Palliyaguru, Roshani, Amaratunga, Dilanthi and Haigh, Richard

Post-tsunami road reconstruction in Sri Lanka: Efficacy of mainstreaming disaster risk reduction

Original Citation

Palliyaguru, Roshani, Amaratunga, Dilanthi and Haigh, Richard (2013) Post-tsunami road reconstruction in Sri Lanka: Efficacy of mainstreaming disaster risk reduction. In: 2013 International Conference on Building Resilience, 17th-19th September 2013, Heritance Ahungalla, Sri Lanka.

Post-tsunami road reconstruction in Sri Lanka: Efficacy of mainstreaming disaster risk reduction

Roshani Palliyaguru,
School of the Built Environment, Heriot-Watt University, UK
(email: r.palliyaguru@hw.ac.uk)
Dilanthi Amaratunga
School of the Built Environment, University of Salford, UK
(email: r.d.g.amaratunga@salford.ac.uk)

Abstract

Following the 2004 Indian Ocean tsunami all roads in the affected areas in Sri Lanka were inaccessible during the immediate aftermath of the disaster either due to the damages they sustained or poor networking of roads and lack of contingency planning within the road network systems. This paper aims at proving the necessity of effective mainstreaming of disaster risk reduction during road reconstruction as a basic precondition for reduced exposure of road structures to hazards; improved resistance of road structures; improved resilience of authorities/teams involved in road projects. It presents the experiences of the road reconstruction sector in Sri Lanka following the 2004 Indian Ocean Tsunami. The paper discusses the perceptions of the key project stakeholders on mainstreaming disaster risk reduction and the effects of mainstreaming disaster risk reduction on vulnerability reduction. The study was empirically supported by the case study approach and independent expert interviews. This paper only presents the analysis of one case study which was conducted in a post-tsunami road reconstruction project in the Southern Sri Lanka, out of two case studies conducted within the study.

The results of the study demonstrate that vulnerabilities of road project's structures and authorities/teams involved in road projects must be paid the key attention when mainstreaming disaster risk reduction. Although the disaster risk reduction strategies such as physical/technical, emergency preparedness and knowledge management strategies are considered to be very important to make road structures more disaster resistance and authorities/teams more disaster resilience, they are not integrated into the case study project up to the required level except the physical/technical strategies. The paper concludes that although the importance of effective mainstreaming of disaster risk reduction during road reconstruction has been considerably identified by the individuals, adequate attention had not been given at the project planning and design phases to make it a project priority due to a range of internal and external hindrances.

Keywords: Road reconstruction, Disaster risk reduction, Vulnerability reduction

1. Background of the study

Sri Lanka became one of the worst affected countries with a very large death toll and losses in housing and infrastructure by the 2004 Indian Ocean tsunami. It washed over the coastlines of many countries; and killed more than 35,000 people and displaced nearly 2,500,000 people in Sri Lanka. The tsunami devastated the coastal infrastructure in Sri Lanka: roads, railways, power, telecommunications, water supplies and fishing ports, which were already in a seriously debilitated condition due to the ethnic conflict, maintenance negligence, lack of development investment and the effects of high rainfall and flooding in recent years (ADB, 2005; ADB et al., 2005). The damage to Sri Lanka's infrastructure is estimated to be over US Dollars 1.7 billion (Gunasekara, 2006). Erosion damage occurred on sections of the coastal highway network and a number of roads were damaged or completely washed away. The road transport from Colombo to Hambantota in the South and some parts of the Puttalam district were badly damaged. Approximately eight hundred (800) kilometres of national roads together with approximately one thousand five hundred (1,500) kilometres of provincial and local government roads located in the North, East and South of the country were damaged by the force of the tsunami (GoSL, 2005; RADA, 2006a; RADA, 2006b).

