

Policy Implications of Integration of Disaster Risk Reduction to Infrastructure Reconstruction

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Abstract

Infrastructure facilities need to be planned and constructed in such a way not only to change the vulnerable conditions of the infrastructure facility itself but also the society, the economy and the environment. Literature emphasises that integration of disaster risk reduction (DRR) to planning processes is a key to reduce natural disaster losses, boost socio-economic development needs and ensure sustainability in development gains. But linking development concerns and DRR to infrastructure reconstruction has become a challenge in developing country settings. Therefore, the purpose of the main research, of which this paper is based on, is to explore how integration of DRR to infrastructure reconstruction could contribute to socio-economic development process. However, this paper focuses on the existing gap in the concept of DRR at the policy making level and the construction project level. Thus, the paper seeks to review the current policies on post-disaster reconstruction and DRR at the national and intermediate-organisational level and integration of DRR concept within these policies. Not limiting to the policies, those were assessed on their success through the level of implementation of them at the post-disaster infrastructure reconstruction projects. This paper is based on data collated from a case study conducted in a water supply and sanitation reconstruction project in Sri Lanka supported by expert interviews among national and intermediate-organisational level policy makers. The results highlight the lack of individual policies for reconstruction or DRR of reconstruction at the national and intermediate-organisational level except certain sections within certain policies. It was found that integration of DRR within these policies is lower than the level of importance of such integration. Further, the level of implementation of these policies in practice is below average as it is averted by absence of legitimacy of policies, the level of awareness about policies by the relevant bodies, attitude of construction professionals, required speed and quality of reconstruction, availability of finances for reconstruction etc.

Keywords: national policies, intermediate-organisational policies, disaster risk reduction measures, infrastructure reconstruction

1. Introduction

Disasters are commonly known as sudden events, which bring serious disruption to society with massive human, property, livelihood, industry and environmental losses, which exceed the ability of the affected society to cope using its own resources (UN/ISDR, 2004a; Shaluf and Ahmadun, 2006; Lloyd-Jones, 2006; Quarantelli, 1998 cited Eshghi and Larson, 2008; UN/ISDR, 2009). However, it is now a well accepted norm that disasters are the disruptive and/or deadly and destructive outcome of triggering agent(s) which are called hazards when they interact with, and are exacerbated by, various forms of vulnerability (McEntire, 2001; UN/ISDR, 2004a; UN/ISDR, 2004b; ADRC, 2005; DFID, 2005a). Thus, prevention or mitigation of disaster risk can be achieved by prevention or mitigation of hazard and/or prevention or mitigation of vulnerabilities. However, McEntire *et al.* (2010) points out the fact that all disasters cannot be prevented and completely eliminated. Despite the fact that hazards are preventable or not, their effects and losses can be prevented or mitigated. The concept of DRR comes into light in order to accomplish this need.

2. Disaster risk reduction

2.1 Theoretical and practical aspects of disaster risk reduction

UN/ISDR (2004a) defines DRR as *‘the conceptual framework of elements considered with the possibilities to minimise vulnerabilities and disaster risks throughout society, to avoid (prevention) or to limit (mitigation and preparedness) the adverse impacts of hazards, within the broad context of sustainable development’*. UN/ISDR (2009) defines it as *systematic development and application of policies, strategies and practices for the same purpose as above* (UN/ISDR, 2009). Incorporating further clarification, UN/ISDR, (2002) views disaster reduction as *‘taking measures in advance to address vulnerabilities, reduce risk and anticipate hazards, which involve environmental protection, social equity and economic growth, the three cornerstones of sustainable development, to ensure that development efforts do not increase the vulnerability to hazards’*. Thus, disaster and risk reduction is emerging as an important requisite for sustainable development (UN/ISDR, 2003). DRR entails measures to curb disaster losses by addressing hazards and the vulnerability of people to them (DFID, 2005a). Good DRR happens well before disasters strike, but also continues afterwards, building resilience to future hazards (DFID, 2005a). Literature identifies various classifications of DRR strategies. Among all, DFID (2005b) has a classification of DRR strategies as (i) Policy and planning measures (ii) Physical preventative measures (iii) Physical coping and/or adaptive measures (iv) Community capacity building measures. All such categories of measures are of paramount importance, for example as noted by Lawther (2009) community involvement in reconstruction is an important ingredient to the overall success of housing and infrastructure redevelopment.

2.2 The concept of ‘disaster risk reduction’ for infrastructure reconstruction

There is a general consciousness that disasters provide opportunities for risk reduction (risk mitigation) (Alexander, 2006; Christoplos, 2006; Thiruppugazh, 2007). As noted by Christoplos (2006), it is largely because the concept of DRR can be more easily promoted after a disaster than

before due to many facts such as new awareness of risk after a disaster that leads to broad consensus, revealing of fault lines in development policies, exposition of institutional weaknesses (eg: corruption, lack of human resources, weak institutional structures that allowed high risk planning and discouraged appropriate monitoring before the disaster have been exposed), high damage to improperly designed infrastructure, weakened old vested interests, availability of money to do things better, the enhanced political will etc. Reconstruction can therefore of course be used as development opportunity to help reduce disaster risks. Jayaraj (2002) also realises that reconstruction provides an opportunity to reduce vulnerability to hazards. It is evident from above classification of DRR strategies in the section 2.1 that the possible areas to link infrastructure reconstruction with DRR are at the national level, intermediate-organisational level, construction consultant/contract organisational level, project level and individual level. This classification is not only based on the various classifications of DRR measures in the current literature but also the semi-structured interviews conducted among two levels of policy makers (national and intermediate-organisational levels) and within the case studies. The new DRR strategies classification is depicted in figure 1.

