depth investigation into the potential and value of these studies was conducted, addressing the issues of disaster prevention and mitigation from a more comprehensive and multi-level perspective.

3. Result

3.1. Word frequency result about analysis of disaster prevention policy in Japan

Figure 1 shows that "disaster" and "disasters" together are the most frequent words with a total of 125 occurrences. "Measures" appeared 50 times, followed by "local" (47 times), "public" (45 times), "evacuation" and "information" (44 times each), "government" (41 times), "ministry" (37 times), "transport" (34 times),

“water” (33 times), “activities” (32 times) and “management” (31 times). These word frequency data allow for the inference that the policy document focuses on response to disasters, including natural hazards and emergencies, with an emphasis on local government and public participation and the need for collaboration between government departments, as well as attention to transport and water resource management and a variety of disaster preparedness and management activities.

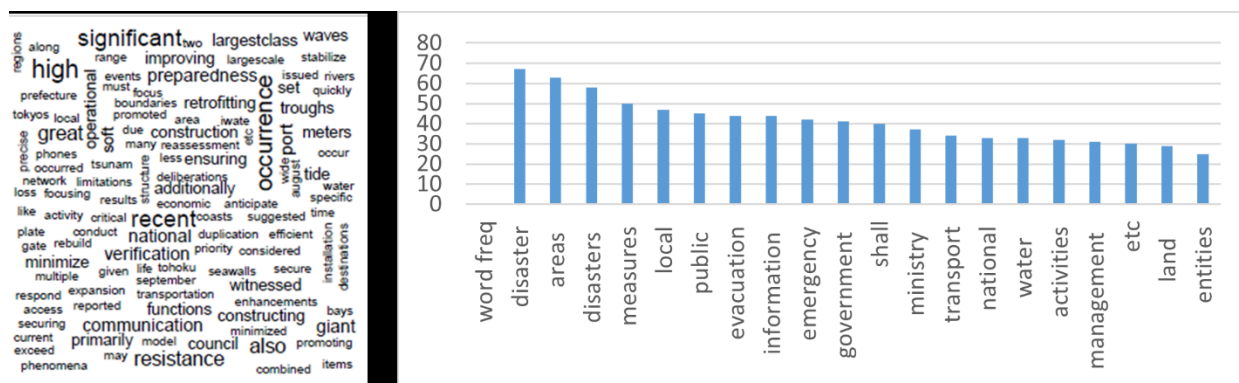


Figure 1. Word frequency analysis of Japan’s disaster prevention policy

3.2. Word frequency result about analysis of disaster prevention policy in Tokyo

Figure 2 shows that “damage” is the most frequent word with a total appearance of 22 times, followed by “tsunamis” (16 times) and “measures” and “earthquake” (15 times each). “Disaster” and “tsunami” appeared 11 times each, while other words such as “Tokyo,” “assumptions,” “earthquakes,” and “based” appeared 10 times each. Words such as “committee,” “facilities,” and “countermeasures” appeared 8 times, whereas “evacuation” and “prevention” appeared 7 times.

