EFFECTS OF POST DISASTER INFRASTRUCTURE RECONSTRUCTION ON DISASTER MANAGEMENT CYCLE AND CHALLENGES CONFRONTED: THE CASE OF INDIAN OCEAN TSUNAMI IN SRI LANKA

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ABSTRACT: There has been an increase in the number of natural disasters over the past few years. Sri Lanka was particularly hard hit by the Indian Ocean tsunami of 26 December 2004, which caused devastating effects on the economy, in terms of huge human and economic losses, and washed away most of its basic infrastructure that served the poorer communities while significantly setting back the development efforts of the country. The developing countries are less able to face the impacts of disasters and so it is imperative to develop the infrastructure for the poorer nations in order to quip them to manage disasters. Without being able to provide the basic infrastructure, the plight of these affected people have been further compounded. Post-disaster reconstruction has a key relevancy to development discourse and disaster management cycle; particularly infrastructure reconstruction should be envisaged from development perspectives. However infrastructure reconstruction projects are sandwiched between the short-term necessity to act promptly and the long-term requirement of sustainable development. In this context this paper aims to discover the necessity of rebuilding infrastructure for a successful disaster management cycle and some key challenges for post-tsunami long-term infrastructure reconstruction in Sri Lanka. A comprehensive literature review was carried out regarding these issues. Results confirm that infrastructure can both reduce the losses resulting from natural disasters and facilitate easy post-disaster recovery and thus more investment in infrastructure reconstruction is needed. Currently disaster management teams in Sri Lanka faces some key challenges in reconstructing the affected infrastructure; most aggravating is the unfamiliarity of the event, poor institutional capacity, and current security problems in the north and east of the country. Sri Lanka has to learn much from other settings and there is a strong need to develop the capacity.

Keywords - Challenges, Disaster Management Cycle, Infrastructure, Reconstruction, Tsunami 2004.

1. BACKGROUND

'Disasters' have become a common word to people all over the world. The whole world is prone to natural disasters as well as to abrupt man made ones, which have been occurring repeatedly in recent history. Devastating earthquakes in Turkey, Taiwan and Pakistan, Indian Ocean Tsunami 2004, landslides in Venezuela and Mexico are a few of the major natural disasters. Without doubt the most devastating loss of life in recent years was the much larger in magnitude (9.3 on the Richter scale) Indian Ocean Tsunami 2004, which was driven by one of the most powerful earthquakes (third largest ever recorded), six miles beneath the sea bed of the Indian Ocean. Its epicenter was near the west coast of Northern Sumatra. The tidal waves set about their journey with incredible speed and unremitting force towards more distant coastlines – Indonesia, Sri Lanka, Thailand, India, Bangladesh, Malaysia, Maldives, Seychelles, Kenya and Somalia. The Tsunami was responsible for the bulk of the damage and casualties. This awesome Tsunami washed over the coastlines of these countries and it is now estimated to have claimed 275,000 lives. The Tsunami struck at a time when Sri Lanka's Government had a ceasefire agreement with the Liberation Tigers of Tamil Eelam (LTTE) to stop the civil war of over 20 years' duration, and which claimed the lives of an estimated 65,000 people and uprooted more than one million civilians. The breakdown of essential

infrastructure is one of the most widely shared characteristics of all disasters. In the manner Tsunami destructed most of the coastal based infrastructure in Sri Lanka.

Infrastructure is essential for quality of life and it plays a critical role in people's daily lives and the economic outlook. Whether partial or complete, the failure of infrastructure leads to loss of life and damage to property. Infrastructure appears in many ways as transport, communication services, water supply and sanitation services, health and education services, electricity and other energy services (Anand, 2005). This paper is most concerned with infrastructure in the four key sectors of transport, telecommunications, energy and water supply and sanitation.

2. TSUNAMI 2004: IMPACTS ON SRI LANKA

This Tsunami, with its unprecedented force, caused tremendous destruction on two third of the island's coastal line affecting thirteen districts. The disaster killed 35,322 persons; 21,441 persons injured and 516,150 persons internally displaced. The estimated economic value of the lost assets is $900 million. Housing, tourism, fisheries and infrastructure, mainly coastal infrastructure, such as roads, railways, power, telecommunications, water supply and fishing ports were the most affected sectors - with the number of lost livelihoods at 150,000 (ADB, 2006).

