CIB2007-209

Improving Infrastructure to Reduce Future Vulnerabilities to Natural Disasters: Review of Infrastructure Development Associated With Post Tsunami Reconstruction in Sri Lanka

Roshani Palliyaguru, Dilanthi Amaratunga and Richard Haigh

ABSTRACT

An under-sea earthquake near the west coast of Northern Sumatra set off a series of other earthquakes in December 2004 and led to a widespread disaster, Tsunami 2004. Sri Lanka faced one of the worst natural disasters with a large proportion of losses in housing and infrastructure. The developing countries are less able to face the impacts of disasters and so it is imperative to develop the infrastructure of the poorer nations in order to quip them to manage disasters. As a nation, we should demonstrate firm resolve in protecting infrastructures from further disasters. This paper affirms current infrastructure reconstruction process in Sri Lanka is basically hindered by the lack of institutional capacity and current security problems in the north and east of the country. Sri Lanka has much to learn from other settings and there is a strong need to develop the capacity. The infrastructure reconstruction programmes should also aim to change the vulnerable conditions for the development of the country.

Keywords: Tsunami 2004, Infrastructure Reconstruction, Disaster Management, Gaps, Capacity Building.

1. INTRODUCTION

Tsunami 2004 brought to Sri Lanka the worst natural disaster ever recorded in recent history. Our society and modern way of life depend on a

complex system of critical infrastructure. As the infrastructure consists primarily of transportation, electricity and telecommunications, and water and sanitation facilities that provide services to the public through a network of roads, rail, ports, airports, pipes, and lines, the effectiveness of infrastructure systems impact on all economic activities. The objective of this paper is to analyse the progress of post Tsunami infrastructure reconstruction within a developing country, with a special emphasis on identifying the prevailing gaps and lessons learned from other settings that will fit the Sri Lankan context. This paper has revealed just how multi-dimensional the infrastructure contributions to economy and disaster management are. A comprehensive literature review was carried out and the data on infrastructure reconstruction, including the present progress were obtained through RADA (Reconstruction And Development Agency) publications.

2. INDIAN OCEAN TSUNAMI 2004: OVERVIEW

On December 26, 2004, death came as small white ribbons stretched across the Indian Ocean horizon driven by one of the most powerful earthquakes in the last 40 years. At 9.0 on the Richter scale, six miles beneath the seabed of the Indian Ocean, it was produced by movements in tectonic plates at the interface between the India and Burma plates. It gave birth to most devastating tsunami waves suffused in all directions. The devastating waves travelled from their epicentre near the west coast of Northern Sumatra to the western shores of Indonesia and within hours destroyed the coastlines of Indonesia, Sri Lanka, Thailand, India, Bangladesh, Malaysia, Maldives, Seychelles, Kenya and Somalia. The tragic toll still resonates, with more than 200,000 dead; 2 million people displaced; 370,000 homes destroyed or damaged; some 5,000 miles of coastline devastated; and 2,000 miles of roads ruined (Clinton, 2006). Sri Lanka was one of the countries that suffered the heaviest losses.

3. EFFECT OF TSUNAMI 2004 ON SRI LANKA

Generally Sri Lanka experiences frequent natural hazards in the form of droughts, floods, landslides, cyclones and coastal erosion affecting hundreds of people over the years despite the tropical climate and heavy rainfall. However this time Sri Lanka was hit brutally hard by the Tsunami causing thousands of deaths and destruction that stretched over two thirds of the island's coastline with thirteen (13) outlying districts affected. The statistics were staggering: 35,322 people killed; nearly 516,150 people displaced with only memories of normal life and no homes to return to; over 6,000 reported missing and 89,000 houses washed away (United Nations, 2005). The tsunami compounded previously existing vulnerabilities resulting from civil conflict by making the north and east the hardest hit region. The coastal population affected ranged from an estimated 35% in

Kilinochchi to 80% in Mullaitivu and 78% in Ampara coastal district divisions, compared to the southern districts of Galle, Matara, and Hambantota, where less than 20% of the coastal population was affected, albeit with scattered pockets of severe damage (www.recoverlanka.net/data/SLDF05/assessment.pdf).