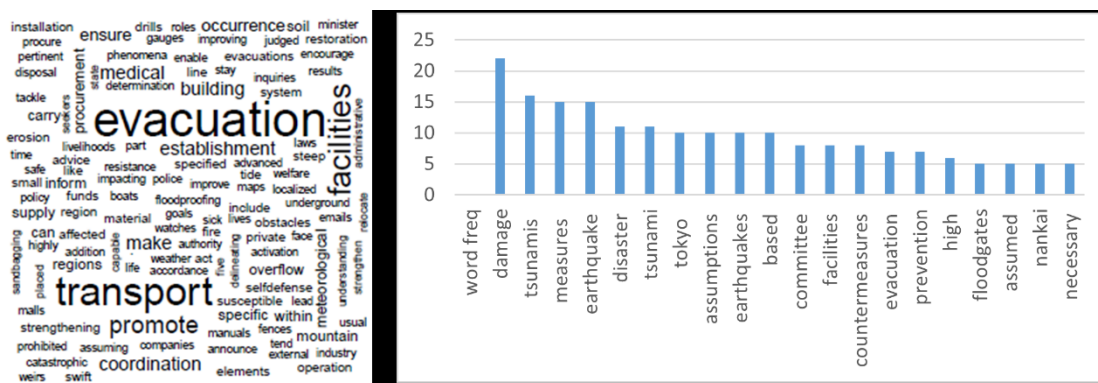


Figure 2. Word frequency analysis of Tokyo disaster prevention policy

3.3. Word frequency result about analysis of disaster prevention policy in China

Figure 3 shows that “disaster” and associated phrases were used 242 times, “emergency” was mentioned 165 times, and “prevention” was mentioned 128 times. Other words such as “comprehensive” (70 times), “national” (68 times), “rescue” (66 times), “reduction” (62 times), “system” (61 times), “natural” (59 times), “construction” (52 times), “risk” and “development” (51 times each), “control” and “disasters” (46 times each), “equipment” and “management” (44 times), “establish” (43 times), “response” (42 times), “improve” (39 times), and “teams” (37 times) had appeared frequently in China’s disaster prevention policy.

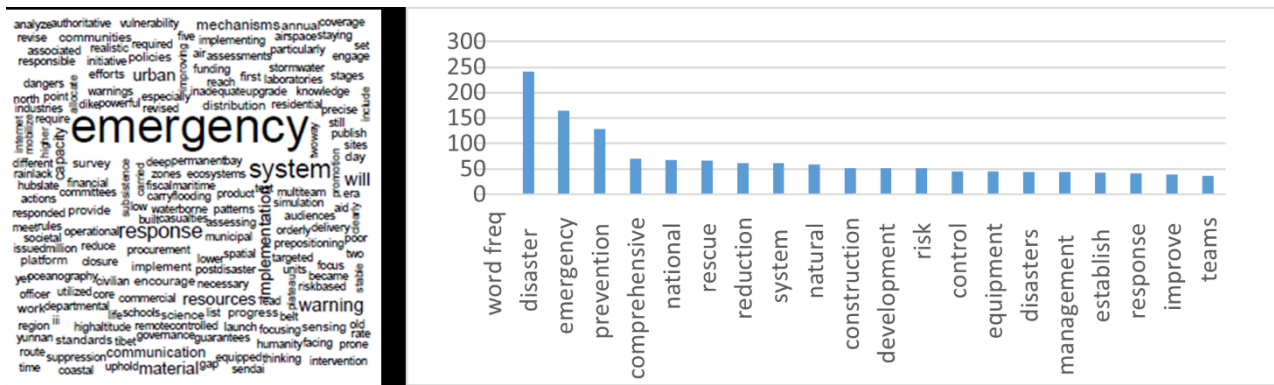


Figure 3. Word frequency analysis of China's disaster prevention policy

3.4. Word frequency result about analysis of disaster prevention policy in Shanghai

Figure 4 shows 246 instances of “flood” being the most common term, followed by “control” with 215 occurrences, and “shall” with 141 occurrences. Words such as “article,” “facilities,” and “engineering” showed up 59, 58, and 57 times, respectively. Subsequently, words such as “water,” “emergency,” “peoples,” and “command” were seen 43, 39, 37, and 35 times, respectively. The words “departments,” “accordance,” and “construction” were noted 34 times each, while “municipal,” “safety,” “units,” and “regulations” were noted 31 times each. “Response” was used 29 times, while “administration” and “district” were used 28 times each.

