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Quantitative cost-benefit analysis for typhoon resilient housing in Danang city, Vietnam

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ABSTRACT

Located in Central Vietnam, Da Nang city is experiencing rapid urbanization and development. In recent years, floods and storms have caused critical damage and losses to local communities and destroyed thousands of houses despite great efforts of local governments and agencies toward disaster risk reduction. Housing is one of the most vulnerable sectors to climate extremes, of which typhoons exhibit the greatest impact in comparison to other climate hazards. This paper examines the costs and benefits of applying typhoon resilient housing measures in Da Nang. The paper aims to test the hypothesis that using typhoon resilient housing has a positive economic return. The cost-benefit analysis (CBA) results show that the return on investment of typhoon resilient housing is positive when typhoon events occur early in the lifetime of the house, suggesting that the investment in typhoon resilient housing is economically desirable. The results from the research illustrate that positive returns exist in most of the scenarios tested, yet home owners are choosing not to make this investment. The findings have investigated the information asymmetry gap that exists between innovation and adoption and explores policy implications to reduce the gap.

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1. Introduction

Housing and climate change have strong links in Vietnam; housing is considered one of the most valuable but also the most vulnerable area of local residents to climate change (MONRE, 2008; Nhu et al., 2011; Phong and Tinh, 2010).

Located on the South Central Coast in the tropical storm belt, Da Nang experiences annual catastrophes. The city is characterized by a sloped topography from west to east, with many mountain ranges, short rivers, deltas, and coastal areas, which creates a diversified ecosystem and perhaps one of the most disaster-prone regions in Vietnam. As a coastal city, Da Nang is affected by many types of climate hazards, including typhoons, floods, drought, coastline erosion, landslides, and so forth, and the risk of such hazards is increasing as a consequence of global climate change.

The most dangerous hazards for Da Nang are storms (tropical lows and typhoons) and floods. The city is impacted by three to five storms per year.[1] Storms hit this city from May to December and are followed by long-lasting rains and inundation floods (ACCCRN, 2010). In recent years, strong storms and floods have caused critical damage and losses to local communities and have destroyed thousands of houses (e.g., flood in 1999, typhoon Xangsane in 2006, typhoon Nari in 2013) despite great efforts by local governments and agencies toward DRR. According to the Vietnam Central Committee for Flood and Storm Control (CCFSC), 80–90% of the population is affected by floods and storms. As reported by the national government, housing is one of the sectors most vulnerable to climate extremes (MONRE, 2008). Typhoons exhibit the greatest impact on housing as compared to other climate hazards (Nhu et al., 2011).

Many studies have acknowledged the relationship between housing vulnerability and household poverty (Jones and Anh, 2010; McEntire, 2011; Wisner et al., 2004), but few studies deal with the economic aspects of climate resilient housing. This research, therefore, examines the performance of climate resilient housing through an economic lens in order to analyze the costs and benefits brought by resilient housing. This paper tests the hypothesis that applying climate resilient-related principles to housing construction has a positive economic return to households in Da Nang.

2. Background

People living in flood and storm affected areas in Da Nang often belong to low-income groups. A significant amount of household income is spent on housing repairs or reconstruction after annual floods and storms (Norton and Chantry, 2008). In many cases, this causes a downward spiral into poverty because households borrow more money than they can afford from friends, relatives, or neighbors, which results in further debt. In addition, without technical guidance related to storm resistant construction techniques (see CECI, 2003), they reconstruct their homes using the same construction principles, thus reproducing vulnerabilities.

In Vietnam after the Reform (Đổimới) policy in 1986, households began to use new materials (cement blocks, steel bars, fired bricks, or corrugated sheeting) in their housing construction instead of traditional materials (timber, bamboo; (Norton and Chantry, 2008) but frequently without safety-related measures (Tinh et al., 2011). This failure has generated a so-called twofold source of vulnerability (Norton and Chantry, 2008). Over 70% of houses built during this period did not incorporate typhoon resistant features; flat roofs were constructed, limited attachments between building elements were implemented, and structural bracings were lacking (Norton and Chantry, 2008). In addition, houses in low-lying areas lack flood protection features; for example, they lack upper floors for safekeeping valuables during floods or have hard and heavy roofs that are difficult to open for escape.

Literature review shows that there are not many studies done in the field of climate resilient housing regarding economic dimensions. Pompe and Rinehart (2008) addressed the link between hurricane resistant construction and the role of the insurance system, where appropriate insurance measures could reduce people's vulnerabilities to disasters. Sutter et al. (2009) talked about the reduction of

[1] A storm with a wind speed of 118 kph (Category 12 on the Beaufort scale) is called a typhoon.