The massive damage to infrastructure and capital assets was estimated at $1 billion, 5% of GDP, with a large proportion of losses concentrated on housing, tourism, fisheries and infrastructure. Coastal infrastructure, namely roads, railways, power, telecommunications, water supply and fishing ports were significantly affected (ADB, 2006). Major infrastructure in the country was severely damaged, as most have been continuously maintained without any significant capacity upgrade for nearly 100 years. The island's road transport network from Colombo to Hambantota and some roads in the Northern and Eastern parts of the country were severely damaged, with approximately 800km of national roads, 1500km of provincial and local government roads, 25 bridges and causeways located in the coastal belt of the country (Palliyaguru et al., 2006). Electricity distribution lines were damaged abolishing the power for 22,660 households and damaging 6500 km of service lines, 600 km of low voltage lines and 50 km of medium voltage lines. Water supply and sanitation systems were damaged making holes in water supply schemes, public and private wells and reticulation systems. Telecommunication systems in 10 districts were badly affected: with 25 telephone exchanges (PABX) damaged and cable networks in most of the districts experiencing the disaster. Several transmission towers and telephone exchanges in coastal belt were severely damaged.

The largest damage to livelihood was incurred in the fisheries and tourism sectors causing greater susceptibility to poverty. Eight (8) out of twelve (12) fishing harbours were completely destroyed leaving another two (2) with considerable damages. 75% of the fishing boats were reported to have been damaged (RADA, 2006b) including approximately 1 million fishing nets lost. In the tourism industry 65% of the room capacity in the hotel sector was affected.

The total reconstruction cost is estimated at EUR 1.5 billion, anticipating 3-5 years for completion (Perera, 2006). With vast immediate local and international assistance, communities were able to get back some normality to their normal lives to a certain extent.

4. ROLE OF INFRASTRUCTURE IN ECONOMY & DISASTER MANAGEMENT: OVERALL PERSPECTIVE

The role of infrastructure in people's daily activities and the economic growth of a country is apparent. Critical infrastructure is broadly defined to include the systems, facilities and networks that support the health, safety and economic well being of the population during and after natural disasters. These usually include transportation (road, railways and bridges), energy and utilities (electricity, gas), water supply and sanitation

services, telecommunication systems, health services and essential government services (ESCAP, 2006). Four key infrastructure sectors namely, transport, telecommunications, energy and water supply and sanitation are discussed in this research paper. This will in turn open up access to identification and construction of solutions for challenges in infrastructure reconstruction thus sustaining the countries disaster mitigation and economic growth.

It is difficult to imagine a modern world without infrastructure. Construction represents the largest proportion of every nation's savings. The physical infrastructure built through construction activity, at great expense, is the nation's economic backbone as it constitutes the arteries for the facilitation of productive activity and spreading the benefits of growth by enabling goods and services to be distributed (Ofori, 2002). On the other hand infrastructure has strong supply and demand side economic linkages (ESCAP, 2006). In much the same way, infrastructure caters directly to demand. Improving trade efficiency can do much more to spur economic growth than tariff reform and improving infrastructure is a major factor in improving efficiency of trade. It is found that the availability of good quality physical infrastructure improves the climate for foreign direct investment (FDI) by reducing the "cost of total investment" incurred by foreign investors and thus raising the rate of return (ESCAP, 2006). The creation of significant negative consequences to infrastructure, together with other built environment facilities due to disasters, would lead to pathetic economic consequences and an impoverished quality of life often for long periods of time. When events such as natural disasters destroy infrastructure, their opportunity cost becomes painfully evident.

Ignorance of sound infrastructure is shown in numerous ways. It exacerbates civil imperfections and demoralizes staff working in remote locations, particularly in vulnerable areas, further delaying the process of state rebuilding and undermining the effectiveness of rebuilding process. It also leads to poverty, hunger and infectious diseases. Moreover infrastructure failures can have an effect on gender and other aspects of identity and exaggerate powerlessness, vulnerability and disability (Anand, 2005). Infrastructure failures in the 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. This is particularly significant for the Sri Lankan economy as initiatives in this area are lacking. Sound infrastructure can increase productivity, reduce the cost of production, increase trade and reduce poverty whereas the lack of it can create major disaster or can enhance the effects of disaster in completely negative manner.