2. Why mainstreaming disaster risk reduction into road reconstruction?

Outcomes of post-disaster reconstruction projects in developing countries are often criticised for their lack of design efficacy, quality of construction, cost effectiveness and time taken for completion of rebuilding. On the other hand, it is often suggested in the literature that reconstruction must take into account the implications of reducing disaster vulnerability in the long-term because lack of disaster risk reduction initiatives within post-disaster reconstruction results in major failures in reconstruction projects, subjecting them to high vulnerabilities even to small scale future disasters (for example in Jigyasu, 2002). As far as infrastructure is concerned, it is evident from the literature that there are many problems associated with post-disaster reconstruction in terms of its ability to achieve socio-economic development needs following major disasters which needs proper attention to find the necessary solutions. This need was sufficiently highlighted in the post-tsunami reconstruction following the tsunami 2004 in Sri Lanka. The South Asian Disaster Report, 'Tackling the Tides and Tremors', by Wisner et al. (2005) questions whether recovery is used to address disparities in quality and access of infrastructure and services to communities, to what extent infrastructure re-development would extend towards and deal with issues related to infrastructure and services needs in poorer communities, reconcile environmental-development complexities and link development to future disaster risk management because it is found that issues of varying vulnerabilities, people's needs and access to infrastructures are not well articulated in post-tsunami infrastructure reconstruction plans in Sri Lanka. Therefore, it can be presumed that reconstruction process can be improved by the integration of DRR strategies that may result in vulnerability reduction and ultimately on development.

The concept of “disaster risk reduction” (DRR) has taken its momentum due to severe loss of lives and property resulting from the recent natural and human induced disasters. DRR can be defined as a means of tackling the fundamental elements of disaster risk: vulnerability and hazards (DFID, 2006); hence it brings about measures to hold back disaster losses by addressing hazards and the vulnerability of social and physical environments. Although many people tend to appreciate structural or technically advanced strategies (‘hard engineering measures’) soft methods such as polices, planning and knowledge management strategies also form part of DRR strategies (Mileti, 1999; Weichselgartner 2001). There are a range of classifications of DRR strategies where all of them mostly address policy and planning strategies; physical/technical prevention/mitigation strategies (such as engineering and construction measures); emergency preparedness strategies; natural protection strategies; and knowledge management strategies. Table 1 is an outcome generated from an analysis of various classifications of DRR strategies and the table is mainly developed focusing on road reconstruction projects.

Table 1: DRR strategies that can be adopted in road (re)construction projects

Policy and planning strategies
National level legal arrangements that govern enactment and enforcement of construction policies/guidelines/regulations
Requirement for organisational level policy/guidelines for planning and implementation of DRR
Mechanisms to maintain appropriate standards of reliability of infrastructure
Hazard assessment/analysis
Vulnerability assessment/analysis
Procedures for conducting infrastructure risk assessment/analysis
Assessment of potential of loss of infrastructure services during disasters
Damage assessment to assess effectiveness of previous mitigation measures
Physical/technical strategies
Land use planning/buffer zones for reconstruction
Construction of raised roads
Construction of drainage systems/drainage pumps for roads
Construction of flood defences (e.g. sea walls) alongside road networks
Construction of robust concrete roads
Emergency preparedness strategies
Contingency mechanisms for coping with disasters (e.g. escape roads)
Pre-positioning/strategic stock piling of relief material (e.g. life boats, life jackets, tools, first aid)
Regular maintenance of road project after reconstruction
Construction professionals’ (project participants) disaster preparedness after reconstruction

Integrated warning and response system
Natural protection strategies
Reforestation of watersheds/replanting of vegetation
Knowledge management strategies
*Project participants' engagement in training & education/awareness programmes on infrastructure sa*fety
Community engagement in training and education/awareness programmes on infrastructure safety
Community engagement in project decision making and physical reconstruction
Women's engagement in project decision making and physical reconstruction
Communication, information management and sharing inside the project
Communication, information management and sharing outside the project

Hazard is a natural or man-made phenomenon. Although man-made hazards such as bomb blasts in which there is an element of human intent, negligence, error or involving a failure of a system (Eshghi and Larson, 2008) are preventable/controllable the natural hazards are evidently the opposite of it. A few examples for natural hazards are cyclones, tsunamis, earthquakes and volcanic eruptions. Due to the nature of exclusively of natural origin, the only means to prevent/reduce the potential risk (loss) generated by such hazards is through addressing the vulnerability of social (e.g. communities) and physical environments (e.g. buildings, infrastructure). Therefore, it is clear that DRR strategies pre-dominantly focus on the aspects of vulnerabilities in the context of natural disasters.

There is a no common consensus between the practitioners, policy makers and the researchers about the exact meaning of "vulnerability". Majority of definitions are weak in one or the other way due to lack of comprehensiveness of the overall aspects covered within them. Although it should address both social and physical environments most of the definitions fail to do so. Fairly meaningful definition had been presented by the UN/ISDR (2004) which pronounces vulnerability as the "degree of exposure of the population/property and its capacity to prepare *for and respond to the hazard"*. McEntire (2001) defines vulnerability as a product of four components: risk, susceptibility, resistance and resilience (see Figure 1) which exist either in physical (e.g. natural systems, built environmental structures and technological structures) or social environment (e.g. individuals, groups of individuals, cultural systems, political systems and economic systems).