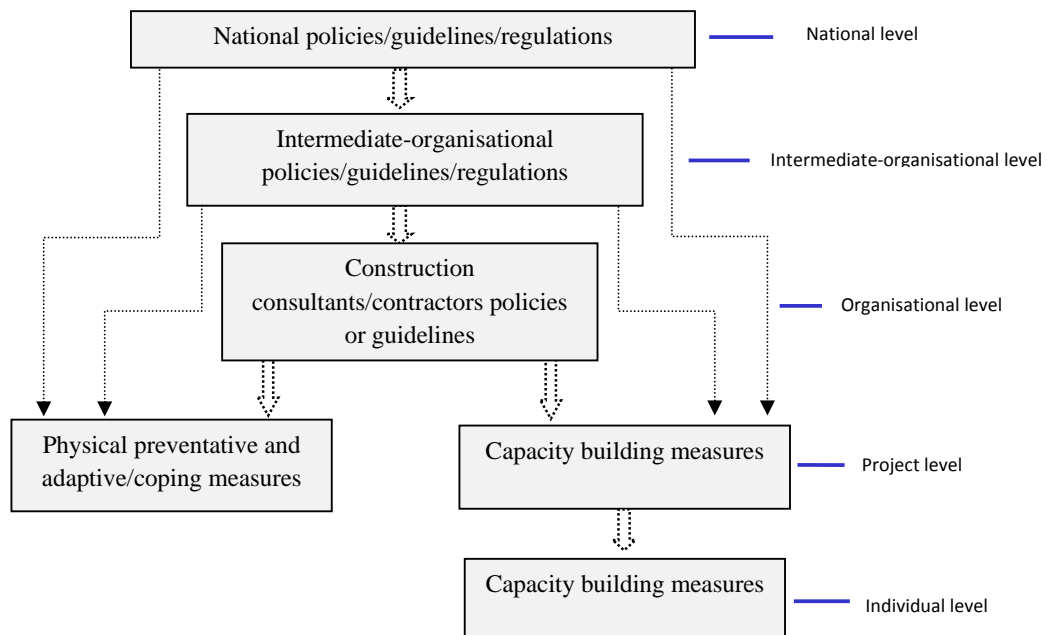


Figure 1: Classification of DRR strategies

DRR can be planned and implemented within above five levels. The national level measures are primarily the disaster risk management policies, relevant guidelines and legal frameworks and provision of legitimacy apart from various programs which directly aim at DRR such as construction of reservoir dams etc. 'Intermediate-organisational level' measures constitute of also forms any reconstruction policies, guidelines and regulations developed by regulatory bodies of main infrastructure sectors in Sri Lanka such as Road Development Authority (for roads), National Water Supply and Drainage Board (NWS&DB - for water supply and sanitation). The 'construction consultant/contract organisational level' DRR measures are the construction guidelines and planning

measures which are in existence for the betterment of reconstruction project planning, implementation, operation, maintenance, disaster preparedness and emergency planning at the institutional level. Project level measures are mainly the physical and engineering measures such as construction of flood defences within road projects etc. 'Individual level' measures constitute capacity building of project stakeholders and community as a whole for better reconstruction of infrastructures, prevention of infrastructures from future disasters, preparedness and emergency management with regard to predicted and unpredicted future disasters. It is emphasised that in the rehabilitation and reconstruction phases, considerations of DRR should form the foundations for all activities (ADRC, 2005). This evidences that 'DRR' deserves an important position in the pre-disaster phase of the disaster management cycle, and also an important position in the post-disaster reconstruction too.

3. Research methodology

The main research, based on which this paper is constructed intends to explore and investigate the contribution of post-disaster infrastructure reconstruction towards socio-economic development. The best research approach for this study was decided as case studies due to range of justifiable reasons. A case study is; *'An empirical inquiry that investigates a contemporary phenomenon in depth within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident'* (Yin, 2003). The boundary of the 'case' was identified as the *'process of integration of disaster risk reduction to post-disaster infrastructure reconstruction'*. Accordingly, within this boundary, the unit of analysis is the *'disaster risk reduction strategies'*, which is entirely holistic in nature. The selected unit of analysis was decided to be studied within multiple case studies; post-tsunami infrastructure reconstruction projects. Accordingly, the data were gathered using semi-structured interviews from individuals in infrastructure reconstruction projects. In addition, few expert interviews were conducted among national and intermediate-organisational level policy makers in Sri Lanka who are experienced in post-disaster reconstruction field as a supportive to the case studies and for the purpose of triangulation. This paper is entirely based on the data collated from these expert interviews and one case study conducted in a water supply & sanitation reconstruction project. The expert interviews were conducted among two national level policy makers at the Disaster Management Centre (DMC); one intermediate-organisational level policy makers at NWS&DB; three officials from each very important intermediate-organisations involved in preparation of various guidelines for construction activities, namely, Environmental Authority, National Building Research Organisation and Coast Conservation Department; and one official from an International Non-Governmental Organisation.

