Knowledge Communication in Post Disaster Reconstruction Projects

Benny Hidayat[1] and Charles Egbu[1]

[1]School of Built Environment,
University of Salford,
Salford, M5 4WT
United Kingdom
Email: B.Hidayat@edu.salford.ac.uk ; C.O.Egbu@Salford.ac.uk

Abstract

It has been argued that the construction sector is a provider of services, which includes the provision of considerable knowledge and other intangible assets. Construction project knowledge is generated by activities of individuals, project teams and construction organisations, and communicated across project teams and supply chains. The source and communication of Project knowledge, arguably, start from the very beginning of the project; that is from concept design stage, right to the hand-over of the final products (e.g. buildings, roads, and bridges). Communication involves interaction between people or organisations in the project. It enables information and knowledge to move from those who have them to those who need them. Recent and massive natural disasters reveal a great deal of challenge which those involved in the management of reconstruction projects face. The nature of disasters and the complexity of reconstruction projects pose unique challenges compared to 'normal' construction projects. Based on a thorough literature review, this paper investigates and documents the role of knowledge management in disaster management especially from a post disaster reconstruction perspective. Furthermore, it identifies knowledge communication practices and techniques that are currently being employed in post-disaster reconstruction in a number of countries. Lessons for academia and for project managers are proffered.

Keywords: disaster management, knowledge communication, post-disaster reconstruction, project management.

1 INTRODUCTION

A disaster is 'a serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceed the ability of the affected community and society to cope using its own resources' (UN/ISDR, 2010). The cause of a disaster may be due to natural causes, a failure of technology and an act of human violence, such as terrorism or war (Eshghi and Larson, 2008). Disasters can be classified into two main classifications; natural disasters and man-made disasters. This classification can be developed furthermore into the following sub-classifications: biological, geological, meteorological, human conflict and technological hazardous.

Eshghi and Larson (2008) report that the frequency of disasters and their effects seem to be increasing. Disaster records were analysed in Emergency Event Database (EM-DAT, available at www.em-dat.net), showing that from the 100 most costly natural disasters of the 20th century, 65 occurred in the 1990s, 25 in the 1980s and 10 in the 1970s. The reason for this increasing level of occurrence of disasters is partly due to better modern technology, communication and media to detect and record disasters. Another reason is the growth of the world's population, where more people live in vulnerable areas. The world's population has grown sharply from 1.6 billion in the beginning of the 20th century to more than 6 billion in 1999.

Indonesia is considered as a very vulnerable county to natural disasters. Recent earthquakes: Aceh earthquake and tsunami 2004, Yogyakarta earthquake 2006 and West Sumatra earthquake 2009 have shown great damages and challenges in the reconstructions.

2 METHODOLOGY

This paper is part of on an on-going PhD research study, which is aimed at investigating the role of knowledge communication in post-disaster reconstruction projects in Indonesia.

This paper is based on a thorough review of relevant literature on post-disaster reconstruction, knowledge management and knowledge communication. The literature review will set up initial conceptual framework for the PhD research. In this paper, a review of knowledge management (KM) in post-disaster reconstruction will be conducted. Challenges associated with post-disaster reconstruction would also be considered and discussed in the paper along with a review of the role that knowledge communication could play in post-disaster reconstruction.

3 POST DISASTER RECONSTRUCTION

In the disaster management cycle, response and recovery activities occur after disaster strikes. Response is an emergency action taken during disaster and short term after disaster. The main purpose of a response phase is to save human lives in the form of rescue and the supply of victims' needs. Recovery phases take a longer time, and occur after emergency actions in response phase aiming to repair damage, to restore services, and to reconstruct facilities after a disaster has struck (Alexander, 2002).

The reconstruction phase plays an important role in disaster management. Livelihoods of affected communities are restored by re-building new house units and infrastructure. It is an opportunity to re-plan the community and, in a way, begin a new life from start. Previous living conditions can be restored and reconstruction may result in a better living condition if managed wisely. Regarding the disaster cycle, reconstruction also plays the key role of mitigation and preparedness for the next disaster by applying structural disaster mitigation in the reconstruction. The quality of constructed houses and infrastructure during reconstruction phase will influence vulnerability conditions for the next disasters.

