The importance of pre mitigation strategies in development planning

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Abstract

Natural hazards destroy vital rural infrastructure. In Asia, which accounts for approximately half the number of the natural catastrophes in the world, and 70% of all floods, the average annual cost of floods over the past decade is approximately 15 billion USD [1]. Recovery from disasters is hard to cope with, especially for developing countries. To reduce rural poverty, effective infrastructure projects related to agriculture have proven to be an essential policy tool. In particular, infrastructure development for transportation, irrigation, and electricity plays an important role. Rural infrastructure loss in the developing world has severely affected the activities of the world's international lending institutions. For instance, the World Bank loan to developing countries in the last 20 years, for damages from natural disasters, has been estimated to be 14 billion USD [2]. It is assumed to be financially beneficial for a poor region to be provided with aid as a risk reduction measure instead of post disaster relief. That is, as a pre mitigation strategy in order to reduce the impact of a hazard and reduce risk. However, evaluations of preparedness actions are seldom performed and hard to find. In this article we present a framework for evaluating the possible benefits of a pre mitigation strategy. The framework is based on an earlier performed flood mitigation project in Hungary [3], and extensive literature studies. It must be emphasised that we do not suggest that no aid should be provided after a hazardous event. Instead, hopefully, less aid should be needed since precautions should have been taken before the event.

Keywords: development planning, disaster preparedness, risk-reduction, vulnerability.
1 Development planning and risk reduction

Disasters are seldom discussed in development literature, however hazard preparedness literature often discuss development planning. This is strange since it is important to consider these types of events in the economy and what their potential impact have on both direct and indirect costs. Rather than to wait for a disaster to occur a country must take action to prevent or minimise the impact of the disaster c.f. [4,5]. Rising understanding of the importance of awareness and risk reduction measures is closely related to climate change. Increasing temperature makes the air moister, which increases precipitation c.f. [6]. Flood prone areas become even more risky. Moreover, development strategies that are misguided increase peoples vulnerability to extreme weather events, for example, deforestation, poor land use (construction of houses and facilities on flood prone land) and population growth [7,8]. Integrating disaster risk in development strategies is one important way to handle the increasing risk and costs for coping with disasters [9].

Policies and public schemes must include preparedness programs to reduce social vulnerability, and ought to be incorporated in the daily agenda of politics and infrastructure planning. It is assumed to be financial beneficial for a poor region to be provided with aid as a risk reduction measure instead of post disaster relief. That is, as a pre mitigation strategy in order to reduce the impact of a hazard and reduce risk. Making mitigation and disaster prevention an integrated part in the development program requires action and some form of evidence that pre mitigation strategies are less costly than the actual recovery cost, therefore evaluations are essential. In Hungary a flood mitigation evaluation project was initiated by the government [3]. The purpose of this project was to find a sustainable balance of responsibility for compensation of damages to flood victims by introducing insurance and flood funds in different forms. In an initial phase of the project interviews with stakeholders in the region were performed [10]. These interviews reviled several important factors to consider when constructing different flood management strategies. Within the project, the strategies were evaluated with the use of a simulation model linked to a decision analytical tool. The flood failures were simulated with geographical, hydrological, social, and institutional data taken into account [11]. From the simulation model, the generated results were automatically transposed to the decision tool. To clarify, taking the simulation results into account, the scenarios were analysed with the decision tool for evaluating the various costs, criteria and probabilities involved [12]. Moreover, the experiments within this project revealed that the evaluation method in this project can be beneficial for stakeholders and decision makers to orchestrate the problem and by this get a more accurate picture of the problem [3].

Already in 1991 Willam E. Riebsame [13] called for a new approach in development planning. This approach stated that planners must develop strategies that 1) reflects the sensitivity of resource systems and variations in climate, 2) uncertainty about climate changes and how this uncertainty is incorporated into the development, 3) awareness on the developments effect
(good or bad) on both social adaptively and greenhouse effects. The mitigation of hazards should be linked to all of the above statements. These statements are still and perhaps even more important today, since the number and strength of hazards are increasing [14]. Furthermore the growing number of poor people in the world makes the topic even more relevant.

In order to reach a future as sustainable as possible, with regards to both reducing loss from disasters and development planning, it is important to consider several vital aspects when introducing risk reduction measures such as education and warning systems. The Hungarian flood mitigation study revealed that the pre disaster mitigation strategy “insurance” is not sufficient for developing countries. Poor households do not have the means to purchase insurance [15]. Furthermore, governments of these regions often lack the funding of subsidising poor households.