4. Analysis

4.1 National & intermediate-organisational level policies, guidelines, regulations for reconstruction and disaster risk reduction

Majority of interviewees did not claim any direct policies solely set up for reconstruction of housing or infrastructure. According to 70% of policy makers, *"there is no policy as such with regard to reconstruction"*. But there are sections within certain policies which particularly attend reconstruction

activities and handful of national-level policies which have links with reconstruction and DRR. There are policies emerged, following the Indian Ocean Tsunami 2004 such as Disaster Management Policy by the DMC-Sri Lanka. The Disaster Management Act was also established after the tsunami, which is supposed to be the legal document. These two documents give some level of guidance on disaster reconstruction although they are not entirely aimed at reconstruction. According to the Disaster Management Act in Sri Lanka, there is a need to prepare a Disaster Management Plan, which is currently in progress. Furthermore, the buffer zone regulation was enacted following the major tsunami, which became a national wide policy for reconstruction. Apart from that, there are various policies, guidelines and regulations are in existence at the intermediate-organisational level such as Water Supply and Sanitation Policy developed by the NWS&DB –Sri Lanka.

The circumstances are much equivalent regarding the policies on DRR. There are no exact policies related to DRR or DRR in reconstruction work. All national level plans and policy documents are aimed at broader theme of disaster management through which certain DRR issues of reconstruction are being covered. However, the ultimate goal of all existing policies is to reduce the risk of disasters. These policies address this aim at two different levels:

- Various national level programs for DRR
- DRR within individual reconstruction projects

Current policies in this regard are Disaster Management Act, Disaster Management Policy and Towards a safer Sri Lanka: Road map for disaster risk management - project proposal developed by the DMC-Sri Lanka. Figure 2 summarises existing national and intermediate-organisational level policies, guidelines and regulations on reconstruction and DRR.

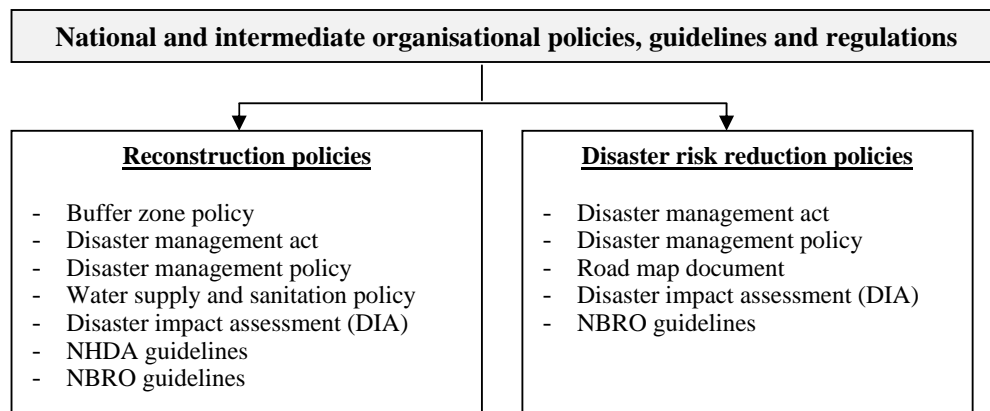


Figure 2: Current national and intermediate-organisational level policies, guidelines and regulations on reconstruction and disaster risk reduction

Despite the above stated, there can be yet more guidelines developed by various individual institutions which are yet not adequately recognised at the national level. The policies and guidelines depicted in figure 2 have affected the infrastructure reconstruction sector as a whole and the process of DRR in the infrastructure reconstruction sector in particular, in a diverse manner. For instance, the disaster

management policy guides us on two things: (i) reconstruction, development, mitigation and DRR after a disaster; (ii) rescue and relief.

The disaster management plan, the one yet under development, will guide builders on reconstruction of damaged infrastructure, the process which is currently based on normal construction guidelines. Furthermore, when an infrastructure reconstruction work is to be done, there are many issues to be considered such as reducing impacts of future disasters on the structure, designing to withstand against disasters and maximum levels of hazards, design it in such a way that people can use it in disaster times etc. Thus, disaster management plan and the DIA will guide us on these issues in future and recommend necessities for reconstruction. Certain policies such as buffer zone policy resulted in reconstruction projects being delayed due to discrepancies it created within the tsunami affected communities.