Emergency response directly after a disaster strikes is often considered an effective operation. This activity is built around an international infrastructure of national,

international and inter-governmental organisations and backed by media interest to generate public awareness and response (Lloyd-Jones, 2006). In contrast, a recovery activity is usually slow, expensive and complex in terms of coordination and management (Koria, 2009). The reconstruction effort is largely ad-hoc, without strategic framework and coordination (Shaw *et al.*, 2003). Furthermore, Shaw et al also note that inadequate planning, lack of preparedness and mitigation infrastructure, poor dissemination and inappropriate measures for accountability contribute to problems during reconstruction. This situation seems to be caused by the fact that reconstruction, long term recovery, is a local government-led activity and in which, too often, local governments have limited and often incapacitated (as result of the disaster) level of resources to plan and implement a recovery strategy (Lloyd-Jones, 2006).

The reconstruction phase provides an opportunity for affected communities to rebuild, and also to consider and possibly prepare for the next disaster. It also offers an opportunity of better living conditions through building better facilities than what existed before a disaster. 'Build back better' as a jargon was introduced after the 2004 Indian Ocean tsunami reconstruction, even though the word 'better' has different interpretations (Kennedy *et al.*, 2008). Does better mean more modern, more environmentally friendly, more resistant to disaster, more oriented towards livelihoods, or a combination? Kennedy et al (2008) also suggest that it is difficult to fulfil all those characteristics of 'build back better' where there is a trade off between characteristics. It seems that post-disaster reconstruction is heavily tagged with expectation to provide better conditions. However, the nature of the reconstruction is quite different, commonly with the addition of chaotic conditions, rarity of resources and many simultaneous projects at the same time (Davidson *et al.*, 2007, Siriwardena *et al.*, 2009). With regards to size of the disaster, reconstruction has challenges that are different to common construction. In table 1 the list of challenges in reconstruction are shown, identified from journals and other publications on post-disaster reconstruction in recent years and by frequency of citations.

Table 1: Challenges of reconstruction identified across 50 publications

No.	Challenges	Count of citations
1	Coordination between stakeholders	20
2	Availability of resources	16
3	Capacity of local government/agency	11
4	Quality of the construction and its inspection	10
5	Information and Communication	10
6	Reconstruction that culturally fit local people	9
7	Conducive safety and political situation in the reconstruction region	9
8	Land acquisition and location	9
9	Organisation of Reconstruction	8
10	Adequate number of qualified people	8
11	Regulation and legislation that apply to big disasters	8
12	Finance the reconstruction	7

13	Rising materials, labour cost	7
14	Adequate skills for reconstruction	6
15	Start reconstruction as soon as possible; tight schedule	5
16	Establish property rights (land ownership, leaseholds and tenant)	5
17	Accountability and transparency	5
18	Corruption	4
19	Lack of services and facilities, infrastructures	4
20	Construct housing that withstands future disaster	4
21	Transportation and distribution, logistic coordination	3
22	Turn the reconstruction into development opportunities	3
23	Selection of beneficiaries	3
24	Introduce and implement new technology (e.g. materials) in reconstruction	2
25	Limited site information	2
26	Meet the minimum standard of house design requirement	2
27	Keep reconstruction process equal	2
28	Governance	2
29	Planning as a whole system of reconstruction	2
30	Social-cultural difference (i.e. language and religious) between organisations and victims	2
31	Clear debris and its disposal	2
32	Community participation in local decision	2

An inspection of Table 1 clearly reveals that Coordination between stakeholders, Availability of resources, and Capacity of local government/agency are the three most challenging in reconstruction after disasters. These are areas that need closer attention. The roles that knowledge communication play in these contexts are also worthy of close and detailed investigation.

4 KNOWLEDGE COMMUNICATION IN POST-DISASTER RECONSTRUCTION

In project environments, knowledge management helps to improve communication within teams and to provide informed insightful advice to project managers and project teams. Knowledge management also focuses on improved sharing of best practice, lesson learned, project management, system engineering methodologies and improved rationale for decision making (Olomolaiye, 2007).

Rennie (1999, cited in Olomolaiye, 2007) defines knowledge from five different perspectives: know-why, know-how, know-where, know-what, know-when and know-who. Know-why is the scientific knowledge of principle and laws of nature; know-what is accumulation of facts; know-how is the skill or ability to do something; know-where

is the ability to find the right information; know-when is sense of timing; and know-who is the information about who knows what (Egbu and Robinson, 2005).