In this paper we present and discuss several vital aspects to consider when evaluating a pre mitigation strategy for a developing country, excluding the introduction of insurance. Several projects of disaster preparedness have been performed c.f. [16,17,18,19,20]. Numerous findings are extracted from these reports and presented here. Furthermore, the discussion is to a large extent based on findings from the Hungarian study. The aspects discussed here are to be of assistance to policy makes when evaluating preparedness strategies. The findings should be useful for donor agencies as well as for governments and lending institutions. The presented framework is provided as an initial core set of principles and goals to understand, and thus guide and monitor, disaster risk reduction. Moreover, it should be applicable internationally.

2 Post disaster relief

Vulnerability is linked to poverty. Some districts and some groups of people are more vulnerable than others. Class, ethnicity, disability and age are some factors that affect the grade of vulnerability of people [21,22]. Population density, scientific understanding of the area, public education and awareness of hazards, construction styles and building codes and cultural factors that influence public response are factors that can explain the fact that less developed countries and areas are much more vulnerable to natural hazards than industrialised countries. Vulnerability is not just poverty, but the poor tend to be the most vulnerable c.f. [23,24].

Developing countries are often not able to finance disaster losses, relief and reconstruction by their own means [5]. The combination of low per capita incomes and unequal distribution means that in large parts of the developing world, people might lack access to many basic services: health, sanitation, education, and so on. Many developing countries see international donors as the prime insurers of natural catastrophe risk. However, there is a concern about the high and increasing amounts of post-catastrophe aid and loans while donor funds have become scarcer. Foreign borrowing to finance post disaster reconstruction raises important policy issues. Around 56 countries have since 1980 borrowed 14 billion USD from the World Bank and 7.5 billions are for post disaster
reconstruction, mainly for infrastructure projects [2]. Borrowing has a cost as it increases debt and has to be repaid. Increasing debt for developing countries affects spending and economic performance in the future due to budgetary constraints. An important issue for developing countries is their reliance on external debt as the primary means to finance post disaster reconstruction, which may exacerbate existing budgetary constraints.

Flooding, often an annual occurrence, which is a very important aspect of agricultural production, has the potential to be the source of greatest disaster. Disasters in some sense or to some extent are predictable, usually there is some form of probability estimations on when a disaster will occur. This is particularly true when it comes to floods. For instance, melt water in the spring can be a factor that increases the risk of flood c.f. [15]. In order to be prepared, governments should try to measure their risk to natural hazard events. Mecheler [5] identifies three factors that are important here:

1. the magnitude of the risks,
2. the size of the group sharing the risk,
3. resources for spreading risks.

Often dykes and floodwalls form the primary defence against floods and inundation. Also reservoirs are constructed and used in combination with dykes as a mean of flood control [25]. The condition of the structural measures and the ability to maintain them in the social and economic climate is of concern. The land behind the dykes is often reclaimed by inhabitants in the region. The dykes serve as a protection and a more secure environment for investment, which can be of negative effect: if the dyke breaks, the flood impact will be immense. Losses increase due to more dense population in land areas protected by the dykes. However, it seems that many consider further measures of dyke rehabilitation to be economically and socially justifiable [26].

In most countries, the necessary data to evaluate hazard exposure and vulnerability exist. What is lacking is the time and resources to extract and integrate the information. The lack of information can limit the ability of the government to plan for disasters, instead of solely responding [27]. More than 80% of the countries, who lend money for reconstruction after a disaster from the World Bank, took more than one such loan between 1947 and 1989. By the use of statistics and probabilities for a flood to occur, donor organisations and lending institutions could minimise poor countries suffering by introducing risk reduction measures instead of post disaster relief c.f. [23].

### 3 Important aspects for pre mitigation strategies to be successful

The success of pre flood mitigation strategies is often undermined by insufficient flood detection and forecasting capabilities. The flood forecasting information often does not reach the inhabitants in remote and vulnerable areas. In order to convince governments, aid and lending institutions that it is financially beneficial to incorporate risk reduction measure into development planning, these strategies
must be evaluated c.f. [8]. In this section several aspects to consider when evaluating and implementing a pre mitigation strategy are discussed.