The contribution of DRR policies and guidelines on post-disaster infrastructure reconstruction is also worth illustrating here. In fact, incorporation of DRR for development work is a key concern of these policies. When the DIA process is introduced to reconstruction projects, it will require the donor agencies and the authorities to incorporate disaster mitigation activities to counter the impact of disaster. Presently the Environmental Impact Assessment (EIA) considers some disasters up to a certain extent nevertheless there are many inherent limitations associated with it. According to the interview respondents, although all new projects do undergo an EIA, there are instances of the drastically affected by natural disasters regardless of the EIA clearances. Presently, the rehabilitation and reconstruction projects do not undertake an EIA. However, the reconstruction took place after the tsunami has incorporated some preventative DRR measures such as construction of buildings on columns with no major functional ground floors etc. These designs features are very effective in case of future disasters and evidence of novel trend of construction industry resulted through the DRR policies. The main target of these policies is to promote most accurate construction techniques and assist with elimination of weak construction methods. Further, the disaster management plan and the policy address stakeholder responsibilities in immediate recovery, rehabilitation and reconstruction. The disaster management plan addresses the required coordination among many of these institutions for the reason that otherwise none of these institutions covet to look upon their projects from the disaster perspective. For example, Road Development Authority does not want to view their projects from disaster management or DRR perspective or there is no one to inform them about such need. It is DMC's responsibility to coordinate these institutions and lead them towards integration of DRR to their projects. The problems could be resolved up to a greater extent by introducing the DIA process to reconstruction process with legitimacy through the Act.

4.2 Incorporation of disaster risk reduction within national and intermediate-organisational level policies

The coverage of various DRR requirements within the national and intermediate organisational policies is discussed in this section. Coverage of such strategies is assessed against their importance within the policies. The results presented in figure 3 are based on the survey type question presented at two national level policy makers and six intermediate-organisational level policy makers within the expert interviews and explanations given by them at the interviews.

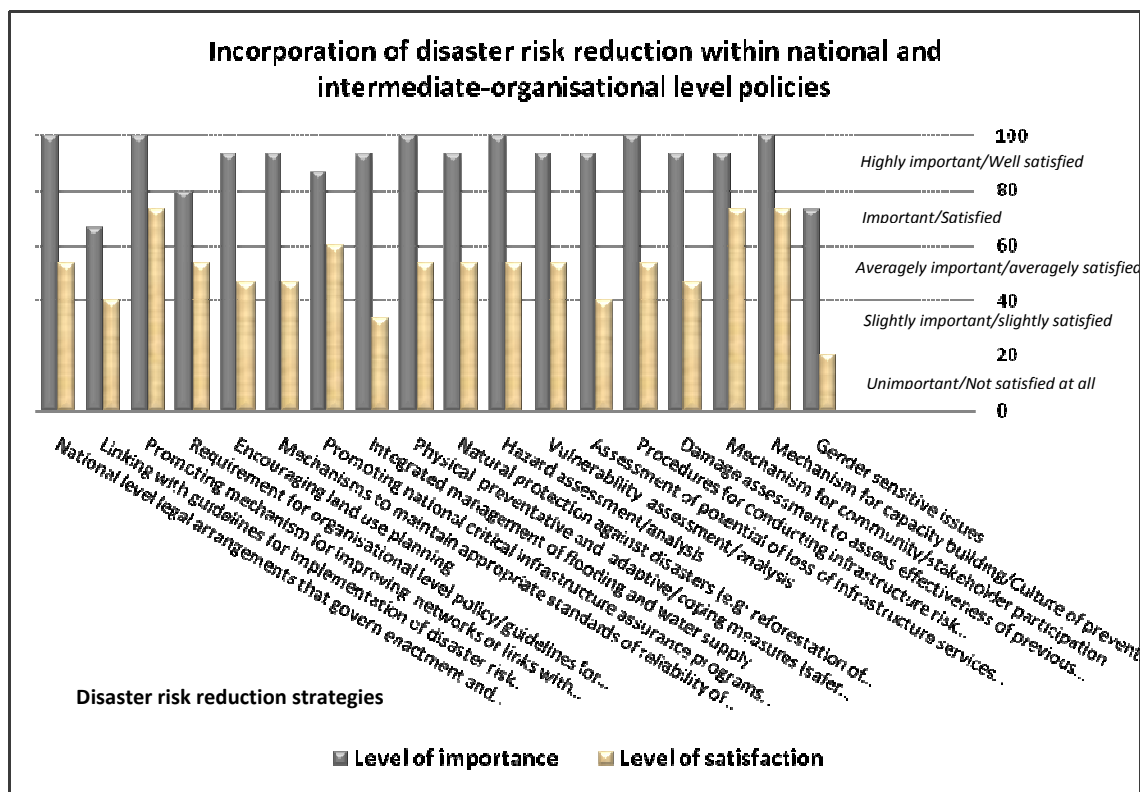


Figure 3: Coverage of disaster risk reduction within national and intermediate-organisational level policies

All DRR strategies had fallen either within important or highly important categories. Regardless of their importance, none of these DRR strategies are well satisfied within the policies. However, the strategies such as promoting mechanism for improving networks or links with local governments and other relevant institutions (coordinated approach), mechanism for community/stakeholder participation and mechanism for capacity building/culture of prevention are satisfactorily incorporated within the policies. DRR strategies such as linking with guidelines for implementation of DRR strategies, integrated management of flooding and water supply and assessment of potential of loss of infrastructure services during disasters are very slightly satisfied within the policies, which is not adequate at all. The gender sensitive issues have received very minimum attention and it is almost like not incorporated within the policies at all.

