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Does it make economic sense to build storm-resilient housing? A cost-benefit study from Vietnam

In recent years, the province of Thua Thien Hue (TTH) in Central Vietnam has experienced many floods and storms that have caused widespread damages to local communities and destroyed thousands of houses. This has happened despite the significant efforts that the local government agencies have made to mitigate the impact of such disasters. To help policy makers decide what steps should be taken to help the local people better cope with storms, a new EEPSEA study has examined the costs and benefits of using storm-resilient construction techniques to improve the housing stock in TTH.

The research is the work of a team led by Tran Tuan Anh from the Faculty of Architecture, College of Sciences, Hue University, Vietnam. It finds that investing in storm-resilient housing is economically desirable. The study recommends establishing the appropriate legal frameworks and supporting programs to improve local construction methods and to build safer and more resilient communities. In addition, it recommends for the development and implementation of storm insurance policies to help people cope with the damages that storms bring. Lastly, the study recommends that more investment should be made in public storm shelters and early warning systems.



A summary of EEPSEA Research Report No. 2016-RR6:
"Cost-Benefit Analysis of Climate-Resilient Housing in Central Vietnam"
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The storm risk in Central Vietnam

Following recent economic development, housing construction in Central Vietnam has undergone a series of significant changes, with traditional materials and techniques being replaced by more durable and costly materials and modern methods. However, despite these changes, a lack of guidance and instruction from professionals has resulted in housing that is often more vulnerable to flooding and storms than the older style buildings it has replaced.

This problem is compounded by the fact that government projections on climate change suggest that storm intensity would likely increase in Central Vietnam. As a result, it is projected that climate change would intensify future flood risks in the region's low-lying areas, which are already flood-prone and where major economic and housing growth is taking place. What's more, many people living in storm-affected regions in Central Vietnam belong to the low-income groups; they already spend a considerable amount of their money on housing repairs or reconstruction after annual storms and floods. This situation is set to get worse.

In light of this mounting crisis, this study estimated and compared the costs and benefits of providing storm-resilient housing for low-income households in TTH. The aim of the study is to provide policy makers with in-depth understanding of the economic returns of storm-resilient housing to determine if this policy should be pursued.

Thua Thien Hue province

In terms of its exposure to extreme weather events, TTH province is one of the most vulnerable provinces in Vietnam. It is close to the sea, and is struck by tropical cyclones on a regular basis.

Recent years have witnessed an increase in these types of storms and in the level of housing destruction that they cause.

On average, about 0.6 storms affect TTH every year. Storms with Level 9 intensity on the Beaufort scale occur every 10 years, and Level 10 storms occur every 20 years. The strongest storm to hit TTH in the last 30 years was named Xangsane. This storm, which occurred in 2006, had wind speeds that reached a magnitude of 10–11. It destroyed 1,185 houses and damaged 48,244 houses in TTH. Another major storm that has recently affected TTH is Ketsana. This storm hit TTH in October 2009, and had winds that reached a magnitude of 9–10. This storm caused 376 houses to collapse totally, and damaged a further 11,556 homes. Most of the homes that were destroyed and damaged by these storms were less permanent and temporary houses, which commonly belong to low-income group.

The study area: Loc Vinh commune and Huong So ward

Two extremely climate-exposed areas in TTH, one in a rural and one in an urban area, were selected as the study areas of this research. These were Loc Vinh commune (rural setting) and Huong So ward (urban setting). Loc Vinh commune in Phu Loc district is located near the Chan May Bay, where storm risks are critical and pose the biggest hazards to people living there. Housing in this commune mainly follows the three-compartment form for the main house, with various types of spatial expansion (sub-house) attached to the main house. On the other hand, Huong So ward in Hue City is located in a peri-urban area where a mix of rural and urban housing can be found. In this ward, tube houses are commonly found and are increasingly favored by the local residents.