Approximately 800 km of national roads, together with approximately 1,500 km of provincial and local government roads were damaged due to the tidal waves (Palliyaguru et al, 2006). The road and rail transport from Colombo to Hambantota in the south and some parts of the Puttalam district were badly damaged along with 25 bridges and causeways located in the coastal belt of the country. 22,660 households lost electricity and 6,500 km of service lines, 600 km of low voltage lines and 50 km of medium voltage lines damaged. 10 pipe borne water schemes damaged, 15,000 wells contaminated due to salt water intrusion and potable water treatment and reticulation systems damaged. Telecommunications in 10 districts were badly affected. Telephones to important places like hospitals, police stations and government offices completely disconnected. 25 telephone exchanges (PABX) damaged and cable networks in Hambantota, Matara, Galle, Kalutara, Panadura, Trincomalee, Batticaloa, Ampara, Kalmunai and Jaffna districts were damaged. Several transmission towers and telephone exchanges in the coastal belt were severely damaged.

Key income generators in the country lost their livelihoods causing greater susceptibility to poverty, as these mainly served the fisheries, tourism and coastal communities. The largest share of output losses appear to be in first two sectors mentioned above due, to lost income and production. As far as the fishery industry is concerned eight out of twelve fishery harbours were completely destroyed leaving another two harbours with considerable damages. 75% of the fishing boats were reported to have been damaged. RADA (2006b), simply reports 16,919 fishing boats lost or destroyed including approximately 1 million fishing nets lost. Many of the landing sites around the coast were also seriously damaged. In the tourism industry 65% of the room capacity in the hotel sector was affected.

The enormity of this particular tragedy generated an outpouring of aid from both the international and local communities. With an overwhelming immediate assistance to communities and local governments in re-establishing themselves as speedily as possible and to rebuild their infrastructure and housing, they were able to again have normal lives and eventually recover from the trauma of the Tsunami. In addition to immediate relief, the reconstruction phase in Sri Lanka was estimated to need some EUR 1.5 billion and would take 3-5 years. Sri Lanka received this full amount in pledges (Perera, 2006). Sri Lanka recently celebrated with religious ceremonies to mark the second anniversary of the Tsunami

and on this second anniversary, nearly 100% has been committed and over half of it has been disbursed onto specific contracts (Perera, 2006).

3. POST DISASTER INFRASTRUCTURE RECONSTRUCTION AS A TOOL WITHIN DISASTER MANAGEMENT CYCLE

The role of post-disaster infrastructure reconstruction in the disaster management cycle is worth exploring. Post-disaster reconstruction has been the subject of a significant body of research particularly in developing countries (Haige, 2006). Infrastructure includes both 'hard' and 'soft' assets of societies and the rebuilding of social institutions and capacity of communities is as crucial as reconstructing roads and bridges (Anand, 2005). 'Disaster' is defined as a serious disruption of the functioning of a community or a society causing widespread human, material, economic or environmental losses which exceed the ability of the affected community or society to cope using its own resources (Lloyd-Jones, 2006). Infrastructure reconstruction, after major disasters, involves immediate and temporary restoration of infrastructure such as health services, educational services, roads, railways, power, telecommunications, water supply and sanitation, medium term reconstruction and long term reconstruction. Disaster management is in fact a systematic on going process of using administrative decisions, organisation, operational skills and capacities to implement policies, strategies and coping capacities of the society and communities. Its purpose is to reduce, or avoid the potential losses from disasters, assure prompt and appropriate assistance to victims of disaster, and achieve rapid and effective recovery. Disaster prevention, mitigation, preparedness, disaster itself, immediate relief, medium term recovery and long term recovery are the main phases of disaster management cycle. Appropriate actions at all points in the cycle lead to greater preparedness, better warnings, reduced vulnerability or the prevention of disasters during the next iteration of the cycle. The different stages may be achieved within different timescales in different regions. According to Fox (2006) the issues related to link between disaster and development has been raised by various disaster planners (Haigh, 2006). Investment in infrastructure for disaster management is essential in this context as it can result in the reduction of lives lost. Thus post-disaster infrastructure reconstruction as a tool within the disaster management cycle can be explored as follows.