4.3 Implementation of national and intermediate organisational level policies within post-disaster infrastructure projects: Importance vs. their level of satisfaction within project level

The national and intermediate-organisational level policies aim to reduce the risk of disasters through implementation of such policies on various national level programs (for example, some mitigatory programs by the DMC in collaboration with other agencies like Irrigation Department) and individual reconstruction projects. Though there are many construction guidelines, it is not trouble-free to bring

them to the project level. Reportedly, there is comparatively low level of implementation in practice. Level of implementation of national and intermediate-organisational level policies within post-disaster infrastructure projects was assessed against the importance given to them by the policy makers. This result is based on the survey type question posed at two national level policy makers and six intermediate-organisational level policy makers and explanations given by at the three interviewees in the case study project.

According to the policy makers responses, DRR strategies such as linking policies with other guidelines for implementation of DRR strategies, requirement for organisational level policy/guidelines for planning and implementation of DRR and gender sensitive issues are identified as important strategies to be incorporated within policies while all other listed strategies considered as highly important. Regardless of high importance, the implementation processes at organisational, project and individual levels have inherent shortcomings and diverse attitudes by the implementers as tabulated in table 1.

Table 1: Implementation DRR strategies within organisational, project and individual levels

<i>Disaster Risk Reduction Strategies</i>	<i>Activities/Process</i>
<i>Organisational level policy and planning measures</i>	
<i>Organisational arrangements that govern enactment and enforcement of construction regulations/ land use planning, urban planning</i>	<p><i>No special arrangement to govern enactment and enforcement of national policies</i></p> <p><i>It is necessary to adhere to relevant guidelines at the feasibility stage</i></p> <p><i>There is an organisational requirement to use proper guidelines for construction. There were separate QC and QA Managers. There were separate Material Engineers for giving material approvals. Quality related problems were referred to the American institution</i></p>
<i>Organisational policies/guidelines for planning and implementation of disaster risk reduction strategies</i>	<p><i>No organisational policies or written or printed guidelines as such</i></p> <p><i>A design guideline called 'Design of Buildings for high winds Sri Lanka (CP3 Chapter 5)', The SPEC, BSS standards, American standards and BNA standards were used</i></p> <p><i>Water projects are now constructed according to NWS&DB guidelines</i></p> <p><i>Fire regulations were used</i></p> <p><i>The health & safety standard within the organisation are to be maintained during construction</i></p>
<i>Land use planning</i>	<p><i>Construction was done 300 meters away from the coast (eg. bore holes) and therefore no effect due to a disaster like tsunami</i></p> <p><i>Most of the treatment plants were constructed on interior, elevated land. But there are some which are close to the coastal line</i></p>
<i>Mechanisms to maintain appropriate standards of reliability of infrastructure</i>	<i>A database was implemented to check whether the people enter the plants do exit</i>
<i>Critical infrastructure assurance programmes including protection,</i>	<i>Alternative water supply means established in case of system damage due to a future disaster. People can extract water from un-purified tube wells and observation-wells constructed nearby</i>

<p><i>emergency preparedness measures (eg: National alert system for critical infrastructure/Integrated warning and response system) and contingency planning (eg: escape roads)</i></p>	<p><i>However, most of these contingency planning measures had not been solely established as alternative means of obtaining water in case of system failure</i></p> <p><i>Contingency planning for pipe line burst is available as it is the most common type of damage</i></p> <p><i>A bowser supply of water will be made available in case of delayed repairs. There are situations where bowser supplies are not available but the divisional secretaries assist in finding bowsers</i></p> <p><i>In case of a fire temporary water pumps needs to be installed immediately. Normally the NWS&DB does not have that much of capacity water pumps because the standby pumps are also installed just next to the original pumps. If these are also damaged, then the situation becomes critical. Then systems need to be run with temporary pumps which are in somewhere</i></p> <p><i>Precautions are available for lightning and lightning arrangements established everywhere</i></p> <p><i>There is a system to check over usage of chemicals within the plant</i></p>
<p><i>Integrated management of flooding & water supply</i></p>	<p><i>The tube wells tend to be affected by flooding. The structures can be damaged by the flooded water. The structures are constructed in the river bank. Therefore, during a flood these structures can get affected because the river bank erodes during floods. Areas where regular floods take place, structures are constructed above the high flood levels even to prevent ingress of water to bores holes. When a bore hole is constructed the high flood levels are considered first as otherwise the bore hole will be polluted due to flood water</i></p> <p><i>Structures are designed, levels are formed, foundations are raised and proper drainage system installed</i></p> <p><i>But the project could not do anything to reduce the flood levels in that area. But no further flooding will occur due to our project</i></p>
<p><i>Physical measures (Prevention/coping or adaptive/safer construction)</i></p>	
<p><i>More resilient water supply systems (eg: boreholes, raised hand-pumps, raised plat forms equipped with latrines and drinking water, drainage pumps)</i></p>	<p><i>60% of physical preventative measure had been implemented</i></p> <p><i>In roof construction wind speeds were highly considered. These are compulsory things to be incorporated in a design. For example, column sizes of a single storey building were strong enough to bear a load of a 3 storey building</i></p> <p><i>Resiliency was achieved by strengthening the structures, bearing in mind the major cyclones. No major precautions taken for tsunami situations. There is a need to design water towers in coastal towns considering an average tsunami wave height after considering the minimum waves height. But as we have designed for floods tsunamis may be compensated to some extent. The initial designs of the project were strong enough to resist a tsunami</i></p> <p><i>But how economical is a doubt. There is a no point just buildings resists while people killed</i></p>
<p><i>Natural protection against floods (eg: reforestation of watersheds)</i></p>	<p>-</p>
<p><i>Hazard analysis</i></p>	<p><i>There is an understanding of the major natural hazards/disasters that pose a risk to infrastructure to some extent but not adequate</i></p> <p><i>Hazard analysis had been done for common and frequent events in this area</i></p>