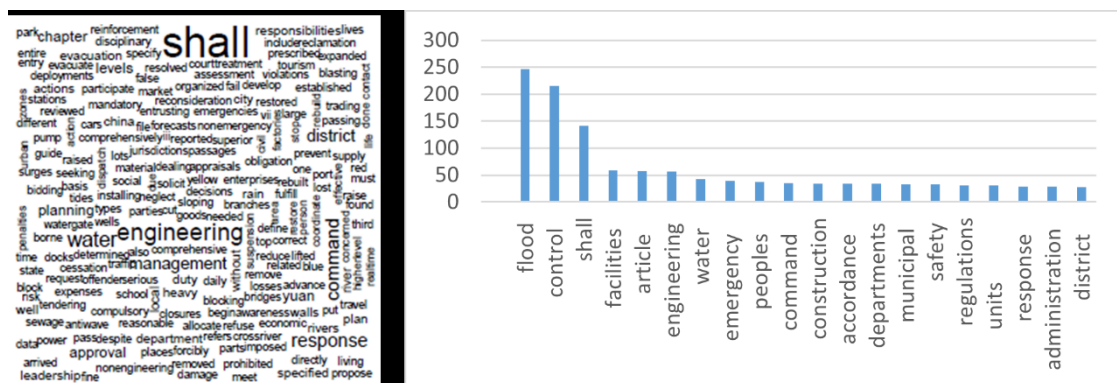


Figure 4. Word frequency analysis of Shanghai disaster prevention policy

4. Discussion and conclusion

The word frequency results of disaster prevention policies in Tokyo and Japan indicate prioritization of soft aspects such as public participation and preparedness. Notably, earthquakes and tsunamis emerge as the primary disasters in Japan. Conversely, the word frequency results of disaster prevention policies in Shanghai and China reveal that floods are the primary hazard. These policies emphasize the more challenging aspects of disaster prevention, such as engineering and construction. China lags behind Japan in the application of Eco-DRR, with most research on Eco-DRR related to flooding focusing on sponge cities rather than other ecosystem disaster prevention strategies. The primary focus has been on utilizing engineering, environmental, and social indicators to evaluate sponge cities' resilience to flood impacts, as well as optimization models to identify the optimal arrangement of grey-green infrastructure ^[12,13].

Simultaneously, water-related disasters garner attention in Shanghai, China, and Tokyo, Japan, according to the word frequency results of disaster prevention policies. This suggests recent policymakers' focus on urban disasters. In response to flooding, research on eco-DRR has produced encouraging results. Studies have

demonstrated the effectiveness of ecosystems and man-made structures in lessening wave energy and regulating the build-up of floating debris ^[14]. Programs for mangrove planting and restoration have been implemented to combat sea-level rise and involve residents in high-risk areas ^[15]. The ability of existing Pandanus forests on the Bangladeshi island of Saint Martin to reduce the risk of storm surge hazards has been measured ^[16]. Nevertheless, none of the ecosystem disaster prevention policies of the research subjects extended to floods. This implies a misalignment between policy specifiers' expectations and pertinent research findings.

Future research efforts should prioritize a thorough evaluation of the existing disaster response policies in both Tokyo and Shanghai. This assessment is crucial for gaining insights into the strengths and weaknesses of current frameworks, enabling policymakers to make informed decisions aimed at enhancing the overall effectiveness of disaster management in these densely populated urban areas.

An important avenue for inquiry involves a comprehensive examination of the effects of implementing Eco-DRR strategies. Understanding how these eco-friendly strategies impact ecosystem preservation and disaster risk reduction is crucial. Focusing on Eco-DRR allows scholars to make a comprehensive contribution to understanding how these tactics affect urban environments' resilience and ecosystem health in potential calamities.

However, it is imperative to recognize specific constraints within the current corpus of knowledge. Previous studies on disaster response strategies might benefit from an updated analysis that considers new developments and changing urban landscapes, as they may not have included a thorough evaluation of their long-term efficacy. Furthermore, there might be trade-offs and difficulties when integrating Eco-DRR into current frameworks, which should be carefully considered. To provide a sophisticated and current understanding of disaster management in Tokyo and Shanghai and to aid in the creation of more resilient and sustainable policies going forward, future research should address these gaps.

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