Alavi and Liedner (2001) define knowledge as "a justified belief that increases an entity's capacity for effective action". Furthermore, they noted five different perspectives of knowledge: a state of mind, an object, a process, a condition of having access to information, and a capability. As a result, they argue that the different perspectives of knowledge lead to different perceptions of knowledge management. For example, if knowledge is viewed as an object then knowledge management should focus on building and managing knowledge stocks. Whereas when knowledge is viewed as a process, knowledge management should focus on knowledge flow and the process of creation, sharing and distribution of knowledge (Alavi and Leidner, 2001).

Knowledge management in construction

The construction industry is considered as an important sector in a county's economy, as the industry employs millions of people and contributes significantly to GDP. The industry is dominated by small and medium enterprises and with small numbers of large companies. In the UK, small and medium enterprises (SMEs) account for over 90% of all organisations (Egbu and Robinson, 2005), in Indonesia, the proportion of SMEs is greater where the large enterprises only account for 1% of all organisations (LPJK, 2011).

Egbu and Robinson (2005) point out that the construction industry is a knowledge-based industry, although the industry is commonly known for its products: buildings, roads, bridges, dams and monuments. Construction industry provides services to its clients and customers and the industry may be rightly labelled as a knowledge-intensive industry which depends on professional knowledge or expertise. Egbu and Robinson (2005) gave an example of the construction a new modern office complex, in which 70% of production cost can be associated to knowledge-base elements.

Based on Nonaka and Takeuchi's (1995) theory of knowledge creation, the SECI model, knowledge production in a construction project can be considered along four modes (Socialisation, Externalisation, Combination, and Internalisation) through interaction of individuals and organisations from the beginning of the project to the handing over of the completed project. The socialisation process transforms tacit knowledge into tacit knowledge. Trainee workers learn skill from their mentors through observation, imitation and practise (Egbu and Robinson, 2005). Reading manuals, textbooks or standards then interpreting those documents to develop an internal mental model is an example of the internalisation process which converts explicit knowledge into tacit knowledge. The opposite process, externalisation, is the process to convert tacit into explicit knowledge. An example of externalisation in construction is the drawing from the designer, which explains the designer's concept. Explicit to explicit knowledge interaction takes place through a process called combination. Individuals and project teams create knowledge through integrating and processing of various project documents.

Knowledge management in a disaster management context

Thanurjan & Seneviratne (2009) investigated several knowledge management (KM) parameters in post-disaster housing reconstruction in Sri Lanka after 2004 Indian Ocean

tsunami. They employed a questionnaire survey sent to 56 donors and consultation organisations, and also interviewed 12 donors and consultation organizations. Their findings are, inter alia, lists of KM parameters: knowledge sources, KM technologies, KM techniques, benefits and challenges to KM in post-disaster housing reconstruction. However, there is no weight or percentage in the list, so it is difficult to draw meaningful conclusions from their results as to the relative significance of the identified factors, and whether and why, in post-disaster housing in Sri Lanka, there is a lack of effective information and knowledge dissemination.

Thanurjan & Seneviratne (2009) conclude that most of the organisations have not implemented knowledge management formally into post-disaster housing reconstruction, however they point out that there is knowledge management awareness in the industry to implement KM in post-disaster reconstruction to improve performance.

Perhaps the main findings of Thanurjan & Seneviratne are in the challenges to KM in post-housing reconstruction in Sri Lanka. They listed the challenges as follows:

1. Lack of compiling and synthesizing the accumulated data, information and knowledge, storing and organizing.
2. Lack of systematic collection of standardized data.
3. Lack of documentation of knowledge and application of lesson learned and best practices for decision-making.
4. No validation mechanism.
5. Lack of measure to value the performance of knowledge assets.
6. Unstructured KM approach.
7. Overload of information in the form of reporting.
8. Changing people's behaviour.
9. What knowledge should be managed?
10. Organisational culture.

Gharaati (2010) highlights few issues regarding knowledge transfer in post-disaster reconstruction. He notes that despite the fact that post disaster reconstruction is considered a success by authorities at the end of the programme, the reconstruction always fail to provide safe-construction methods that can be sustained and repeated over time. He also argues that the real impact of the reconstruction is only known in the long run, and actual success or failure of reconstruction project depends on intangible aspects such as awareness, preparedness, acceptance or rejection of preventive measures, and sustainability.

