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Disaster knowledge factors: benefits and challenges

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Abstract

Disasters bring about the loss of lives, property, employment and damage to the physical infrastructure and the environment. The number of reported disasters has increased steadily over the past century and risen very sharply during the past decade. While knowledge management can enhance the process of disaster management, there is a perceived gap in information coordination and sharing within the context of disaster management. Identification of key disaster knowledge factors will be an enabler to manage disasters successfully. This study aims to identify and map key disaster knowledge success factors in managing disasters successfully through capturing good practices and lessons learned. A list of disaster knowledge factors was first identified through a comprehensive literature review, covering the whole disaster management cycle. Based on these literature findings, semi-structured interviews were conducted among few disaster management practitioners to explore the influence and lacking areas relating to these factors in managing disasters. The objective of this paper is to present the interview findings on benefits and challenges related to the disaster knowledge factors. A comprehensive list of benefits and challenges of disaster knowledge factors in managing disasters is identified.

Keywords: Disaster management, Disaster knowledge management, Disaster knowledge factors, benefits, challenges

1. Introduction

There is evidence that the frequency and extent of natural disasters are increasing on a global scale (Warren, 2010). In the decade 1900-1909, natural disasters occurred 73 times, but in the period 2000-2005 the number of occurrences rose to 2,788 (Kusumasari *et al.*, 2010). This increase is a result of more frequent and intense disasters, the growth of global populations located in increasingly vulnerable areas and continued environmental degradation. With the increased frequency and intensity of natural disasters, there is an increase in the numbers of deaths, the numbers of people affected by disasters and their devastating impacts on human life, economy and environment (Bayrak, 2009). Efforts need to be made in order to reduce these impacts. Within this context disaster management aims to reduce or avoid the potential losses from hazards, assure prompt and appropriate assistance to victims of disaster, and achieve rapid and effective recovery (Warfield, 2004). The Disaster management cycle represents the ongoing process by which various stakeholders in the society plan for and reduce the impact of disasters, react during and immediately following a disaster, and take steps to recover from the impact (Clerveaux *et al.*, 2010). There are essentially three phases in which disaster management efforts could make contributions: disaster mitigation or preparedness; the immediate aftermath or relief; and the reconstruction or recovery phase. Knowledge management can play a vital role through ensuring the availability and accessibility of accurate and reliable disaster risk information when required and through effective sharing of lessons learned. Despite this, it is observed that there is a perceived gap in knowledge management within the context of disaster management (Seneviratne *et al.*, 2010). The lack of effective information and knowledge sharing, and dissemination on disaster mitigation measures can thereby be identified as one of the major reasons behind the unsatisfactory performance levels of current disaster management practices. Within this context, the study reported in this paper aims to identify and map key disaster knowledge factors in managing disasters successfully. The main objective of this paper is to present the interview findings on benefits and challenges of disaster knowledge factors. Paper starts with an introduction to disaster management, while identifying its key phases. Next section describes the disaster knowledge management followed by an introduction to the disaster knowledge factors. Methodology is introduced in the succeeding section followed by a discussion on interview findings on benefits and challenges related to the disaster knowledge factors. A discussion and the way forward are provided at the end of the paper.

2. Disaster management

Disaster management is an integrated process of planning, organising, coordinating and implementing measures that are needed for effectively dealing with its impact on people (Deshmukh *et al.*, 2008). Key phases of disaster management are identified as mitigation/preparedness, relief and long term reconstruction. Mitigation or risk reduction activities include structural and non-structural measures undertaken to limit the adverse impacts of natural hazards (Atmanand, 2003; Boshier *et al.*, 2007; Moe *et al.*, 2007; RICS *et al.*, 2009). Preparedness deals with activities and measures taken in advance to ensure effective response to the impact of hazards, including the issuance of timely and effective early warnings and temporary evacuation of people and property from threatened locations (Atmanand, 2003; Moe

et al., 2007). Provision of assistance or intervention during or after a disaster to meet the life preservation and basic subsistence needs of those people affected is made during the relief phase (Moe *et al.*, 2007). Reconstruction refers to the rebuilding of damaged living conditions of the stricken community with the aim of long term sustainability (Moe *et al.*, 2007).