	<p>like cyclones</p> <p>Everything is designed for a flood frequency. But not definitely for a 100 yrs disaster</p>
Assessment of potential of loss of infrastructure services during disasters	-
Vulnerability analysis	<p>No much consideration given to social and economic vulnerabilities (for the structural part). It was done up to some extent at the feasibility. In those feasibility studies, main aim was assessing people needs than about disasters. There had been studies undertaken about the people in the area but not particularly aiming the disasters and their related vulnerabilities</p> <p>Feasibility studies done for financial feasibility of the project</p> <p>The main problem of people in this area is all about the fear of any future cyclones or any similar tsunami situations. They are not much concerned about floods as this area is not a flood vulnerable area. Therefore, the precautionary measures had been taken in construction of roofs etc.</p> <p>Physical vulnerability of structures was taken into account. If they are again to be built close to the coast, they need to be reconstructed with concrete instead of masonry to make the structures more strong to withstand any waves. That means their structural or technical vulnerability is considered during the design</p> <p>People, including children should be educated about how to react a disaster. They should be educated about another proper place to move into in case of a disaster. That means people's social and cultural vulnerabilities are considered. These things also can be incorporated into the design</p> <p>Selection of land for a water project is a major challenge. Once a land is found investigations are carried out to identify the vulnerability factors in the location. Vulnerabilities studies are done for winds, floods frequencies and so on. It is not practical to shift a water supply project as we require. Everything needs to be decided based on the land and the design too. Then soil investigation is done to see how foundations are laid. These should be definitely done</p>
Procedures for conducting infrastructure risk assessment	<p>A risk register prepared at the very beginning of the project</p> <p>Hazard risk management was available during construction</p>
Damage assessment to assess effectiveness of previous mitigation measures	Very minimum
Capacity building/Culture of prevention measures	
Capacity building programs on DRR & infrastructure safety for project participants (training & educational/awareness)	<p>Some programs were conducted regarding carrying out construction work at the site</p> <p>No capacity building programs for how to tackle a natural disaster such as cyclones</p> <p>But the workers were educated through educational programs about disaster situations such as fires and electric shorts in terms of how to tackle such a situation</p> <p>But no such major steps are taken for disasters like floods</p>

	<p><i>Recruited a maintenance staff of 11 people including an Office In Charge</i></p> <p><i>Lack of construction supervision is a major weakness in the infrastructure reconstruction sector in the Eastern Sri Lanka, particularly within NWS&DB workers. Recruiting trained people for construction supervision has been a problem. New employees' poor understanding on required quality and their lack of moral towards achieving project success is a major challenge. NWS&DB in Sri Lanka presently conduct training programmes/capacity building programmes to uplift employees' moral, eradicate cultural barriers etc.</i></p> <p><i>There are capacity building programs at NWS&DB. Capacities are expected to be built in O&M, non revenue water reduction, finance management, human resource management. Training modules are currently being prepared. But no such module for disaster management although there is a need to train our people to tackle disaster situations. They have a good training for that. There are programs for staff capacity development, skill development, attitude development, basically for human development, and out bound trainings and the things</i></p>
<i>Coordination of critical infrastructure protection responsibilities among various project stakeholders</i>	<i>O&M staff has been trained to tackle disastrous situations like pipe bursts. If there is a contingency plan, they should be trained on how to implement that plan in a disaster situation. These things are not currently happening in the water supply sector in Sri Lanka</i>
<i>Community engagement in decision making of integration of DRR to reconstruction</i>	<i>No - this had to be done at a very early stage</i>
<i>Mechanisms to involve community in the capacity building programs & public awareness programs</i>	<p><i>Some programs were conducted to the community regarding water supply connections. It is difficult to convince people to drink this water as they have to pay some amount to obtain water. The Government could have done some awareness programmes in advance</i></p> <p><i>But nothing is done with regard to disasters</i></p> <p><i>NWS&DB has some disaster management programmes; for example to take actions against incidents like water poisoning. This is an event that people getting very excited but in reality there is no chance of happening something like this. But as this happened several times NWS&BD has now formed a system to make people aware, educate and inform about these types of events through television, radio, loudspeaker programmes</i></p>
<i>Community involvement in physical reconstruction</i>	<i>Very minimum</i>
<i>Gender sensitivity in capacity building programs</i>	<i>Awareness programs for women for sanitation are promoted and are in progress. The water management focuses on females due to gender segregation of this task of obtaining water. There are gender considerations in water supply a lot</i>
<i>Women involvement in decision making of integration of DRR to reconstruction</i>	<i>No special arrangement</i>
<i>Women involvement in physical reconstruction</i>	<i>No</i>