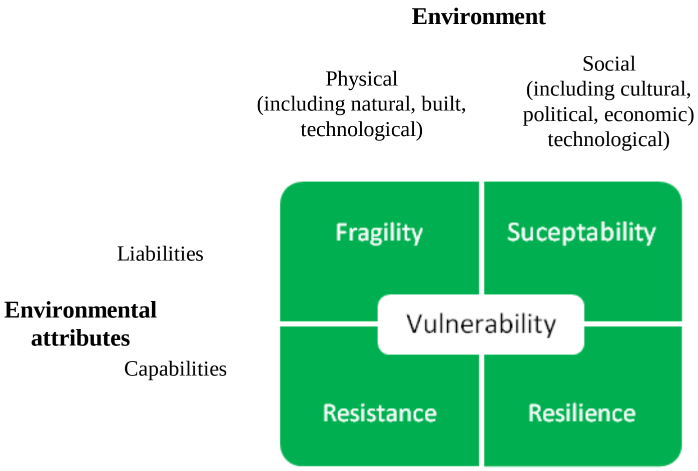

Figure 1: Components of vulnerability (Source: McEntire, 2001)

The terms risk, susceptibility, resistance and resilience are described by McEntire (2001) as follows:

- Proximity or exposure to hazards which increases the probability of disaster losses put the physical environment at **risk**.
- Social, political, economic, and cultural forces and activities that determine the proneness of individuals and groups to being adversely affected by disasters makes social environment more **susceptible** to hazards.
- Physical environment's ability to resist the damage imposed by hazards is called **resistance** (Norton and Chantry, 1993)
- The capacity of the social environment to cope or the ability to react or effectively recover from a hazard that becomes disastrous is called **resilience** of social environments (Buckle et al., 2000; Mileti, 1999).

Since the term 'risk' already has a different meaning than exposure, it can be replaced with a more meaningful term such as 'fragility'. Since all four components of vulnerability are formed either due to the nature and level of **exposure** or **capacity** of the respective environment, DRR should be aimed at:

- eliminating/reducing the exposure to hazards; and
- improving the capacity (capacity has two attributes called resistance and resilience)

These four components of vulnerability are usually determined by numerous variables which can be categorised under physical, social, cultural, political, economic and technological headings (more details are available in the analysis section of this manuscript). It is a matter of collecting and analysing meaningful empirical evidences to demonstrate which variables address the fragility, susceptibility, resistance and resilience components of vulnerability and how effective the mainstreaming of DRR into road reconstruction in improving resistance of road structures; improving resilience of road reconstruction teams (the authorities); and reducing their exposure to hazards.

3. Research Methodology

In order to empirically test the mainstreaming of DRR during road reconstruction and their effect on vulnerability reduction of the road structures, road authorities and individuals involved in reconstruction, a case study was carried out which was supported by independent expert interviews. The case study was conducted in a post-tsunami road reconstruction project in the Southern Sri Lanka. This project was begun with the aim of rehabilitating the tsunami affected roads in the Galle, Marata and Hambantota districts; three of the worst affected areas. The project has mainly undertaken reconstruction work in class C, D, E roads, urban and rural roads which are managed by the provincial councils, urban councils and the local councils. The project did not involve reconstruction of a single network of roads because most of the affected roads were spread around the districts.

The case study consisted of a series of semi-structured interviews and a questionnaire survey. The semi-interview guideline was prepared with the aim of capturing the respondents' knowledge and experience on the level of mainstreaming DRR into the road project and the existing vulnerabilities of the road project once it is fully reconstructed. Five (5) semi-structured interviews were conducted among the project officials. A questionnaire survey was conducted as a supplementary technique to semi-structured interviews which enabled the same issue to be investigated quantitatively. The data were collated from six questionnaire respondents.

4. Analysis of empirical data and discussion

4.1 Vulnerability of road reconstruction project

The level of vulnerability of the road project was identified using the likert scale denoted below associated with the questionnaire survey.

