Identification of the impacts of infrastructure failure on businesses for community resilience analysis

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Abstract

The objective of this research is to identify the impacts of the earthquake-induced failure of infrastructure system on the commercial activities of a community. Earthquakes can negatively affect the functionality of community infrastructure systems by damaging their components. The failure of infrastructure systems can negatively affect the businesses that are dependent upon their functionality. In addition, an earthquake can cause death and injury, which can lead to a shortage of workforce and a reduction in the number of customers for the goods and services produced by businesses. This can disrupt or stop business activities, which will, in turn, lead to business closure, unemployment, and workforce migration. The economic and social consequences of such events are vast. Several past research studies have focused on the identification of the impacts of earthquake-induced disruption of the infrastructures systems on business activities. Nevertheless, there is a need for research to identify and classify the impacts of an earthquake on the economic activities of a community. In this study, using an extensive review of literature and analysis of relevant content, a complete map of the impacts of an earthquake on the economic activities of community is developed. This map identifies the causal relationship among various earthquake consequences. This research is a stepping-stone for the quantification of the costs associated with lack of resilience of infrastructure systems in communities. It contributes to the quantification and analysis of community resilience.

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1. Introduction

Severe events such as earthquakes can damage the infrastructure systems (e.g., utility networks, transportation networks) as well as the commercial and industrial facilities in a community. These damages can disrupt the performance of the infrastructure systems and reduce their functionality. The reduction in the functionality of the infrastructure systems can affect the operation and profitability of the businesses that rely on them for their operations [1], [2]. The consequences of such events for the community are manifold. Among the key consequences are the changes in the discretionary income of the citizens [3], [4], demand for the goods and services produced by businesses, activity levels of businesses, available employment opportunities, costs of doing business, the profitability of businesses, and the tax income of the government. Appropriate measures can be adopted in order to reduce the negative consequences of potential future earthquakes for the community and its businesses.

Specific measures can be adopted to enhance the robustness of the community, its infrastructure systems, and its businesses against earthquakes. Alternatively, measures can be adopted to expedite the recovery of damaged components of infrastructure systems so that they can resume their services in a timely manner. In order to make the best use of limited available resources, decision makers require appropriate tools that characterize the post-earthquake state of a community, its infrastructures systems, and businesses. These tools can facilitate the evaluation of the impact of measures that are aimed at enhancing the robustness of a community against earthquakes or expediting the recovery of its seismically vulnerable infrastructures. In order to characterize the post-earthquake state of community businesses, there is a need to identify and classify the impacts of the earthquake-induced failure of infrastructure systems on the

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