Figure. Tube houses and three-compartment houses in Loc Vinh and Huong So, Central Vietnam

Damages to houses caused by recent storms

Focus group discussions (FGD), key informant interviews (KII), and field surveys were conducted in the study in order to gather data on the impacts of climate change on the housing of the study sites, and to collect information on the direct and indirect losses that households have suffered due to the recent major storms. Direct monetary losses included the structural and asset damage that storms produced. Indirect monetary losses included business interruption costs and fees paid for the medical treatment for injured people.

The study found that the total housing damage due to the two recent storms in Loc Vinh (three-compartment house) was VND 28,295 million in 2006 (Xangsane storm) and VND 22,295 million in 2009 (Ketsana storm). On the other hand, total housing damage in Huong So was VND 30,356 in 2006 and VND 21,725 million in 2009.

The benefits and costs of storm-resilient housing

Cost-benefit analysis (CBA) was used to assess the economic efficiency of building storm-resilient homes. CBA compares the costs of conducting a project with the benefits that result from that project.

To help define these benefits and costs, architects and local builders were consulted to identify resilient housing options that would be capable of withstanding windstorms up to Level 11–12 on the Beaufort scale. The main features of this storm-resilient housing included the interconnection of all key structural components, the anchoring of roofing materials, thicker walls, the strategic use of concrete to strengthen walls and windows, the establishment of safe rooms, and the avoidance of courtyards and other features that would concentrate wind pressures.

The value of the benefits of resilient-housing measures were defined as the value of the damage and loss that would be avoided following the adoption of these construction measures. The costs of implementing resilient-housing measures were defined as (1) the major investment costs of building resilient houses (i.e., construction costs) and (2) the operation and maintenance expenses of the resulting homes.

A combined backward- and forward-looking approach was applied to assess current and future storm risk. A review of past storms provided estimates for current risks, while projected climate and storm exposure changes were used to estimate risks for the next 30 years (i.e., the lifetime of a house).

Specifically, the study used a scenario approach to investigate the future economic impacts of storms in Central Vietnam. In the first scenario, it was assumed that the frequency and intensity of storms in the next 30 years

would be similar to that of the storms over the past 30 years. The second scenario was based on the assumption that future storms would be fewer but would be more intense in the region.

The net present values (NPV), benefit-cost ratio (BCR), and internal rate of return (IRR) of each housing type were calculated using the assumptions in the two scenarios.

The returns on investment in building storm-resilient housing

The study found that the returns from investing in storm-resilient housing would highly depend on the year in which a storm event would take place. If a storm event would happen early in the lifespan of a storm-resilient home, then the investment will provide positive returns—in other words the benefits will outweigh the costs (i.e., best case). If the storm event would take place later in the lifespan of such a house, then the costs will outweigh the benefits (i.e., worst case). The breakeven cases (i.e., the period when a positive NPV would turn into negative) in both the storm-resilient tube and three-compartment housing would take place if the storms would happen in the middle of the housing lifetime. Likewise, if the impacts of climate change would be considered, the returns would be higher.

Using the first scenario in the storm-resilient three-compartment

housing, the results of the study showed that IRR in the averaged case would be about 7.5% (much higher than the real discount rate of 4%). Likewise, NPV would be > 0 and BCR would be > 1. This implies that the economic returns on investing in storm-resilient three-compartment housing would be desirable. The breakeven case would happen between Years 17 and 19 of the lifetime of the house.

In the second scenario, where storm events would be more intense in the next 30 years, results showed that the base case IRR would be about 9.5% (compared to 7.5% in Scenario 1), and the breakeven case would occur between Years 19 and 21 of the housing lifetime. This means that the returns in Scenario 2 would be higher than that in Scenario 1. Thus, taking the impact of climate change into account in house building would result in higher returns on investment.

Meanwhile, the results of Scenario 1 in the tube housing showed that in the averaged case, IRR would be equal to about 6.5% (i.e., higher than the real discount rate of 4%), which means that investing in a storm-resilient tube housing would be more preferable than investing in the bank. Similar to the results of the three-compartment housing under the same scenario, NPV in the averaged case would be > 0 and the BCR would be > 1. The breakeven case would occur between Years 15 and 17 of the housing lifetime.