> 1 and below = Not present at all; 1 to 2 = Present to a very little extent; 2 to 3 = Somewhat present; 3 to 4 = Present; 4 to 5 = Present to a great extent

The mean values of each factor forming vulnerabilities and total mean values of each type of vulnerabilities within the road project were then computed which are shown in Table 2. As shown there, the questionnaire survey analysis revealed that various vulnerabilities exist within the road reconstruction project at different levels due to presence of a number of factors forming such vulnerabilities. For example, economic vulnerabilities (mean 3.44) were identified as the most critical type among all 6 categories, indicating it is 'present' within the project. The next highest recorded vulnerabilities are physical (mean 2.78), political (mean 2.50), technological (mean 2.17) and cultural (mean 2.11) indicating they are 'somewhat present' within the project. Social vulnerabilities are 'present to a very little extent' (mean 2.00).

Table 2: Vulnerabilities of road reconstruction project

Types of vulnerabilities	**Factors forming road reconstruction project vulnerabilities**	**Mean**	**Total mean**
Physical	Proximity of road reconstruction project to natural hazards	3.00	2.78
	Degradation of the environment due to the road reconstruction project	2.67	
	Interdependencies of road project on other infrastructures (two or more infrastructures depend on each other)	2.67	
Technological	*Project participants' over*-reliance upon or ineffective warning systems	2.00	2.17
	Project participants' inadequate foresight regarding new technology for reconstruction	1.67	
	Interdependencies of road project on other infrastructures (two or more infrastructures depend on each other)	2.67	
	Lack of detailed planning and structural mitigation of road reconstruction project	2.33	
Social	*Project participants' limited education (including insufficient* knowledge) about disasters	2.00	2.00
	Marginalisation of specific project participants (e.g. women)	2.00	
Cultural	*Project participants' objection to safety precautions and* regulations	1.67	2.11
	Dependency and absence of personal responsibility within road reconstruction project	2.33	
	Project participants' carelessness/inadequate foresight regarding design and reconstruction of road project considering the consequences of disasters	2.33	
Political	Minimal support for disaster programmes amongst elected officials	2.67	2.50
	Inability to enforce or encourage steps for mitigation within road project	2.33	
	Over-centralisation of decision making within road project	2.33	
	Isolated or weak disaster related institutions related to road reconstruction	2.67	
Economic	Lack of funding and resources for disaster prevention, planning and management within road reconstruction project	2.33	3.44
	Failure to purchase insurance against potential economic losses of road reconstruction project	5.00	
	Project participants' pursuit of profit with little regard for consequences	3.00	

4.2 Mainstreaming DRR for reduced exposure and improved resistance of road structures and improved resilience of project teams

This section presents the data analysis and discussion on the effects of mainstreaming DRR into the road project on vulnerability reduction of the project. The section addresses three types of vulnerabilities: physical, technological and political (social, cultural and economic vulnerabilities are not covered within this paper).

4.2.1 Physical vulnerabilities

Semi-structured interview and questionnaire survey findings identified the same set of factors as listed in Table 2, but interviews called upon an additional factor called 'problems with acquisition of land'. Factors forming physical vulnerabilities mainly lead to increased exposure of road structures to natural hazards and sometimes to reduced resistance of road structures itself. How far mainstreaming DRR into the case study project had been able to address the physical vulnerabilities is discussed below:

- The existing ground and road levels of this project are below that of the sea level and the road is located very close to the sea where certain parts are regularly subject to flooding for various reasons, proving the factor the 'proximity of road reconstruction project to natural hazards'. Although a DRR strategy such as land use planning would provide a better solution for the problem it has become impossible in a reconstruction project like this as it involves shifting/re-routing roads. Such an action is not something to be decided and enacted by the local authorities or at the project level unless the national governmental level provisions are in place in this regard. The Sri Lankan government attempted to implement a rule called buffer zones for reconstruction after the tsunami 2004 disaster by prohibiting all construction within close proximity to the sea. It started with 100 feet from the sea, later reduced to 35 feet, but finally became a poorly functional rule and was abandoned. The next solution is 'raised roads which is a strategy implemented within this project to the extent of its importance.

- In raising roads, the interview respondents stated that the roads were not raised considerably, as the most economic solution for flood prone areas is not raising roads, but installation of proper drainage systems. 'Construction of flood defences (e.g. sea walls) alongside road networks' is another useful physical/technical strategy in this regard, but it had not been attended at all by the road project. The other most important strategy is 'contingency mechanisms for coping with disasters (escape roads)', but is also not adequately implemented within the project. The project had not been undertaken as a network of roads or interconnected roads. Therefore, the possibility of identifying alternative or escape roads in case of disaster became difficult and impossible. Moreover, some interview respondents believed that such alternative routes are not a must in rural roads as it is normally in the case of major roads.