3. Disaster knowledge management

Knowledge management is a process by which knowledge is created, shared and utilised (Deshmukh *et al.*, 2008). While abundant of knowledge about risk and vulnerability to hazards exists, its access and utilisation at community, national, regional and international levels to empower or protect is yet to reach full potential (UNESCO *et al.*, 2005). Kaklauskas *et al.* (2009) indicate that in countries affected by Asian tsunami the lack of knowledge management is apparent. By reinforcing this fact, Korla (2009) finds that in Sri Lanka organisations have not been able to capture, retain and/or re-use the learning from similar operations. This resulted in 're-inventing the wheel' in terms of setting up and managing the construction programmes and projects within the tsunami recovery operation (Korla, 2009). According to Pourezat *et al.* (2010), disaster response is dynamic and therefore decision makers need to receive updated information on the current emergency situations. Disaster response is also time-sensitive with little allowance on delay in decision making and response operations. Therefore, any problem or delay in data collection, access, usage, and dissemination has negative impacts on the quality of decisions and hence the quality of disaster response (Pourezat *et al.*, 2010). All these highlight the importance of managing knowledge within the context of disaster management.

4. Disaster knowledge factors

Factors to be considered in managing disasters are identified through a literature survey and classified into eight categories as: Technological; Social; Environmental; Legal; Economical; Operational/managerial; Institutional; and Political, based on their characteristics. These factors are common to all types of disasters, covering all three phases: mitigation/ preparedness; relief/recovery; and reconstruction/rehabilitation. Technological factors include aspects relating to or involving the application of scientific advances including any tool, techniques, product, process or method to benefit disaster management. While social factors represent the aspects relating to human society and its members, aspects relating to natural and built environment are considered under environmental factors. Legal factors include aspects relating to law, accepted rules, and regulations for managing disasters. Economical factors can be classified into two: long term economic planning measures and financial factors. Economic planning measures include aspects relating to production, distribution and consumption of goods and services in a society. Aspects relating to monetary assets are covered under the financial sub-category. Operational/managerial factors include issues relating to skills, competencies and processes. While aspects relating to institutions and organisations in managing disasters are included under institutional factors, issues related to politics or political parties are considered in political factors.

5. Methodology

In view of addressing the perceived need to share knowledge in relation to disaster management strategies, the School of the Built Environment, at the University of Salford, undertook the research project titled 'ISLAND'. ISLAND aimed at increasing the effectiveness of disaster management by facilitating the sharing of appropriate knowledge and good practices in land, property and construction. Due to the broad scope of disaster-management related activities, this initial study focused on creating a knowledgebase on the post-tsunami response, with specific reference to case materials in Sri Lanka. Research proposed through ISLAND-II aimed at further extending the scope of ISLAND, by incorporating appropriate knowledge and good practices relating to the three key phases/stages of disaster management cycle, namely: mitigation/ preparedness, relief/recovery and reconstruction/rehabilitation. As part of ISLAND-II, a knowledge map highlighting key knowledge factors in connection with the disaster management cycle will be delivered. The knowledge map will be delivered based on interviews with experts who are involved with disaster management process and supported by an extensive questionnaire survey. This paper presents the interview findings on benefits and challenges that need to be addressed in managing disasters.

6. Findings

Expert interviewees identified a number of benefits and challenges related to disaster knowledge factors. Benefits include aspects that contribute to successful management of disasters while challenges highlight lacking areas which need to be improved for future responses. A summary of benefits and challenges are shown in the Table 1. These benefits and challenges are discussed in detail in succeeding sections.