The poor are often the main victims of disasters, as it aggravates inequality and hinders progress towards the development goals. Disasters damage the entire economy of the country including the physical and human resources, especially when they predominantly take place in the developing countries. They influence aid priorities and thus have a crowding-out effect. Half of the world's natural disasters have been recorded in Asian countries and 70% of all floods, and much of the damage

inflicted by floods is to infrastructure. By some estimates, infrastructure losses account for 65% of all flood losses. Approximately 50% of the World Bank's total lending is equivalent to total cost of damage to infrastructure due to natural disasters in the Asian context (ESCAP, 2006). Physical infrastructure can be developed to withstand disasters and reduce and even prevent damage from natural disasters. For instance, drinking water systems can be very effective for flood management. Every nation must take care to keep damage to critical infrastructure to a minimum during disasters through the necessary mitigatory measures. If such activities undertaken before disasters aim, in particular, at protecting these critical infrastructures, it would result in effective and efficient relief and reconstruction activities in post-disaster phases (ESCAP, 2006). Post-disaster reconstruction is relevant to development discourse. Reconstruction infrastructure is often essential to sustain recovery after major disasters (Anand, 2005). Investment in infrastructure for disaster management is essential in this context and it is necessary to explore the management of infrastructure systems and the association between natural disaster reduction /mitigation with infrastructure management and development.

5. REVIEW OF INFRASTRUCTURE DEVELOPMENT IN POST TSUNAMI RECONSTRUCTION

5.1 Background – Institutional Arrangements

Subsequent to the Tsunami, the government set up three task forces. In November 2005, a single government agency was created to focus on reconstruction and development issues across all sectors and stakeholders in the affected areas. Hence, RADA is the result of a merger of all the Tsunami related organizations such as Task Force for Rebuilding the Nation (TAFREN), Task Force for Relief (TAFOR) and Transitional Accommodation Project (TAP) into a single organization.

RADA aims to improve the re-building of the affected communities. It has a clear objective of reducing future vulnerability through improved physical infrastructure (RADA, 2006b). RADA is involved in overall coordination of housing and those sectors from which the population derives their livelihood. Infrastructure sectors are largely coordinated by the relevant line ministries/departments with limited coordination from RADA except for the infrastructure related to housing in which RADA is involved with the relevant government institutions and donors (www.lankamission.org).

Soon after the 2004 Tsunami relevant parties recognized the need of a comprehensive, long term and holistic disaster risk management framework. The Tsunami showed the policy and institutional weaknesses of disaster risk management in the country. As a result, the Sri Lanka Disaster Management Act No 13 of 2005 was enacted in May 2005,

providing a solid legislative and institutional arrangement for disaster risk management. This established a powerful National Council for Disaster Management and the Disaster Management Centre (DMC) as the lead agency for disaster risk management (Jayawardane, 2006). Before the Tsunami, disaster management came under the purview of the Ministry of Social Services (MoSS). Later in November 2005 the Ministry of Disaster Management (MoDM) was established to provide undiluted leadership (Jayawardane, 2006).

Sri Lanka is now attempting to move towards a safer country recognizing the Tsunami as an opportunity to create sustainable development. The declaration of Road Map by the DMC under MoDM in December 2005, "Towards a Safer Sri Lanka: Road Map for Disaster Risk Management" aims to provide an overall framework for disaster risk management in the country and unify efforts of different agencies. It has clearly identified the emerging requirements of development and improvement of infrastructure in future vulnerability reduction (MoDM, 2006).

5.2 Progress in Different Sectors

Already several millions had been spent on restoring basic infrastructure. However, although almost all the required funding has been received, in some cases contracts have been awarded and rehabilitation work is in progress, whereas in others contracts have not yet been finalised.

5.2.1 Transport (Roads, Railways and Bridges)

General

One main focus of reconstruction is in rebuilding the roads. This includes rehabilitation of 1,173 Km of national roads and 25 major bridges (RADA, 2006a). On the railways, 80 buildings (including station buildings, officers'/workers' quarters, gate huts, parapet walls, culverts), 130 Km of track, 4 bridges, 50 signals, 5 locomotives and 8 rolling stock needs to be restored.

Institutional Set-Up

National roads are handled by the Road Development Authority (RDA) and others by provincial and local governments (RADA, 2006a).