- Interdependencies of the roads (projects) with other infrastructures and infrastructure sectors can occur during their normal functioning, disaster situations and reconstruction. For example, high geographical interdependency of the case study road (project) (two or more infrastructures are located in the same area that can be affected by a local event) with other infrastructures (sectors) such as communications, electricity, and water resulted in severe reconstruction delays due to overlap in reconstruction and delayed implementation of initially drafted road designs. As a result of the latter issue, the initial designs became out-dated by the time of their implementation as the road conditions changed from subsequent small scale disasters, such as floods which took place following the tsunami 2004, leaving the already damaged roads and roads being reconstructed more exposed future hazards. On the other hand, major impacts of natural disasters on critical infrastructure could result in secondary impacts on functions and services of associated industries in the affected areas because of their inevitable geographical interdependency from one to another. This is something to be focused on during reconstruction in order to prevent/minimise effects of future disasters on interdependent infrastructure. Although DRR strategy called 'communication, information management and sharing outside the project' could have been the most effective strategy in this regard, since the project had not had timely and effective communication between other relevant infrastructure sectors (e.g. telecommunication, electricity), interdependencies have negatively affected the efficacy of the final outcome of the project. Although the interview respondents stated that communication was taking place with the external authorities such as local authorities in designing the project it had not been sufficient to overcome the negative effects of infrastructure interdependencies during reconstruction or when the reconstructed roads are made available to the public for use.

4.2.2 Technological vulnerabilities

Semi-structured interview findings identified an additional factor called 'existing structures' as a factor forming technological vulnerabilities, apart from the factors listed in Table 2. These factors mainly led to reduced resistance of road structures to natural hazards, as well as sometimes to increased exposure to natural hazards. How far mainstreaming DRR into the case study project had been able to address the technological vulnerabilities is discussed below:

- Although the project had used new technologies to a certain extent to improve the structural stability (e.g. new road surfacing systems), use of more advanced technologies had become limited due to financial problems and project participants' inadequate foresight regarding new technology for reconstruction at the project inception, because the roads in question had been initially managed by the provincial and local governments who normally suffer from lack of professionally qualified engineers with adequate technical knowledge. Although the 'project part*icipants'* engagement in training and education/awareness programmes on infrastructure safety' is a very important knowledge management DRR strategy to overcome the lack of skills for new technology this strategy had not been adequately implemented in the project. Although most of the interview respondents agreed that there were some capacity building programmes, they too questioned their adequacy given the fact that this project was initiated as a capacity building project for local authorities and southern provincial administrative authorities. Moreover, it was revealed that the opportunities opened up for employees from the contractors' side for this kind of training programmes were very minimum. As a solution for '*project participants' inadequate foresight* regarding new technology for reconstruction', the experts suggested the importance of being familiar with the local construction technologies, design features and construction materials in order to overcome unnecessary reliance on new technologies which would not necessarily suit the local context. It can be achieved through 'community engagement in decision making and physical reconstruction'.

- Apart from the high interdependencies described above, it was further ascertained that the project was technologically vulnerable due to its cyber interdependency of information transmitted through information and communication infrastructures. Cyber interdependencies mainly affected communication just before, during and immediately after the tsunami, in receiving disaster warnings and in responding to the hazard, leading to increased exposure of the road structures to the tsunami hazard. As a result the opportunities for protecting the road structures from the tsunami were lost as no emergency preparedness and immediate response could take place within the road authorities. This problem will be further continued as the reconstruction project did no pay sufficient attention to resolving it targeting at future hazards. The expert interviews also highlighted the importance of establishing integrated warning systems, regular upgrades of warning systems, proper lines of communication (collaborative approach between infrastructure authorities) when warning systems are activated which themselves are means of creating cyber interdependencies between infrastructures and the relevant authorities. This is where the importance of 'communication, information management and sharing outside the project' appears as part and parcel of reconstruction and post-reconstruction, given its ability to establish lines of communication through proper coordination with the relevant external entities appear. These would positively help overcome the technological vulnerabilities; however, the case study project in focus had not gone into that extent in adopting integrated warning systems or collaborative approaches to prevent future disasters through information sharing. Discontinuity of personnel and authorities involved in reconstruction for the operational phase of the road structures (including maintenance) would make the reconstructed structures more technologically vulnerable as the officials in-charge of operation and maintenance may have different understanding and mind-set about minimising disaster risks than the officials who were originally engaged in the reconstruction.