3.1 Disaster Prevention and Mitigation Phase

Disaster prevention phase involves the actions taken to eliminate or avoid harmful natural phenomena and their effects. After a disaster or even before, the population returns to pre-disaster standards of living. But, they recognise the need for certain measures which may be needed to reduce the extent or impact of damage during the next similar disaster. This is the process of making the impact less severe. Physical infrastructure can be developed to withstand disasters and prevent damage from natural disasters. For instance drinking water systems can be very effective for flood management. Thus infrastructure can play a major role in case of a disaster particularly in minimizing devastating impacts and even prevention of disasters. Infrastructure failures in post-disaster period can become the fundamental reason for another series of devastating effects followed by later natural disasters. Poor infrastructure also contributes to high logistics costs and high inventory levels. For example, in Sri Lanka although the transport sector was affected relatively little by the tsunami as such, the needs emerging in the post-tsunami period have highlighted the neglected and general lack of development that the transport network has suffered for many years. This is a good example

for lack of mitigation. Every nation must take the necessary mitigation measures to keep the damage to physical infrastructure during natural disasters to a minimum. Mitigation activities before disasters strike should aim, in particular, at protecting these physical infrastructures so that relief and reconstruction activities afterwards can be carried out efficiently (ESCAP, 2006).

Construction of dikes, building of dams, construction of flood control basins/reservoirs, construction of tide walls, construction of erosion control dams, construction of retaining walls etc. all come within the disaster prevention and mitigation phase. Thus post-disaster infrastructure reconstruction has a profound impact on this phase, which makes it a smoother phase. Further, infrastructure can increase productivity, reduce the cost of production, increase trade and reduce poverty It can also create a major disaster or enhance the effects of disaster in completely negative manner.

3.2 Disaster Preparedness Phase

Activities and measures to limit the impact of disasters, through ensuring structured responses and establishing mechanisms for effecting a quick and orderly reaction to disasters, are classified as preparedness and are not aimed at averting the occurrence of a disaster. Further this phase involves the development of awareness among the population on the general aspects of disasters and on how to behave in future events. This includes education on warning signs of disasters, methods of safe and successful evacuation and first aid measures. A larger dimension of disaster planning and preparedness, which may or may not exist in any particular location, but which can have a huge influence of the scale and impact of the disaster resulting from a hazardous natural event, is an important phase in the disaster management cycle. Construction and operation of signaling and communication systems, such as earthquake observation systems, meteorological observation systems and early warning systems, facilitation of additional water supplys and sanitation systems are a few activities which come within this phase. Thus the role of infrastructure in disaster preparedness phase is absolutely clear.

3.3 Disaster Phase

This is the phase during which the event of the disaster takes place. This phase is characterized by profound damage to the human society. This damage may be: loss of human life, loss of property, loss of environment, loss of health, etc.

3.4 Immediate Relief/Early Recovery Phase

This is the period that immediately follows the occurrence of the disaster, which is the immediate post-recovery, which can last days, weeks or months depending on the nature of the disaster and local conditions. The needs of the population during this phase are immediate medical help, food, clothing, shelter and essential infrastructure. When a natural disaster hits an area, the efficiency and effectiveness of the first response can have a profound effect on disaster relief efforts. Engineers and disaster relief organizations have clearly defined first response efforts, specifically in securing the affected infrastructures. The basic community infrastructure must be secured as much as possible and immediate approaches to such infrastructure is very important in assisting people on an emergency basis and immediately

fulfilling sanitation requirements of the community. Proper reconstruction of infrastructure reduces the efforts on securing infrastructure in a second disaster. For example, proper reconstruction and redevelopment of communication systems such as early warning systems would be to include monitoring for secondary disaster.