Achievements

The immediate repairs were carried out within two week of the Tsunami enabling roads and bridges useable. 135 Km of national highways and five 5 major bridges are nearing completion on the southern coast. Tenders

have to be awarded for another 149 Km of national highways and procurement is likely to be completed by March 2007. Other bridges are in tendering or design stage or not yet commenced. It is expected that 5 more bridges will be completed in 2007, 12 in 2008, and 1 in 2009. Over 1000 Km of national B and C roads are under or entering construction. However, the major roads stop after Ampara district as conflict prevents construction further north. With regards to railway reconstruction 75% of the buildings have been rebuilt, damaged track on the coast line (Colombo–Matara line, Trincomalee line and Batticalo line) was restored within two months after Tsunami, 40% of the signal system has already been restored, 2 locomotives and 3 coaches were recovered and are back in use. The large infrastructure projects require a long process of planning and preparatory work before the construction work actually starts. Most of the reconstruction of roads will therefore end in 2008/2009 (RADA, 2006a and RADA, 2006b).

5.2.2 Telecommunications

General

The recovery activities were organised into several phases: emergency responses, restoration and repair, reconstruction of the destroyed for functional replacement, reconstruction for redevelopment and emergency communication.

Institutional Set-Up

Department of Meteorology is responsible for tracking and notifying the public about potential weather emergencies and other hazards. Sri Lanka Telecom is responsible for the restoration of telecommunication systems.

Achievements

Other than the immediate responses to damaged telecommunication infrastructure, a few early warning systems have been constructed and others are in progress. Infrastructure for necessary data collection and decision making on emergency situations, particularly to facilitate the public with required information on time, have been funded and are currently in progress.

5.2.3 Energy (Electricity)

General

The government has planned a three stage approach to rebuilding the electricity energy supply. The first phase will focus on providing a supply of

electricity to temporary settlement camps, replacing the damaged network, and providing a supply to all relocated families. The second stage envisages further network development to cater for new loads that would come as a result of the new infrastructure development. The third stage will focus on additional infrastructure, catering to long term planning for a period of 10 to 15 years including service connections to a projected 23,000 new Tsunami affected houses (RADA, 2006a).

Institutional Set-Up

Power management, generation, transmission and distribution are under the authority of the Ceylon Electricity Board (CEB) (RADA, 2006a).

Achievements

Immediate electricity restoration was carried out and temporary settlement camps were supplied with temporary electricity soon after the Tsunami. The damaged network has been replaced and almost all the relocated families have access to electricity. Within the first phase CEB was able to restore power supply within two months of the Tsunami in all affected areas. CEB has almost fully completed the network development requirements under the second stage by reinstating and newly constructing high tension and low tension distribution lines and substations. Already CEB has connected 17,928 new Tsunami houses (RADA, 2006b).

5.2.4 Water Supply & Sanitation

General

Arrangements have been made to carry out a three stage approach to rebuilding the water supply and sanitation infrastructure. The first phase focused on the immediate need fulfilment. The second stage focused on immediate service restoration to pre Tsunami level and the main target is to restore the service by end of year 2006. The third stage will provide service expansion and augmentation to meet medium and long term needs and aims to restore the service by mid of year 2008.

Institutional Set-Up

The National Water Supply and Drainage Board (NWSDB) is the agency responsible. RADA's Infrastructure unit works closely with this unit and also helps in getting donor assistance (RADA, 2006a).

Achievements

As water supply and sanitation is an essential day to day requirement, immediate restoration was carried out soon after the Tsunami. Affected

wells were emptied and disinfected within a month. Under long-term reconstruction 130 water related projects are expected to be implemented. Donors have committed funds for 96 projects in progress (RADA, 2006a). Most of the projects would not be completed as originally planned due to the various constraints.

6. IDENTIFIED GAPS IN INFRASTRUCTURE RECONSTRUCTION

6.1 Lack of Institutional Capacity

The capacity of developing countries in facing natural disasters is minimal (Ofori, 2002) and Sri Lanka is one of the countries least capable of coping. However reconstruction and rehabilitation activities of infrastructure in the post-disaster period need to be carried out efficiently. Thus infrastructure reconstruction usually takes a long time after a disaster (ESCAP, 2006). Capacity, at local government level, to plan and implement recovery strategies is usually very limited and often incapacitated as a result of the disaster. Stable and secure post-disaster recovery and long term development is threatened by institutional constraints, lack of access to and inappropriate use of professional skills and knowledge to support local effort.