- *'Lack of detailed planning and structural mitigation of road reconstruction project'* directly affects the resistance capacity of the road structures. It was realised that most of the initial project designs lacked sufficient structural details due to 'project *participants' carelessness/ inadequate foresight*', their 'lack of knowledge', 'pursuit of profit' and 'insufficient data and information'. For example, the feasibility studies had been conducted based on a very little initial data available after the tsunami. Only a few studies had been conducted before starting the detailed designs – e.g. studies on issues such as present usage and future expected usage of roads, but no adequate vulnerability, hazard and risk assessments were conducted. In interview respondents' opinion, the reason is attributed to the impossibility to carry out project planning to a great extent in reconstruction projects as normally done in new construction projects. As explained above, although the 'p*roject participants' engagement in training and* education/awareness programmes on infrastructure safety' is a very important knowledge management DRR strategy to overcome the problem of 'lack of knowledge', but this strategy had not been adequately implemented.

4.2.3 Political vulnerabilities

Political vulnerabilities would initially reduce the resilience of the project team and subsequently affect the disaster resistance capacity of the road structures. Four factors have contributed to political vulnerabilities: 'minimal support for disaster programmes amongst elected officials', 'inability to enforce or encourage steps for mitigation within road project', 'over-centralisation of decision making within road project', and 'isolated or weak disaster related institutions related to road reconstruction', according to the questionnaire survey findings. However, the interviews identified only two factors within this area:

- Due to budgetary constraints, the project had to select the highest priority roads for reconstruction. The priority lists had been prepared by the provincial and local governments that resulted in an added political interferences to the selection procedures of roads for reconstruction. Accordingly, the project had undertaken tsunami affected as well as unaffected roads. Thus, some roads which were substantially affected by the tsunami had been neglected due to 'minimal support for disaster programmes amongst elected officials'.

- The 'inability to enforce or encourage steps for mitigation within road project' was identified, again due to political interferences on the project. As noted, sometimes the project officials had not been given the opportunity to plan it unrestricted; changes took place even during the construction phase, for example; certain roads were removed from the project after physical reconstruction had commenced on the site. Although the structural designs of the project were not influenced by the political problems, the overall project planning was affected by political issues. On the other hand, as noted by the interview respondents there was no proper political support to acquire the most critical lands to establish the road boundaries and drainage systems. Apart from that, the project funder's regulations have prohibited the project from acquiring lands from communities. In this way, the road reconstruction project experienced the 'inability to enforce or encourage steps for mitigation within road project' due to 'minimal support for disaster programmes amongst elected officials' and policies and regulations not permitting such mitigatory actions.

Most factors forming political vulnerabilities of reconstruction projects are out of the project control. If there were clear-cut 'national and intermediate-*organisational protocols',* special 'organisational arrangements that govern enactment and enforcement of various national and intermediate-organisational protocols' and 'organisational policies, guidelines for planning and implementation of disaster risk reduction strategies' this problem could have been avoided to a certain extent. Since 'minimal support for disaster programmes amongst elected officials' can take place due to an imbalance of many factors such as lack of economic resources, lack of ability and knowledge, in experts view, improving communication, information management and sharing outside the project (e.g. political agencies) is another strategy that road reconstruction projects can use to resolve this matter.

5. Conclusions

The existing vulnerabilities of road reconstruction projects can be described in a descending order of economic, physical, political, technological, cultural and social vulnerabilities. The results of the study demonstrate that existing vulnerabilities of disaster affected roads', road authorities and individuals involved in those reconstruction projects must be paid a key attention when mainstreaming DRR. Thus, 'vulnerability reduction' can be defined as an enabler that facilitates the process of mainstreaming DRR. Although the DRR strategies such as policy and planning; physical/technical; emergency preparedness; and knowledge management strategies are considered to be very important to make road structures more disaster resistance, authorities/teams more disaster resilience and both less exposed to hazards, they are not adequately mainstreamed into the project up to the required level.