Gharati (2010) also highlights some characteristics of post-disaster and some basic requirements for knowledge transfer.

`

Table 2: A Summary of post-disaster dynamics and the prerequisites of knowledge transfer (Gharaati 2010)

Characteristics of post-disaster environment in developing countries	**Knowledge transfer prerequisites**
Extremely chaotic/Human dynamics	Suitable context, absorptive capacity, close relationship
Push for quick results	Long-term process, person to person experience
Trauma added to an old social context	New social context for new knowledge

It is obvious from Table 2 that absorptive capacity (the ability and willingness of key payers to understand, assimilate and have the requisite skill sets to address contextual issues) is important in knowledge transfer and communication. Similarly, knowledge exchanges in social contexts, and the tacit knowledge between and among people are vital.

Knowledge communication in post disaster reconstruction

Eppler (2007) defines knowledge communication as "(deliberate) activity of interactively conveying and co-constructing insights, assessments, experiences, or skills through verbal and non-verbal means". Furthermore he points out that knowledge communication is about the successful transfer of know-how, know-why, know-what, and know-who through face-to-face (collocated) or media-based (virtual) interaction.

Knowledge sharing is a form of communication (Hooff and Ridder, 2004). These authors argue that knowledge transfer involves either actively communicating to others what one knows or actively consulting others in order to learn what they know. Similarly, Liyanage *et al.* (2009) also suggest that knowledge transfer is an act of communication. They considered knowledge transfer as the conveyance of knowledge form one place, person or ownership to another. Successful knowledge transfer means that the transfer of knowledge results in the successful creation and application of knowledge in an organisation. In their research, Liyanage et al (2009) analysed theories and models of knowledge transfer and they concluded that all theories and models were developed from the basic idea of communication and collaboration between the sender and receiver. This idea was originally introduced and popularised by Shannon and Weaver in 1949, in their theory 'mathematical approach to communication and information'. The work of Shannon and Weaver is most widely known in communication research (Emmitt and Gorse, 2003).

Based on the source-receiver model, Liyanage et al (2009) introduced a model for process knowledge transfer that theoretically involves six steps: awareness, acquisition, transformation, association, application and externalisation or feedback. They also suggest four factors as prerequisites of the knowledge transfer process:

1. Identifying the most suitable source of knowledge;
2. Willingness of the sources to share their knowledge;
3. Willingness of the receiver to acquire the knowledge; and
4. The receiver's absorptive capacity.

A series of publications from Eppler (Eppler, 2006, Lurati and Eppler, 2006, Eppler, 2007) investigates problems in knowledge communication. Eppler has investigated knowledge communication problems between experts and decision makers, which are basically problems between source and receiver in communication model. According to Eppler, the first type of problem is expert-caused difficulties which lead to the others. For example, managers have difficulties in grasping insights of the experts. Experts fail to convert their insight into an understandable form to non-experts. Secondly, Eppler explains that some of the problems in knowledge communication come from managers, the non-experts. Since the managers are unwilling to discuss the detail of problems they may have, the experts have difficulties in suggesting what they know to solve the problems. Furthermore, the other types of problems are caused by mutual behaviour of experts and non experts; and interaction between them (Eppler, 2007).

With regards to communication, one of the influencing factors in knowledge communication is the tools and medium used in communication. KM tools can be differentiated into 'KM techniques' and 'KM technologies' or information technology (IT) and non-IT tools (Al-Ghassani *et al.,* 2005). In the context of reconstruction, Thanurjan and Seneviratne (2009) identified those tools in housing reconstruction in Sri Lanka. The ten (10) most used techniques and technologies are presented table 3.

Table 3: KM techniques and technologies in housing reconstruction (Thanurjan and Seneviratne, 2009).

KM Techniques	KM Technologies
Project reviews	E-mail system
Task teams	Costing and cost management system
Face-to-face communications	Document management system
Formal meetings	The central project file
Brainstorming	Intranet
Site liaison initiative	Knowledge bases
Quality circle	On-line project management
Recruitment	Data and text mining
Seminars	Skills Yellow Page
Training	Groupware

In comparing the table with previous research by Egbu and Botterill (2002), surprisingly telephone and documents and reports are not considered a one of the main tools identified in Thanurjan and Seneviratne's findings. The most frequently used techniques and technologies in construction organisations are: the telephone, internet/intranet/e-mail and documents and reports (Egbu and Botterill, 2002).