Table 1: A summary of the benefits and challenges of disaster knowledge factors

<i>Disaster Knowledge Factors</i>	<i>Benefits</i>	<i>Challenges</i>
<i>Technological</i>	<ul style="list-style-type: none"> – <i>Detection and warning systems to save lives and minimise the effects</i> – <i>Satellite images and GIS to gather real time data of the disaster impact and plan reconstruction</i> – <i>Ground and air transport to maximise the survivors and distribute goods and services</i> – <i>Structural measures to enhance the resilience of built structures</i> 	<ul style="list-style-type: none"> – <i>The need for proactive technologies</i> – <i>Poor communication</i> – <i>Lack of necessary skills for proper use of technology</i> – <i>Gaps in implementation of technology</i> – <i>The need for effective use of technology to create networks among communities and between communities and policy makers</i>
<i>Social</i>	<ul style="list-style-type: none"> – <i>Social networks to enhance relief and reconstruction</i> – <i>Education, training and awareness raising to enhance culture of preparedness</i> 	<ul style="list-style-type: none"> – <i>The need for effective education, training and awareness raising programmes to enhance culture of preparedness</i> – <i>Addressing the issues related to peoples' attitudes and perceptions</i> – <i>Lack of consideration of social factors</i>

		<i>during long term reconstruction and mitigation/preparedness phase</i>
<i>Environmental</i>	<ul style="list-style-type: none"> – <i>Natural barriers to minimise the effect and damages</i> – <i>Man-made structures to minimise the effect and damages</i> 	<ul style="list-style-type: none"> – <i>Lack of understanding of the environmental related factors</i>
<i>Legal</i>	<ul style="list-style-type: none"> – <i>To implement disaster mitigation measures</i> – <i>To enhance relief operations through emergency and civic duty laws</i> 	<ul style="list-style-type: none"> – <i>Challenges related to implementation of laws</i> – <i>Lack of consideration of social factors when making laws</i> – <i>The need for regular updating</i>
<i>Economic</i>	<p><i>Long term economic planning</i></p> <ul style="list-style-type: none"> – <i>To minimise the effect of disasters through taking necessary mitigative measures on country's wealth generation mechanism</i> – <i>To enhance the recovery through insurance</i> <p><i>Financial</i></p> <ul style="list-style-type: none"> – <i>An essential resource to effective management of disasters</i> 	<p><i>Long term economic planning</i></p> <ul style="list-style-type: none"> – <i>Lack of investment on risk and vulnerability assessment of country's wealth generation mechanism</i> – <i>Long term recovery is only focused on reconstruction of damaged infrastructure. Looking for alternatives is neglected</i> <p><i>Financial</i></p> <ul style="list-style-type: none"> – <i>Poor management of finance</i> – <i>Rigid policies</i> – <i>Lack of funds for reconstruction and mitigation/preparedness</i> – <i>Not learning from investment or insurance companies</i> – <i>Financial mismanagement and poor accountability</i>
<i>Operational/Managerial</i>	<ul style="list-style-type: none"> – <i>An essential to effective management of disasters</i> 	<ul style="list-style-type: none"> – <i>Poor decision making</i> – <i>Poor communication</i> – <i>Participatory approach to decision making</i> – <i>Aspects related to leadership</i> – <i>Poor humanitarian logistics management</i> – <i>Lack of knowledge management</i>
<i>Institutional</i>	<ul style="list-style-type: none"> – <i>To develop and implement necessary building codes</i> – <i>To develop and provide necessary education, training and awareness raising programmes</i> – <i>To develop and implement necessary planning and building regulations</i> – <i>To conduct risk and vulnerability studies on country's wealth generation mechanism and take necessary mitigative measures</i> 	<ul style="list-style-type: none"> – <i>The need for proper institutional formation and integration</i> – <i>The need for a centralised institution to overlook and monitor all other institutions</i>
<i>Political</i>	<ul style="list-style-type: none"> – <i>Positive influence on decision making, allocation of resources and implementation of laws</i> 	<ul style="list-style-type: none"> – <i>The need for studies on political expectations in context of disaster management</i> – <i>Domination of short-term political</i>