The case study being a project involved in reconstruction of provincial and local roads, there were less application of policy and planning strategies such as national policies, design guidelines, regulations, and organisational level policy/guidelines. Although the feasibility studies had been carried out to a certain extent, mostly the case study project did not receive sufficient funding for detailed planning activities such as hazard mapping, vulnerability assessments, risk assessments, disaster impact assessments etc., activities which are directly related to DRR and it is therefore unusual for mainstreaming DRR to be a top project priority at the early stages of project preparation. However, the study reveals that the key to successful mainstreaming of DRR into road reconstruction is planning and design phases.

The study further reveals that although the importance of effective mainstreaming of DRR into road reconstruction has been considerably identified by individual team members, adequate attention had not been given at the project planning and design phases to make it a project priority. This is mainly due to various external factors such as political and economic restrictions which are out of the project's controlling capacity and internal factors such as socio-cultural variables (limited education about effects of hazards, dependency and absence of personal responsibility etc.). As far as the internal factors are concerned, while some of the project team members consider mainstreaming DRR as an alien concept some of them do not bring a serious negative attitude towards it. However, majority of them are not ready to accept it as a project priority due to their narrow minded thinking of mainstreaming DRR as something alien and not bearable for developing countries like Sri Lanka. Principally, they are morally getting demotivated due to these external factors explained above.

References

Asian Development Bank (ADB) (2005) Rebuilding Sri Lanka: Assessment of Tsunami Recovery Implementation, Colombo: ADB, Available from: www.recoverlanka.net/data/SLDF05/assessment.pdf, (Accessed 02/12/2006).

Asian Development Bank (ADB), Japan Bank for International Cooperation and World Bank (2005) Sri Lanka 2005 Post-Tsunami Recovery Program: Preliminary Damage and Needs Assessment, Colombo, Sri Lanka: ADB

Department for International Development (DFID) (2006), Reducing the risk of disasters – Helping to achieve sustainable poverty reduction in a vulnerable world, A DFID Policy Paper, London: DFID.

Eshghi, K. and Larson, R.C. (2008) "Disasters: Lessons from the past 105 years", Disaster Prevention and Management, Vol. 17(1), pp. 62-82.

Government of Sri Lanka (GoSL) (2005) Sri Lanka Post Tsunami Recovery and Reconstruction – Progress, Challenges and Way Forward, Joint Report of the Government of Sri Lanka and Development Partners, Colombo: Government of Sri Lanka.

Gunasekara, J. (2006) Building capacity for sustainable and participatory post-tsunami rebuilding, International Conference and Student Competition on Post-Disaster Reconstruction: Meeting Stakeholder Interests, 17th-19th May 2006, Florence, Italy, Available from: www.grif.umontreal.ca/pages/papersmenu2006.htm, (Accessed on 10/12/2006).

Jigyasu, R. (2002) "From Marathwada to Gujarat – emerging challenges in post-earthquake rehabilitation for sustainable eco-development in South Asia", 1st International Conference on Post-Disaster Reconstruction: Improving Post-Disaster Reconstruction in Developing Countries, 23rd-25th May, Universite de Montreal, Canada.

McEntire, D.A. (2001) "Triggering agents, vulnerabilities and disaster reduction: Towards a holistic paradigm", Disaster Prevention and Management, Vol. 10(3), pp. 189-196.

Mileti, D.S. (1999) Disasters by Design: A Reassessment of Natural Hazards in the United States, Washington, D.C.: Joseph Henry Press.

Reconstruction and Development Agency (RADA) (2006a) Tsunami Recovery & Reconstruction in Sri Lanka, Colombo: RADA, Available from: www.lankamission.org, (Accessed on 01/12/2006).

Reconstruction and Development Agency (RADA) (2006b) Midyear Review: Post-Tsunami Recovery and Reconstruction, Colombo: RADA.

United Nations International Strategy for Disaster Reduction (UN/ISDR) (2004) Living With Risk: A Global Review of Disaster Reduction Initiatives, Geneva: United Nations Inter-Agency secretariat.

Weichselgartner, J. (2001) "Disaster mitigation: The concept of vulnerability revisited", Disaster Prevention and Management, Vol. 10(2), pp. 85-94.

Wisner, B., Louise, P. and Bhatti, A. (2005) Tackling the tides and tremors: South Asia Disaster Report 2005, Rawalpindi, Pakistan: Duryog Nivaran Secretariat and Practical Action - South Asia Programme, Rawalpindi, Pakistan.