5 DISCUSSION & CONCLUSION

It suggested that there are differences in the nature, extent and type of challenges between normal construction and post-disaster reconstruction. Catastrophic disasters bring enormous challenges to the reconstruction, while as suggested by Rotimi et al (2006) routine construction will fit well into small scale disasters. The scale of disasters is different from one disaster to another, thus the general disaster scaling by Eshghi and Larson (2008) which uses scale 1 for emergency situation to scale 6 for catastrophe may be appropriate in determining the scale of disaster.

The nature of post-disaster is probably different with common construction, which is likely to affect the use and effectiveness of tools of KM in different contexts. Perhaps this may partly explain why in Thanurjan & Seneviratne's study on tools and techniques for KM, the use of telephone was not prominent when compared to Egbu & Botterill's study. The notion of context is important in the role that knowledge communication plays as well as the approaches in maximising the role; and includes types construction's product and processes and also people in construction; and the use of different mix of tacit and explicit knowledge (Robinson *et al.*, 2005).

There are many factors that contribute to the outcome of a project, however coordination is considered as an important factor by project participant in many projects (Jha and Iyer, 2006). Furthermore Jha & Lyer (2007) conclude that better coordination is a most required attribute in managing mega projects involving multiple stakeholders. Better coordination is not only required for internal members of the organisation but is needed with external agencies as well. Lack of coordination on both fronts may result in overshooting of cost of the project (Jha and Iyer, 2007). This is supported by the findings of the literature review of over 50 publications in post-disaster reconstruction. Coordination is the most cited challenge.

Since coordination needs current information which is to be communicated within and across organisation, there is a need for an integrated communication and information system for disaster management (Meissner *et al.*, 2002). Information and communication is also a big challenge in reconstruction as emerged from the literature review. Research by Sandhu et. al. (2011) in knowledge sharing in the Malaysian context reveals interesting facts about knowledge sharing barriers. The greatest barrier, from and individual perspective, was "general lack of time to share knowledge". This is followed by "lack of interactions between those who can provide and those who need knowledge". Knowledge communication would not run properly if coordination was not managed well.

Furthermore, as can be seen from Table 1, the lack of capacity and skills of locals is also a main challenge. Their capacity is almost always limited, thus it is the external actors role to transfer knowledge to the locals (Ingirige *et al.*, 2008). Therefore knowledge communication among stakeholders in reconstruction activities becomes important to achieve reconstructions' goals. Knowledge communication, if addressed well, could aid in problem solving and reduction of re-work. In the same vein, knowledge communication processes have barriers that impact on their implementation, which have their origin in the sender, receiver or medium and the environment of knowledge communication.

6 Acknowledgement

The authors are thankful for the doctoral scholarship support provided by ministry of education of Republic of Indonesia.

7 REFERENCES

Al-Ghassani, A., Anumba, C. J., Carrillo, P. & Robinson, H. S. 2005. Tools and techniques for knowledge management. In: Anumba, C. J., Egbu, C. & Carrillo, P. (eds.) *Knowledge management in construction*. Blackwell publishing.

Alavi, M. & Leidner, D. E. 2001. Knowledge management and knowledge management systems: conceptual foundations and research issues. *MIS Quarterly*, **25**, 107-136.

Alexander, D. 2002. *Principles of emergency planning and management*, Hertfordshire, England, Terra Publishing.

Davidson, C. H., Johnson, C., Lizarralde, G., Dikmen, N. & Siliwinski 2007. Truths and myths about community participation in post-disaster housing project. *Habitat International*, **31**, 100-115.

Egbu, C. & Botterill, K. 2002. Information technologies for knowledge management: their usage and effectiveness. *ITCon*, **7**, 125-136.

Egbu, C. O. & Robinson, H. S. 2005. Construction as knowledge-based industry. In: Anumba, C. J., Egbu, C. & Carrillo, P. (eds.) *Knowledge management in construction*. Blackwell publishing.

Emmitt, S. & Gorse, C. 2003. Construction communication, Blackwell publishing.