<p><i>Coordinated approach to provision of infrastructure that meets requirements for disaster risk reduction/ Improving networks or links with local governments</i></p>	<p><i>Coordinated approach was in place. That was through RDA, Irrigation Department and NWS&BD. Always we had to be in touch with the Irrigation Department to make sure that paddy fields are not getting affected during flooding. Coordination with the RDA was with regard to road excavations etc. NWS&DB always involved in the project with regard to quality of the project. From the construction stage, we had to get the approval from the NWS&DB. They had certain regulations and we had to undergo those regulations. All work was carried out as instructed by them. The project was always under investigation and observation of the officials and investigators from the NWS&DB. After construction the project was handed over to the NWS&DB which is the regulatory body of water supply and distribution in Sri Lanka</i></p> <p><i>No any coordination with disaster related centres like DMC etc.</i></p>
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Weaknesses associated with the policies

A low implementation level of policies is encountered within infrastructure reconstruction projects due inherent weaknesses of the policies, guidelines and regulations. According to the expert interview respondents, one main weakness is the policy's very light attention to the aspects of rehabilitation and reconstruction. Apart from that the policy does not provide a clear, detailed explanation for certain DRR strategies, for example, in risk assessment sections; it is advantageous to supplement the policies with necessary basic mathematical requirements. Unless otherwise these types of details are not readily available within policies they tend to become weak and find it difficult to implement in practice. Furthermore, lack of detailed explanation on inter-relationship among different guidelines prepared by different organisations, lack of guidance for users on how to effectively use the policies are some major weaknesses. When it comes to the Act, there are many problems and deficiencies associated particularly with regard to legitimacy for implementation.

Factors contributing to successful implementation of policies in practice

Implementation of policies related to reconstruction and DRR needs to be governed by the DMC. Level of implementation of them at the project level enormously depends on the legitimacy of policies. The Disaster Management Act is very vague in this regard and it is claimed an imperfect Act by the national level policy makers. Act does not provide necessary legitimacy to enforce DRR and reconstruction activities in accordance with the policies and various guidelines. It is such a simple Act and does not address issues such as difficulties encountered in practice. Accordingly, it is highly impossible to get oblige the builders to adhere to advisable measures, prevent any improper construction or reconstruction work. Thus, within these last three years, many weaknesses were identified in act and it is currently being revised. As long as the act does not carry the required legitimacy, neither policies nor the guidelines have legal standing.

The next major factor is the funding problem. Implementation of DRR measures involves more cost. However, most of the reconstruction projects are not in a position to fulfil these additional financial needs to implement such policies and guidelines.

Other factors affecting the level of implementation of them within infrastructure reconstruction projects are the level of awareness about them by the relevant bodies involved in reconstruction activities, attitude of people involved in the reconstruction work, required speed of reconstruction work, required quality of reconstruction work by the builders and the ultimate users, the scale of the reconstruction project, for example major projects having proper funding tend to adhere to more DRR concerns. Furthermore, experience of reconstruction project consultants, designers and the contractor regarding the field of disaster reconstruction is a major factor. They possess different attitude and perceptions towards the projects. Whatever the policies are on hand it is ultimately up to the contractor to take actions against DRR.

Reasons for weaknesses in policies and the challenges associated with development of policies

All existing disaster management policies were prepared within a short period of time; following the tsunami 2004 which has been a major reason behind their weaknesses. Further, *“the DMC is still a 3 year old institution and therefore it is not easy to formulate most accurate policies”*, in their own words. The personnel involved in preparation of such policies had lack of experience about major disasters, the process of disaster management, mitigation and reconstruction in Sri Lanka. In fact, disaster management was a very new subject to Sri Lanka. Therefore, the policy makers had to learn everything from the beginning. In reality, the present work force at the DMC is not fully aware about the initial policies. Also the national level institutions involved in policy making are reported with lack of resources like limited staff such as in DMC. The limited funding allocation for these organisations is another major problem; it is because the concept of DRR is a less prioritised area for the government. The DMC encountered lack of technically capable people in order to develop high technical details of DRR strategies, for example risk assessment procedures.

The professional staff involved in developing policies should be a rich mix of professionals from diverse areas such as Civil Engineers, Economists, Geological Engineers, Environmentalists, etc. However, the individuals involved in setting agenda for these policies is not a rich mix of professionals, reportedly a major reason behind failure of policies. This has resulted in absence of holistic nature of the policies.

Although there are instance of hiring foreign consultants for policy development, still they are not much certain about the country's situation. Though there are opportunities to learn lessons from other country settings in this regards, problems arises regarding suitability of issues addressed in their plans or policies to our country. However, when the local consultants are employed they are not familiar with the subject and field.

