

# EVALUATION OF DISASTER RESILIENCE ON WASTE MANAGEMENT IN DEVELOPING COUNTRIES

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<https://doi.org/10.15017/1500708>

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出版情報：九州大学，2014，博士（工学），課程博士  
バージョン：  
権利関係：全文ファイル公表済

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論 文 名 : EVALUATION OF DISASTER RESILIENCE ON WASTE  
MANAGEMENT IN DEVELOPING COUNTRIES

(開発途上国の災害時における廃棄物処理のレジリエンス評価に関する研究)

区 分 : 甲

### 論 文 内 容 の 要 旨

Disaster events such as earthquakes, tsunamis, floods, volcano eruptions generate tremendous amount of waste and debris causing considerable waste removal and disposal challenges for local public officials. Proper disaster waste management would reduce the economic losses, and help quick emergency response and recovery. To achieve resilience on disaster waste management, it requires acceleration of facility and personnel, organization and communication including legal frameworks. However, many obstacles are found because the waste generation and its characteristics are difficult to predict. Moreover, for developing countries, because of the poor municipal waste management system and lack of management plan, it is very difficult for stakeholders to implement proper waste treatment in disaster events. Researches that describe achievement of proper disaster waste management are not mature. The aim of this research is to evaluate resilience on disaster waste management in developing countries and to propose a strategy for enhancing the preparedness for stakeholders. This study investigated three main objectives; first is pattern of disaster waste management, second is degree of resilience on waste management and third is factor that affect stakeholder's intention to promote preparedness in disaster waste management.

In chapter 1, the background of evaluation for disaster waste management in developing countries, objective of research, theoretical framework for model development, model scoping were presented.

In chapter 2, the generation and disposal of disaster waste were examined using data obtained through field surveys and interviews with involved organizations. Indonesia and Thailand were chosen as case studies. Formula to estimate disaster waste generation by the type of building is proposed, then demolition waste generation caused by major disasters in Indonesia 1990-2012 were estimated such as Flores Earthquake-tsunami in 1992, Yogyakarta Earthquake in 2006 and West Sumatra Earthquake in 2009. Then the problems with disaster waste treatment were revealed. These included a shortage of waste collection capacity under emergency conditions, a lack of appropriately designed temporary waste storage at waste transfer stations, a lack of recycling systems, and the possibility that mixed disposal of municipal and

industrial waste introduced contamination. To improve flood waste treatment, proposals were provided for the pre-disaster, disaster and post-disaster stages.

In chapter 3, disaster resilience index on waste management (DWRMi) was proposed. It is an integrated index using capacity of facilities, preparedness and vulnerability considering the social and economic conditions, disaster experiences in each region and cities in Indonesia. Results indicated that most of the cities and regions were classified at the level middle or low resilience category. Among regions, the highest index was Java region ( index estimated 1.58). The lowest was Sumatra region (index estimated 0.83). Among cities, Banda Aceh was the highest ( index estimated 2.78) and Medan was the lowest (index estimated 0.48).

In chapter 4, a model of structural factors that affect stakeholder intention's to promote disaster waste management and preparedness were presented using structural equation modeling approach. With exploring in tsunami waste management in Banda Aceh at which run for year 2005-2012, the research identified critical factor for promote preparedness and then examine the structure of the factor model. The research defined that factor of awareness of the difficulty running a 3R (reduce, reuse, and recycle) was the most important factor to promote preparedness (correlation coefficient of 0.89). Other factors that have a significant effect of preparedness are awareness of cooperation with other organizations (correlation coefficient 0.83) and concern about previous experience (correlation coefficient 0.78). The result confirmed that preparing plan for intermediate treatment such as ability to run 3R and than manage the capacity of landfill site is the key point to achieve resilience in disaster waste management.

In chapter 5, summary and conclusion of the study concerning the evaluation of disaster resilience on waste management in developing countries were presented.