		<i>perspectives over long term perspectives of disaster management</i>
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6.1 Benefits of disaster knowledge factors

Technological factors

Respondents identified that early warning systems such as effective flood warning systems and effective tsunami warning systems are enormously helpful in managing disasters successfully. In addition they highlighted the use of satellite images to gather real time data during and aftermath of a disaster. As an example, respondents elaborated the use of satellite images to monitor the actual movement of people during the conflict in Sri Lanka and to plan the resettlement process after the conflict. Similarly Geographic Information System is another technology that is mentioned by the respondents to estimate the scale of damages immediately after a disaster. They suggested the usability of robots technology to access too dangerous areas for humans to access during relief operations. Alternatively they proposed the use of reflective waves like laser or radar technology. According to respondents' views, the real time data gathered during the relief phase would help to plan and allocate the resources efficiently. Furthermore they pointed out that, this information is useful in planning mitigative measures as it helps to identify the vulnerability of different areas. Moreover, they described the support of ground transport and helicopters to rescue people and distribute goods and services especially during the relief phase. In addition, respondents recognised the importance of structural measures or product modelling to enhance the resilience of built structures. The use of technology for insurance purpose was highlighted by the respondents. For instance, as certain technological tools can mitigate the risk of flooding, these can ensure the successful claim of money after a disaster. As evident during the interviews, this aspect of technology was used to address certain issues of 2007 flooding in the UK. After a disaster the conventional communication systems could fail due to the failure of mobile towers, telephone communication and power lines. Respondents noted that there are other technologies which could be used to communicate in a disaster situation. For instance they elaborated the use of short wave frequency technology to connect Hambantota and Colombo districts when tsunami hit Sri Lanka.

Social factors

Social factors are seen as essentials in managing disasters by all the respondents. Accordingly, the extent of peoples' network and the culture of preparedness are two major determinants of the successful disaster management. For example, helping each other is embedded in Sri Lankan culture and that was one of the reasons for successful relief after the 2004 tsunami. On the other hand, people in Japan have a great level of preparedness and responsiveness as disasters frequent disasters are experienced in their lives. Therefore, Japan is among one of the world's developed countries even if a major earthquake takes place in every year. Education, training and awareness raising are stated to be the key factors which contribute to enhanced culture of preparedness.

Environmental factors

According to the respondents' views, natural environmental barriers can prevent or minimise the effects of a disaster. As an example, some of the areas in Sri Lanka had minimum effects from 2004 tsunami, because of the vegetations and mangroves. Nevertheless, they stressed that the environmental factors can also further the effects of disasters. Within this context, the role of the built environment was highlighted by the respondents as built environment shapes the natural environment. In doing so, they argued that people need to consider three things: firstly to decide whether people can live as safely as possible within a particular environment, secondly to plan and regulate the built environment accordingly, and thirdly to build man-made barriers to minimise disaster effects. For example they highlighted the use of the Thames barrier as a flood defence in London and the wall built around the sea of Netherland as the country lies below the sea level.

Legal factors

According to the respondents, implementation of disaster mitigation measures is undoubtedly supported by disaster related laws and regulations. As lack of investment on disaster preparedness and mitigation hampers disaster management, statutory requirements imposed on mitigative measures act as a benefit to the community. In addition, emergency and civic duty laws are considered to be helpful in responding to a disaster. Respondents highlighted the fact that law should get the upmost commitment from the government and further the awareness and incorporation of them into training programmes.

Economical factors

Economic planning measures: Respondents viewed that long term economic planning measures basically help to withstand or reduce the effects of a disaster through safeguarding the country's wealth generation mechanism. Also insurance is considered as a mitigative measure by most of the respondents. As an example, in most of the flood prone areas in the UK, the government, property developers and mortgage companies enforced people to take insurance as a mitigative effort.