Eppler, M. J. 2006. The concept of knowledge communication and its relevant to management [Online]. Available: http://www.knowledge-communication.org/pdf/research-note-knowledge-communication.pdf [Accessed 20 April 2010].

Eppler, M. J. 2007. Knowledge communication problems between experts and decission makers: an overview and classification. *Journal of knowledge management*, **5**, 291-300.

Eshghi, K. & Larson, R. C. 2008. Disasters: lesson from past 105 years. *Disaster Prevention and Management*, **17**, 62-68.

Gharaati, M. 2010. Knowledge transfer as the key to sustainable post-disaster reconstruction. *CIB World Congress 2010*. Salford, Manchester, UK (10-14 may 2010).

Hooff, B. v. d. & Ridder, J. A. d. 2004. Knowledge sharing in context: the influence of organizational commitment, communication climate and CMC use on knowledge sharing. *Journal of knowledge management*, **8**, 117-130.

Ingirige, B., Haigh, R., Malalgoda, C. & Palliyaguru, R. 2008. Exploring good practice knowledge transfer related to post-tsunami housing (re-)construction in. *Journal of Construction in Developing Countries*, **13**, 21-42.

Jha, K. & Iyer, K. 2006. Critical determinants of project coordination. *International Journal of Project Management*, **24**, 314-322.

Jha, K. & Iyer, K. 2007. Commitment, coordination, competence and the iron triangle. *International Journal of Project Management*, **25**, 527-540.

Kennedy, J., Ashmore, J., Babister, E. & Kelman, I. 2008. The meaning of 'build back better': evidence from post-tsunami Aceh and Sri Lanka. *Journal of Contingencies and Crisis Management*, **16**, 25-36.

Koria, M. 2009. Managing for innovation in large and complex recovery programmes: tsunami lesson learned from Sri Lanka. *International Journal of Project Management*, **27**, 123-130.

Liyanage, C., Elhag, T., Ballal, T. & Li, Q. 2009. Knowledge communication and translation - a knowledge transfer model. *Journal of knowledge management*, **13**, 118-131.

Lloyd-Jones, T. 2006. Mind the gap! post-disaster reconstruction and the transition from humanitarian relief. *RICS*.

Lurati, F. & Eppler, M. J. 2006. Communication and management: researching corporate communication and knowledge communication in organizational settings. *Studies in communication sciences*, **6**, 75-98.

Meissner, A., Luckenbach, T., Risse, T., Kirste, T. & Kirchner, H. 2002. Design challenges for an integrated disaster management communication and information system. *The First IEEEbWorkshop on Disaster Recovery Network (DIREN)*. New York.

Nonaka, I. & Takeuchi, H. 1995. *The knowledge-creating company: how Japanese companies create the dynamics of innovation*, New York, NY, Oxford University Press.

Olomolaiye, A. O. 2007. The impact of human resource management on knowledge management for performance improvements in construction organisations. PhD, Glasgow Caledonian University.

Robinson, H. S., Carrillo, P. M., Anumba, C. J. & Al-Ghassani, A. M. 2005. Knowledge management practices in large construction organisations. *Engineering, Construction and Architectural Management*, **12**, 431-445.

Rotimi, J. O. B., Masurier, J. L. & Wilkinson, S. 2006. The regulatory framework for effective post-disaster reconstruction in New Zealand [Online].

Sandhu, M. S., Jain, K. K. & Ahmad, I. U. K. b. 2011. Knowledge sharing among public sector employees: evidence from Malaysia. *International Journal of Public Sector Management*, **24**, 206-226.

Shaw, R., Gupta, M. & Sarma, A. 2003. Community recovery and its sustainability: lesson from Gujarat earthquake of India. *The Australian Journal of Emergency Management*, **18**, 28-34.

Siriwardena, N., Haigh, R. & Ingirige, B. 2009. Identifying and classifying stakeholders of post-disaster housing reconstruction projects in Sri Lanka. In: *Salford Post graduate Annual Reserach Conference (SPARC)*, 2009 University of Salford, UK. The University of Salford, 261-277.

Thanurjan, R. & Seneviratne, L. D. I. P. 2009. The role of knowledge management in post-disaster housing reconstruction. *Disaster Prevention and Management*, **18**, 66-77.

UN/ISDR.2010. http://preventionweb.net/english/professional/terminology/v.php?id=475. [Accessed 25 July 2010].