3.5 Medium-Term and Long-Term Recovery Phase

With the recovery of social institutions, the economy and the main infrastructure, transition to the longer-term recovery and reconstruction process can be implemented. Ideally, there should be a smooth transition from relief to long-term recovery. Medium-term recovery fulfills this requirement. It deals with restoring normal conditions and providing financial and technical assistance to rebuild. There is no distinct point at which immediate relief changes into recovery and then into long-term sustainable development. Normally this phase lasts from six months to many years. When the immediate needs of the population are met and people have settled from the hustle-bustle of the event, they begin to enter the next phase, the recovery phase which is the most significant, in terms of long-term outcome. Infrastructure development and reconstruction is vital to the economic development and more susceptible to economic policies. Post-disaster infrastructure reconstruction is relevant to development discourse and is often essential to sustain recovery after major disasters. Proper and pertinent post-disaster infrastructure reconstruction will particularly reduce the needs of infrastructure reconstruction in a second disaster. The priority for 'Enhanced Asia Pacific Regional Cooperation in Disaster Management' will be based upon rebuilding infrastructure and investing in infrastructure for disaster prevention and preparedness (ESCAP, 2006).

4. PROGRESS AND CHALLENGES IN POST-TSUNAMI INFRASTRUCTURE RECONSTRUCTION IN SRI LANKA

'Disaster' itself is a challenge to development in the world when disasters predominantly exist in the developing countries. Sri Lanka is attempting to move towards a safer country recognising Tsunami as an opportunity to to move towards sustainable development, despite the devastation. The Disaster Management Centre under the Ministry of Disaster Management declared its Road Map in December 2005, called 'Towards a Safer Sri Lanka: Road Map for Disaster Risk Management'. This is a key government policy document, which aims to provide an overall framework for disaster risk management in the country and is an effort to unify efforts of different agencies focusing on seven thematic components (Jayawardane, 2006). This document has made a clear attempt to identify developments and improvements in infrastructure in future vulnerability reduction (MoDM, 2006). Despite all these efforts, the progress achieved by the end of 2006, in four key infrastructure sectors i.e. transport, telecommunication, energy and water supply and sanitation are discussed below with major challenges and constraints encountered by each sector.

4.1 Transport (Roads, Railway and Bridges)

The immediate restoration work on roads, bridges was implemented within two weeks of the Tsunami with sufficient repairs. 135 kms of national highways are nearing completion on the southern coast. Tenders have to be awarded for another 149 kms of national highways and procurement is likely to be completed by March 2007. Over 1,000 kms of national B and C

roads are under or entering construction (RADA, 2006a and RADA, 2006b). But the reconstruction and redevelopment of major roads in the north and east are at a cumbersome situation, particularly in areas beyond Ampara district as prevailing conflict prevents such work. The large infrastructure projects require a long process of planning and preparatory work before the construction work actually starts. Therefore most of the reconstructions of roads are likely to be completed in 2008/2009 (RADA, 2006a and RADA, 2006b). Five major bridges in the south are in final stage and others are in tendering or design stage or not yet commenced. It is expected that five more bridges will be completed in 2007, twelve in 2008, and one in 2009 (RADA, 2006a and RADA, 2006b). Damaged railway tracks on coast lines, namely, Colombo-Matara line, Trincomalee line and Batticaloa line were restored within two months of the Tsunami. 40% of the railway signal systems have already been restored, 02 locomotives and 03 coaches were recovered and are in use and other 03 coaches were recovered and are being used as monuments. 75% of the buildings associated with railway infrastructure have been reconstructed (RADA, 2006a and RADA, 2006b).

Local contractors' lack of capacity in terms of numbers of contractors, equipment availability, size and skill of the labour force, and management practices is a major constraint in transportation infrastructure reconstruction (RADA, 2006a). Due to its size and the number of levels of public authorities who are involved, transportation has become a complex sector to manage and appears currently to have been the source of few controvercies at the local level. Nevertheless, how the new transport infrastructure will impact on the lives of key categories of the population, such as women, the disabled and children, is a question that needs to be asked in the course of planning and implementing transport recovery activities. One issue already appearing on the horizon is whether the relevant departments will be accorded the resources required in the future to adequately maintain the roads that will be constructed (ADB, 2005).