The aspects might be summarised in the following categories:

- Warning systems, Awareness and Education
- Multiple levels
- Agricultural Issues and Deceases
- Hazard map
- Environmental aspects
- Funding
- Development planning

3.1 Warning systems, awareness and education

Installations of warning systems are essential since there is a lack of communication equipment i.e., phones, TV, in poor areas. Combining early warning with awareness of risk leads with no doubt to a more sustainable future. This includes changes in people’s perception of hazards. In small villages inhabitants should take protective actions at both family and community levels, for instance house proofing or cultivating flood resistant crops. Education should include for example, knowledge of hazardous areas, escape routes and coping strategies after a disaster. All of these aspects are important to include in long time development planning.

3.2 Multiple levels

The evaluation of mitigation projects as well as the introduction of one should be performed at the national, regional municipal level, and if possible at an individual level c.f. [20]. On the individual level, a common reason why poor people are excluded from services like credit and extension is that they often use the resources for other purposes than intended, for example for housing, medical costs, or repaying old debts, and not for the production purpose intended. Pure production-oriented services are therefore often not feasible for the poor and more integrated forms of services need to be developed. Policies aiming at reaching the poor need to take this into account [29].

3.3 Agricultural issues and deceases

Reducing vulnerability and risk also include agricultural issues, on how to best utilise the soil and how to maintain a good agricultural production with a good water source. Often construction of channels and weirs can be measure to reduce vulnerability as well as poverty. Water from floods often brings contaminated water into the drinking water and diseases such as cholera and malaria often increase. Combining education on how to maintain the weirs and water channels with information on how to obtain fresh water after a flood can save many lives and reduce vulnerability tremendously.
3.4 Hazard map

Homeowners in a high risk region should have access to a hazard map which is continuously updated. Such a map must identify hazard prone areas, and families that are located in these areas. Moreover escape routs ought to be marked out. The map should be kept at a local level (easy to access) for instance in the village church [30].

3.5 Environmental aspects

Environmental aspects must be considered. What are the impacts from the actions of the selected strategy? If other strategies were considered, what were the options and the expected outcome? Structural measures might have severe impact on the eco system by the river – compared to a non structural measure. An economic evaluation for environmental issues is not a perfect tool because of its limitations, uncertainties and poor consideration or neglect of environmental and social aspects. In some areas, the “do nothing” alternative may be the preferred choice causing the least interference with local ecosystems [31,32].

3.6 Funding

It is vital to allocate resources and alternative funding in order to be certain that a risk reduction strategy will be successful. Staff, technical issues, and material often cost more than estimated. Thus, tax might increase, staff can be become ill etc. Preparedness projects show the importance of more and continuous education on disaster preparedness. The problem here is the cost – who should pay for this education? A simple solution could be to give schoolteachers education and they in turn will to teach the children. But also teacher needs to be updated on hazard maps, new techniques etc. Establishing funds is a vital instrument not only for continuing teaching but also for aid to the poorest and other means to reduce risk. However in poor rural areas there is often not much money to pool. Furthermore, if aid is given often it is used to more immediate problems, instead of for instance maintaining the warning systems and continuous education, which in the long run often is more beneficial.

3.7 Development planning

There is a fundamental need in disaster risk management to recognise the relationships between population growth, the physical demands of human settlement, short and longer term economic trade-offs and the most appropriate use of available land. Therefore disaster preparedness ought to be a part of the development planning process. The recognition of the problem (the hazard risk) and its extent, and development of plans to solve the problem can help to maintain a sustainable economy and environment.

Reducing vulnerability by incorporating actions in development planning can be achieved through preparedness programmes aiming at changing human behaviour, through for instance installation of forecasting and warning schemes.
Land use strategies are here essential. Building restrictions and laws are widely used in for instance UK [30]. Construction in floodplains will increase runoff and reduce the capacity for storing water. Regulating constructions in floodplains can reduce the risk of damages caused by a flood. Unfortunately, regulatory approaches are much less applicable to developing countries with fast growing populations, inadequate housing and services, arising tide of migrants and unmanaged, informal economies [30]. Reducing vulnerability to flood can be performed with various techniques, often exposure is reduced simply by building stilt houses, as in for instance vulnerable areas in Malaysia [33]. More importantly, mitigation planning has the potential to produce long-term and recurring benefits by breaking the repetitive cycle of disaster loss. There is always uncertainty involved in prediction and preparedness of a hazard. This is of course reflected in the development planning. As an example, CO2 emissions and the effect of the greenhouse gas is difficult to plan for. When evaluating if hazard mitigation is part of development planning several aspects can be investigated; if there are prevention activities such as open space preservation, channel maintenance, soil erosion and sediment control, building ordinance, property protection in for instance utility relocation and building elevation. Furthermore, public information activities such as map information, environmental education are important. Structural projects and emergency services must also be included in the planning process. Stakeholders in the region at risk should be inquired if they are aware of, and a part of the process of hazard mitigation planning. A participatory approach must be adopted if the strategy planned for is to be successful [20]. The major reason why this is important is that there are often disagreements between different stakeholders on how to create a balance between the economy, the environment and society. These tasks call for a holistic approach to the development planning issues.