Poor standards within the local construction industry have resulted in the frail pace of reconstruction in all infrastructure sectors, further enhanced by the lack of institutional capacity. For instance, the formulation and lack of enhancement of NWSDB project management and monitoring capacity are serious issues that badly affect the expected success of ongoing and future projects. Deficiency in capacity appears in the form of lack of drive to commence sanitation studies and develop sewerage for new settlements. In the power sector, planning difficulties have arisen in electricity reconstruction resulting in lack of any overall power requirement for housing and other reconstructions such as roads/bridges, schools, hospitals and public buildings. Local contractors' lack capacity in terms of numbers of contractors, equipment availability, size and skills of the labour force and management practices is a major constraint in the transportation sector (RADA, 2006a).

6.2 Security Problems/ Communication Barriers

Security problems in the country have now brought reconstruction in the north and east to a near standstill. The security situation in the north and east has worsened from late 2005. For instance the Post Tsunami Operational Structure (PTOMS) was proposed in early 2005 whereby the government and Liberation Tigers of Tamil Eelam (LTTE) would share decisions on Tsunami aid allocations in the north and east. However, discussions were drawn out on this until finally it was declared unconstitutional by the Supreme Court at the end of 2005. This caused a

one year delay for many donors work in the north and east. Construction agencies have restricted access to LTTE controlled areas. Without a ceasefire agreement the Tsunami reconstruction in the north and east will not be completed effectively. However, donors are seeking to take mitigation measures to keep on with their work in the north and east such as focusing on areas where work can continue for the present (eg. as in Ampara). Delays occur in road and bridges rehabilitation projects simply due to off loading and re-loading of materials at Sri Lankan Army and LTTE check points.

6.3 Equity Problems

The aid allocated for the northern and eastern part of the country has been less effective because of disruption by caused by conflict and now by the effective freezing of operations. The situation is made particularly worse as this part of the country suffered double calamities - the devastating Tsunami and by the effects of 20 years of conflict. The north and east of the country accounts for 60% of the damage yet have received less financial assistance compared to the south. In terms of energy rebuilding (electricity), lack of donor funding for stage two and stage three has hampered progress of work. On the other hand road reconstruction projects suffer from less access to finance.

6.4 Procurement Delays and Non Availability of Materials

The government's procurement methods are very lengthy and tedious which makes the reconstruction process very slow. For example, procurement problems with regard to tools, equipment and vehicles for implementation/supervision have caused serious delays in water supply and sanitation projects. Delays in the procurement process in the electricity restoration projects and increased materials requirement has also hindered the expected pace of progress in the restoration exercise. On the other hand non-availability of suitable rock for road works has delayed road reconstruction work.

6.5 Inefficient Management and Coordination

RICS, "Mind the GAP report" by Lloyd–Jones (2006) highlights the ineffectiveness of medium-term recovery and long-term reconstruction due to lack of planning and coordinated management in the post-disaster recovery phase despite the huge improvements in the emergency response. Stable and secure post-tsunami infrastructure reconstruction is threatened by gaps in communication and failures in management and planning. Because of the different types of organizations and interest involved, the link between immediate humanitarian relief and the long-term

reconstruction is often poorly managed. For instance, coordination has been hampered by donors, NGOs and the government. NGOs often do not coordinate their actions effectively. Government suffers from overlaps between ministries, especially from the lack of clarity due to the competences of line ministries and RADA set up for Tsunami. Development partners in part failed to (i) coordinate with government authorities at the central and local level, (ii) link up actions and (iii) do cross-sectoral programming. On the second anniversary of the Tsunami, a situation can be seen where reconstruction in the south has gone ahead relatively well while the north and east has not advanced nearly as far.

7. WHAT LESSONS CAN BE LEARNED FROM OTHER SCENARIOS

Central California experienced an earthquake of 6.5 in magnitude in 2003, which resulted in two deaths and 40 people being injured. By comparison, the 6.6 earthquake, which hit Iran four days later, killed over 40,000 people. Both events took place in areas with high-density populations. This gives a clear indication of how poor the developing countries are in case of natural disasters. Lloyd–Jones (2006) has identified the necessity of developing a worldwide network of trained professionals, ready to join recovery and reconstruction teams working with affected people. The International exchange of best practices and knowledge sharing among practitioners, authorities and NGOs, particularly from the region, can significantly contribute to capacity building at all levels. The need for the working out of an effective framework for drawing on analysis of systems failures and success seen in past disasters has also been emphasised by Lloyd–Jones (2006).