4.2 Telecommunication

Immediate restoration of damaged telecommunication infrastructure was carried out within a few weeks. Several funded projects have been implemented to improve data collection and decision-making infrastructure, thereby improving the response times to inform the public of national emergency situations and developing emergency communications and notification capabilities. A few early warning systems have already been constructed.

4.3 Energy (Electricity)

Electricity was supplied to most of the temporary settlement camps. The damaged network has been replaced and almost all the relocated families have access to electricity. The government has planned to carry out rebuilding of the electricity supply in 3 phases. Within the first phase, CEB (Ceylon Electricity Board) was able to restore power supply within 2 months of the tsunami to all affected areas. CEB has almost fully completed network development requirements under the second phase by reinstating and newly constructing high tension and low tension distribution lines and substations. Already CEB has connected 17,928 new post-tsunami houses (RADA, 2006b).

Constraints in the electricity sector were identified as: more materials required for the rest of restoration exercise, delays in procurement process, lack of donor funding for parts of latter phases and planning difficulties due to unknown overall power requirement for housing and other reconstructions such as roads/bridges, schools, hospitals and public buildings. 10-

15% of the transitional shelters which are mainly in the un-cleared areas do not have electricity.

4.4 Water Supply & Sanitation

Restoration of essential and immediate needs was fulfilled perfectly. Affected wells were emptied and disinfected within a month. 130 water related projects have been planned and donors have committed funds for 96 projects, which are in progress (RADA, 2006a). Long-term sanitation projects are still in progress (RADA, 2006a).

Most of the projects would not be completed as originally planned, due to various constraints e.g. lack of maintenance of water/gully bowsers and packaged water treatment plant, securing counterpart funding (VAT/Duty), delays in procurement of tools, equipment, lack of enhancement of National Water Supply and Drainage Board (NWSDB) project management and monitoring capacity and difficulties related to design and formulation, which has led most of the projects lagging behind the expectations. Being deficient in capacity appears in various forms ranging from the of lack of positive activity to commencement of sanitation studies and development of sewerage for new settlements.

The general lack of institutional capacity, equity problems, procurement delays and non availability of materials, inefficient management and coordination have become major constraints in the infrastructure reconstruction discourse. Mainly the prevailing security problems and communication barriers in the north and east of the country have delayed the reconstruction and construction agencies have restricted access to LTTE controlled areas. Simply stated, delays occur in road and bridge rehabilitation projects are even due to off loading and reloading of materials at Sri Lanka Army and LTTE check points.

5. CONCLUSIONS

The post-disaster reconstruction process needs to address not only infrastructure that may have been damaged in the disaster but also infrastructure that never existed or infrastructure that has been damaged due to lack of maintenance over years. At the same time infrastructure management at long-term recovery phase must involve measures aimed at the whole disaster management cycle. Infrastructure designing and planning in the post-disaster must accomplish the remedial solutions for missing baseline. Experience increasingly affirms that the post-disaster recovery phase provides a critical opportunity to introduce measures to reduce future disaster risk through new physical infrastructure. The study concludes that infrastructure can both reduce the losses resulting from natural disasters and facilitate easy post-disaster recovery and thus more investment in infrastructure reconstruction is needed while lessening the challenges confronted in the post-disaster reconstruction phase.

Sri Lanka has achieved an acceptable recovery in the southern part of the country and the northern region is lagging behind the expectations, largely because of escalating conflict in the north and east of the country. Sri Lanka is the best example to prove that low pre-disaster development leads to slower recovery followed by sluggish progress in long-term reconstruction where some targets may never be achieved. What Sri Lanka was doing has not been working well enough in light of the enormous challenges faced by developing countries. Sri Lanka has to learn much from other relevant settings. The current infrastructure reconstruction process in the country is basically hindered due to the lack of institutional capacity and current security problems prevailing in the north and east region of the country.

Thus there is a strong need to develop the capacity in government, local institutions together with NGO, professionals and the public as a whole.

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