Some of the weakness of the policies can be attributed to economical, social and cultural behaviours of the communities whom were affected due to such reconstruction and DRR policies, for example, the buffer zone regulation. The main livelihood of coastal communities in Sri Lanka is fishery. Therefore, all their activities were based on the coast and they were reluctant to move away from the coastal line. Although they know that they are highly vulnerable to future natural disasters they do not want to move away from the coast because of their inherent attitudes, cultural requirements within

community and so on. This emphasises the need of addressing and catering to communities' and reconstruction projects needs through the policies, where otherwise policies cannot be prevented from being failed.

Whatever the policies developed by the DMC are required to go through the National Council in order to seek the relevant approvals. However, the National Council does not have frequent meetings due to political reasons and lack of prioritisation given to disaster related issues. This has resulted in policies and plans being stuck half way through at the approval stage.

The other major reason is lack of awareness about these policies by the construction level and project level individuals. It is useless having even thousands of guidelines if people are not aware about them. In fact, it is a challenge to bring them to the project level.

Although some of the challenges are solvable at the national and intermediate-organisational level, most of them need governmental level support, for example in getting approvals for disaster management plans, allocating funding and required professionals for development of policies etc. In terms of the additional measures needed to increase the level of implementation of policies within practice and overcome the challenges encountered in development of policies, national level and intermediate level organisations get together with the GA's office planning division and involved in mapping work. These things are currently undertaking up to some extent and help to overcome certain challenges. Further, the Disaster Management Act should be amended to incorporate the legal requirements of carrying out policies, guidelines and other regulations. If the Act is amended, the DIA will get the legal status and the constructors are legally bound to follow it as a regulation. The Act will probably incorporate these issues in the future. Furthermore, at the phase of development of policies, the DMC regularly conducts training programs for their staff and allocates time for guideline preparations. Other than that, all important DRR measures which are not given an adequate attention within the policies should be incorporated to the policies.

5. Conclusions

The findings of the literature revealed that disasters provide opportunities for risk reduction due to a range of reasons, particularly through reconstruction. Literature and expert interviews among policy makers did bring to light the possible areas of linking infrastructure reconstruction with DRR; at the national level, intermediate-organisational level, construction consultant/contract organisational level, project level and individual level.

The interview results proved that there are no direct policies solely developed for reconstruction or DRR of reconstruction at the national and intermediate-organisational level except certain sections within certain policies. Further, study revealed that the integration of DRR concept within these policies is lower regardless of the level of importance assigned to such integration by the respondents where all DRR strategies are considered as either important or highly important in terms of their incorporation within the policies. Regardless of their importance, none of these DRR strategies are well satisfied within the policies. While gender sensitive issues are identified as the lowest rated DRR strategy with zero level of incorporation within policies, strategies such as 'linking with guidelines for

implementation of DRR strategies', 'integrated management of flooding and water supply' and 'assessment of potential of loss of infrastructure services during disasters' are very slightly incorporated within policies which is not adequate at all. However, promoting mechanism for improving networks or links with local governments and other relevant institutions (coordinated approach), mechanism for community/stakeholder participation and mechanism for capacity building/culture of prevention are satisfactorily incorporated within the policies.

Expert interviews and the case study reflect the existing gaps in the concept of DRR at the policy making level and the construction project level in terms of their implementation. Accordingly, the level of implementation of these policies in practice is below average. While mechanism for improving coordinated approach, community/stakeholder participation and capacity building/culture of prevention are satisfactorily incorporated within the policies, the existing coordinated approach of infrastructure reconstruction project is limited to general authorities such as RDA, Irrigation Department and NWS&DB for fulfilment of various construction and quality requirements while setting DRR concerns aside by neglecting coordination with disaster related centres like DMC. The community engagement in decision making regarding integration of DRR to reconstruction and their involvement in physical reconstruction is almost zero. No mechanisms to involve community in the capacity building programs but they are exposed to some awareness programs regarding water connections and about emergency situations. But no awareness programs are done with regard to major natural disaster. Further, there are capacity building programs at the NWS&DB, which are aimed at building capacities in O&M, finance management, human resource management etc whereas concern given on tackling natural disasters is very minimum except training provided for common minor scale disasters such as fires, electric shorts and pipe bursts. NWS&DB in Sri Lanka presently conduct training programmes/capacity building programmes to uplift the employees' moral, eradicate cultural barriers for construction. It was expressed that successful implementation of these strategies are averted by absence legitimacy of policies, the level of awareness about policies by the relevant bodies, attitude of construction professionals, required speed and quality of reconstruction, availability of finances for reconstruction, scale of reconstruction projects, experience of reconstruction bodies on the field of disaster reconstruction etc.

Further, the study found the major weaknesses associated with the policies as the lack of detailed explanations for certain DRR strategies, the inter-relationship among different guidelines prepared by different organisations etc. The reasons behind such weakened policies and the challenges associated with development of policies can be attributed to lack of time available for preparation of post-tsunami policies, lack of experience of policy makers with regard to the process of disaster management, lack of institutional resources, absence of rich mix of professionals from diverse fields for policy development, poor attention paid on addressing and catering to communities' and reconstruction projects needs etc.

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