The issues presented in this chapter are not exhaustive but may be considered to be the most crucial ones.

4 Future work

From the above discussion the following question arises: is it possible to say that a non-structural disaster preparedness project reduces loss and increases income in the long run? And is it possible to say that the strategy “doing nothing and/or post relief” and perhaps even borrow money from lending institutions, will actually decrease the economy in the long run.

The next phase of this research is to evaluate preparedness mechanisms and compare these against disaster relief mechanisms. This can be performed by using a simulation tool in combination with a decision making tool by simulating flood events and evaluate pre mitigation strategies vs. post disaster relief events. Data on pre disaster relief outcome can be obtained by performing qualitative studies in an area that has experienced floods before and after the introduction of preparedness mechanisms. Earlier experiments [15,29] show that this suggested method can be applied for evaluating pre mitigation measures. The benefit of this method is that the simulation tool in combination with the decision making tool
can be of assistance to policy makers. The decision making tool can handle imprecise values (vague information) by the use of utility scales [12]. Several stakeholders or groups of stakeholder can have different opinions since the tool is set to handle multi criteria situations. Furthermore, qualitative aspects can be introduced.

Vietnam will be used as a case for this future research since it is one of the most vulnerable countries in Asia to natural disaster, and is a good example of a country that needs to incorporate disaster preparedness into the development planning [16]. A long coastline, increasing population, deforestation and increasing urbanisation is some of the explanations for the country’s vulnerability. Although Vietnams population below the poverty line has been reduced significantly, from 58% to 37% since 1992/1993, the reduction was less then half in the rural areas. Nearly 94% of the poor in Vietnam live in rural areas [16]. In 1999, natural disasters claimed more than 800 lives and US$300 million in property damage [34]. In the late 1980s the International Federation Delegation in Vietnam was established, the aim was to support the organisational development of the Vietnam Red Cross Society (VNCR) [35]. The Swiss Red Cross has provided bilateral support to VNCR for disaster preparedness through the construction of 250 flood and storm resistant houses. This corresponds well to the overall goal of VNCR towards a more sustainable future. Furthermore, the Federations Secretariat will provide technical support through the regional disaster management network to assist VNCR in lessening the impact of the disasters on the most vulnerable. During recent years several disaster management activities have been implemented in Vietnam, education of teachers in preparedness and reforestation of mangrove trees are some vital activities. The overall goal for these activities is to reduce the impact of disasters for the most vulnerable people in Vietnam. These are examples on several pre mitigation strategies and show that development planning in Vietnam includes disaster preparedness.

5 Conclusion

Inspired by the results from the earlier performed study [3] and when analysing several articles and reports on disaster preparedness using non-structural measures (excluding insurance), several aspects have been identified as important to consider when implementing and evaluating pre mitigation measures. The most significant aspect is to make sure that a continuous funding is introduced after the implementation phase of a pre mitigation strategy, as maintaining drainage channels, education and warning systems are costly. Furthermore, in order to maintain sustainable future, disaster preparedness mechanisms must be incorporated in development strategies. It is difficult to evaluate mitigation strategies since the benefits of the introduction might not show for several years. The amount of different aspects combined with several different perspectives from stakeholders makes the problem of evaluation difficult. In this article we also suggest a possible method for evaluation. By the use of a combination of a simulation tool and a decision analytical tool it is
possible to evaluate the suggested strategy for reducing risk by the introduction of a pre mitigation measure. Disaster aid is generally provided from outside a stricken country. Setting up resources, planning for preparedness and mitigation should be carried out from within the country taking into account its available resources. Precautionary planning and mitigation should rely significantly upon the local resources so that through such reliance, autonomy and self-sufficiency are encouraged. Therefore, the most important goal of international agencies should be to aim for sustainable solutions within the community [36].

References


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