The report, “Enhancing regional cooperation in infrastructure development including that related to disaster management” by the Economic and Social Commission for Asia and the Pacific (ESCAP) identified initiatives taken by a range of institutions in achieving important factors in dealing with disasters. These included infrastructure development for disaster prevention, critical infrastructure protection during disasters and efficient reconstruction of infrastructure in the post-disaster. The report also took into account the combined efforts by all sectors to plan ahead for disasters, build capacity and strengthen institutional arrangements, including legislation that covers land-use regulations, building codes and environmental protection. Other initiatives included: drawing up an integrated disaster risk management plan covering multi hazard risk considerations to guide the post-Tsunami reconstruction programme and in general all development programmes; early warning systems; training and public awareness programmes; emergency response management; recovery resources and strengthening community-based organisations. As location is a key factor determining levels of risk, land-use plans and mapping are useful tools for identifying the most suitable usage of land in vulnerable areas such as in determining the location of buildings, roads, power plants and fuel storage depots (ESCAP, 2006). Even though Sri

Lanka is a member of ESCAP, it was sluggish compared to the progress achieved by other member countries (ESCAP, 2006). However with intensified globalisation, the capacity of individual countries is not enough to meet the scale and scope of the Asian and Pacific region's infrastructure needs and their effective fulfilment and thus require regional solutions to complement national efforts, regional cooperation in both infrastructure development and its financing (ESCAP, 2006). The rebuilding of social institutions and capacity of communities is as crucial as all others.

Awareness and knowledge of disaster risk reduction should be created from professional education through to primary and secondary education. National and local authorities, NGOs and the public should be routinely trained and have exercises in disaster management as part of their civil servant training. They could then share their experiences through identified means, such as conducting short training courses, which could help maintain a well functioning system to respond. Setting up of regional centres of excellence to promote training, awareness raising and the exchange of knowledge between developing countries could do a lot within the disaster management philosophy. Even though research is undertaken in particular disciplines, there should be a proper mechanism for the transference of knowledge from research institutions to the market, government and professionals. The integration of sustainability awareness into mainstream education, graduate and continued professional education is of paramount importance to improve sustainability awareness and skills. The European Commission is taking a number of measures including capacity building of major partners, strengthening the Commission's network of humanitarian experts and supporting the development of the rapid assessment and response capacity of the UN and other key partners. Additional measures foreseen include establishing a network of member states humanitarian emergency focal points to ensure a more coherent EU response.

In Sri Lanka some of these infrastructure facilities have been continuously maintained without any significant capacity upgrade for nearly 100 years. For example, the railway network in Sri Lanka has not been extended since it was introduced under the British rule. Even within the post-tsunami context Sri Lanka faces predicaments in maintenance of water/gully bowsers and packaged water treatment plants and securing counterpart funding (VAT/Duty) (RADA, 2006a). Thus infrastructure planning and design in the post disaster period must accomplish the remedial solutions for missing baseline. 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 damaged due to lack of maintenance over years. Infrastructure management at long term recovery phase must involve disaster reduction or mitigatory measures. For example maintenance is a major issue for all transport modes. This includes preventative maintenance, such as sealing cracks in road pavements, grading shoulders and cleaning drains to minimize the incidence of wash-aways, as well as planned rehabilitation. Regular road maintenance offers major benefits yet is so neglected in

some developing countries like Sri Lanka that every additional rupee spent on maintenance and rehabilitation saves twice as much in reconstruction costs and reduced wear and tear on vehicles (ESCAP, 2006).

The cost of communications breakdowns during the Tsunami was enormous. While seismic monitoring stations throughout the world detected the massive sub-sea earthquake that triggered the Tsunami, a lack of procedures for communicating these warnings to governments and inadequate infrastructure in the country delayed the transmission of warnings. Sri Lanka must develop proper telecommunication and early warning systems to save lives during disasters.

8. THE WAY FORWARD

In Recent research and current research gaps' by Talbot, identifies the growing interest in education in emergencies and reconstruction as a research field. Education in emergencies and early reconstruction is a newly emerging field of academic research, policy research and teaching.

The professional skills and expertise in the built environment will be more crucial in the future, in countries like Sri Lanka, particularly in the more remote regions. However professionals, with appropriate skills and training, have key roles to play during all disaster phases. This requires trained built environment professionals to "think outside the box'" and to work with each other, with other professional intermediaries (e.g. the medical profession) and with skilled, non-professional intermediaries, to make the most cost effective use of their existing skills and knowledge. Thus the development of a skills plan and creation of learning opportunities in the realm of post-disaster reconstruction would build the capacity of educational institutions and produce the relevant professionals to cater for the demand. Identification of skills gaps is very important in developing the capacities and providing support for institutions, both governmental (national and local), non governmental (NGOs, private sector and other civil society organizations) in the form of knowledge inputs, technical support, institutional building and systems development. Thus identification skills and capacity gaps at post-disaster long-term reconstruction phase are an emerging research field.