Indicator	Best Case	Worst Case	Averaged Case
Scenario 1			
NPV ('000 VND)	84,808.50	–21,942.25	14,059.99
IRR (%)	268.00	–	7.50
BCR	4.91	0.08	1.73
Scenario 2			
NPV ('000 VND)	117,135.95	–21,942.25	24,604.24
IRR (%)	279.00	–	9.50
BCR	6.37	0.08	2.23

Note: Scenario 1: The frequency and intensity of storms in the next 30 years would be similar to that of the storms over the past 30 years. Scenario 2: In the next 30 years, storms would be fewer but would be more intense in the region.

Table 2. Projected economic returns of a tube storm-resilient house

Indicator	Best Case	Worst Case	Averaged Case
Scenario 1			
NPV ('000 VND)	82,980.66	-31,274.44	10,695.07
IRR (%)	188.00	–	6.50
BCR	3.75	0.06	1.33
Scenario 2			
NPV ('000 VND)	118,077.71	-31,274.44	23,608.28
IRR (%)	201.00	–	8.50
BCR	4.89	0.06	1.72

Note: Scenario 1: The frequency and intensity of storms in the next 30 years would be similar to the frequency and intensity of storms over the past 30 years. Scenario 2: In the next 30 years, storms would be fewer but would be more intense storms in the region.

In the second scenario, the averaged case IRR would be 8.5% (compared to 6.5% in Scenario 1), and the breakeven case would occur between Years 17 and 19. The returns in Scenario 2 were projected to be higher than that of Scenario 1. Thus, taking climate change into account in house building would result in higher returns on investment.

Investment in storm-resilient housing makes economic sense

The study's results showed that the returns on investment in storm-resilient housing are positive; thus, investing in storm-resilient housing can be economically viable. This implies that households in Central Vietnam should prioritize this type of investment.

However, positive returns are not (in themselves) sufficient to justify investing in storm-resilient housing. This is because many households in Vietnam face significant budget constraints. They may also assume that the government would provide post-disaster assistance to help repair their homes. If this is the case, they will have little financial incentive to invest in storm-resilient housing measures.

In addition, people with low incomes often face extremely

pressing and immediate problems; disasters are not as important as meeting the basic needs of living. What's more, many local household owners residing in disaster-prone communities tend to dismiss the risk of storms as negligible until after such a disaster occurs. These barriers further limit the capacity of individual households, especially the low income, to invest in storm-resilient housing.

How households can be helped to build more resilient homes

In order to encourage individual households to invest in storm-resilient housing, the government should consider offering assistance to households that agree to undertake appropriate storm-resilient housing measures. This may be through providing technical assistance for building design, direct subsidies, or low-interest loans.

The Vietnamese government has already invested a large amount of resources (in cash and in kind) to support or compensate those households that have been affected by storms. For example, after the Xangsane storm in 2006, each household in the study area whose house collapsed was given help worth about VND 5 million (about USD 300). This shows that

it would be more cost-effective for the government to provide households with support that would mitigate the impact of storms rather than providing them with support or compensation after their homes have been damaged. Micro-insurance mechanisms are one possible way in which the government could do this. Micro-insurance has been viewed as an efficient and reliable risk management tool, and has been effective in encouraging households in other developing countries to adopt disaster risk reduction measures.

For example, storm insurance policies were pioneered in the Philippines in 2009 to protect Filipino farmers against storm-related losses. This can be a good model for Vietnam, which has already created a subsidized public-private partnership for agricultural crop, livestock, poultry, and aquaculture insurance. Therefore, the study recommends that, for future disaster risk reduction, storm insurance policies should be considered as an appropriate option for building a resilient housing system.

Finally, the study recommends that investment in public projects such as public shelters or improved early warning systems could also help local people to protect their assets and their lives.

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