9. CONCLUSION

As natural disasters often hit the least developed areas and the most disadvantaged groups hardest, the reconstruction programmes should aim to change the vulnerable conditions through development programmes.

Low pre-disaster development leads to slower recovery and then an even slower progress of long-term reconstruction. As a result of the prevailing conflict in the northern and eastern parts of the country, the pace of infrastructure reconstruction is slow but an acceptable recovery has been achieved in the southern part of the country. Even so, this paper

affirms current infrastructure reconstruction process in all affected areas is basically hindered by the lack of institutional capacity. Therefore necessary actions must be taken to enhance the institutional capacities particularly in government, local institutions together with NGOs, professionals and the public as a whole. Sri Lanka has much to learn from other settings and must convert this fatal event to an opportunity to introduce measures to reduce future disaster risk through new physical infrastructure.

10. REFERENCES

Anand. P.B., 2005, Getting Infrastructure Priorities Right in Post-Conflict Reconstruction, UNU World Institute for Development Economics Research, Research Paper No. 2005/42

Asian Development Bank, 2006, *Sri Lanka: Tsunami summary,* Available from: www.adb.org/Media/Articles/2005/6619_tsunami_impact_Sri_Lanka/default.asp?RegistrationID=guest, viewed 17 June 2006.

Clinton. B., 2006, *Recovering from Tragedy: Lessons of Tsunami Reconstruction after Two Years,* Available from: www.washingtonpost.com/wp-dyn/content/article/2006/12/25/AR2006122500468.html viewed 27 December 2006.

Economic and Social Commission for Asia and the Pacific, 2006, Enhancing Regional Cooperation in Infrastructure Development Including that Related to Disaster Management, Bangkok.

Jayawardene, A.K.W., 2006, Disaster Mitigation Initiatives in Sri Lanka. In *International Symposium on Management Systems for Disaster Prevention*, Kochi, Japan, Available from: www.iiirr.ucalgary.ca/Publications/Kochifullpaper-final.pdf

Lloyd-Jones, T., 2006, *Mind the Gap! Post-Disaster Reconstruction and the Transition from Humanitarian Relief,* RICS, London.

Ministry of Disaster Management and Human Rights, 2006, *Towards a Safer Sri Lanka: Road Map for Disaster Risk Management – Volume 2: Project Proposal,* (Colombo: NEO Graphics).

Ofori, G., 2002, Construction Industry Development for Disaster Prevention and Response, In *Proceedings of i-Rec Conference on Improving Post-Disaster Reconstruction in Developing Countries,* University de Montreal, Canada, Available from: www.GRIF.UMontreal.ca/pages/papersmenu.html, viewed 10 Nov 2006.

Palliyaguru. R.S., Amaratunga. D. and Haigh. R., 2006, Review of Impact of Post-Tsunami Reconstruction and Rehabilitation on Infrastructure Facilities, In *Proceedings of the Annual Research Conference of the Royal Institution of Chartered Surveyors–COBRA 2006,* London, edited by Sivyer, E., 525–534.

Perera. S.C., 2006, *Overall Tsunami reconstruction progress in Sri Lanka,* Colombo, Available from: www.asiantribune.com, viewed 24 Dec 2006.

RADA, 2006a, *Mid Year Review: Post Tsunami Recovery and Reconstruction, Colombo.*

RADA, 2006b, *Tsunami Recovery & Reconstruction in Sri Lanka*, Available from: www.lankamission.org, viewed 01 Dec 2006.

Rebuilding Sri Lanka: Assessment of Tsunami Recovery Implementation, Available from: www.recoverlanka.net/data/SLDF05/assessment.pdf

Talbot, C., *Recent research and current research gaps*, Available from: www.edletter.org/current/ferguson.shtml

United Nations, 2005, *Tsunami Recovery: Taking Stock after 12 Months,* Available from: www.tsunamispecialenvoy.org/pdf/OSE_anniversary.pdf

Tsunami Recovery & Reconstruction in Sri Lanka, Available from: www.lankamission.org