Financial factors: According to respondents, finance is an essential resource in managing disasters. Therefore funding and access to funding is an essential requirement in successful management of disasters. In the UK there is an efficient system to assess the damages and provide the financial support immediately after floods. Loss adjusters, who employ immediately after the floods, assess the losses in monetary terms while working closely with insurance companies to minimise the impact of flooding.

Institutional factors

According to the respondents, institutions and organisations are again essential elements in disaster management as these are considered as the working norm of the disaster management system.

Political factors

Respondents view that making decisions, allocating resources and enforcing statutes and legislations are influenced by politics. As an example they highlighted the confession by US president to institute new laws on oil spill due to recent BP oil spill over, which was one of worst environmental catastrophe in America.

6.2 Challenges

Technological factors

In relation to technological factors, the need for cost effective and proactive technologies is highlighted by the respondents over reactive use of technologies. Respondents identified communication as one of the areas which need technological support. As an example, they elaborated the experiences of Kashmir earthquake that proved the importance of speed communication as many people had died by the time the government realised the scale of the disaster and started the relief operations. Also proper use of the technology and having necessary skills are recognised as highly important by the respondents. Effective technology will not cause a positive impact unless the people who use them have the required competency and knowledge. Respondents stressed that the key issue related to this aspect is lack of training. Knowing the strengths and weaknesses of the technology is another factor identified during the interviews. In addition, respondents identified a gap in the implementation of technology. They indicated that political institutions or bureaucratic structures hamper the uptake of technology. The need to address the social, political, institutional and behavioural barriers in implementation of the required technology was highlighted during the interviews. The effective use of technology to create networks among communities and cross networks between the policy makers and the communities was noted by the respondents as a lacking area which needs further improvement.

Social factors

Interviewees indicated that people need to be educated and trained properly to engage in overall disaster management cycle. Accordingly, people should make aware of any potential disasters and their collective responsibility in preventing or minimising the effects of disasters. Respondents view that these will help to make preparedness part of their lives or enhance their culture of preparedness. As an example, they pointed out that even so the vulnerability is increased in many third world countries due to unsafe power lines and closed running sewer and water lines, the aggravating effects of these are not known by many of the people of these countries. Respondents highlighted that the success of training depends on several factors including the knowledge of the person who delivers training, the environment in which the

training is delivered, the level of resources needed to support the training and the absorptive capacity of the people who receive training. Therefore, a thorough understanding of the context is emphasized by them. For instance it is highlighted by the respondents that there are certain training programmes where the people cannot understand the terminologies or the experts spent only a limited time with people rather than providing a properly structured training.

Issues related to people's attitudes and perceptions are the next challenge identified by the respondents. Respondents admitted that, as civilians of a country people are required to know their strengths and weaknesses and anticipate certain disasters. Respondents were of the view that while some people believe disasters can be prevented, some people do not learn lessons from previous disasters as they struggle for life which takes their focus away. For example, one respondent stated that even after the 2005 earthquake in Kashmir, people have started constructing their houses in hilly places where there are massive power lines running above the place. According to the respondent, in some countries behavioural structure has taken over the legal structure through bribery and corruptions. Therefore these socially embedded issues are needed to be addressed for successful implementation of the laws.

Respondents agreed that social factors should be given a thorough consideration throughout the disaster management cycle. However, social factors are less concerned during the long term reconstruction and preparedness/mitigation phases and a much more attention is paid during the relief stage. Accordingly, people's needs and requirements are not considered in long term reconstruction. As an example, they highlighted the fact that many resettlement programmes do not consider people's livelihood needs. In order to minimise these effects the detachment between the policy makers and affected community should be minimised. Building networks among people and between people and policy makers is viewed as a possible solution for this.

Environmental factors

It is reported that similar scale of disasters cause different effects in different countries due to different environmental factors, different population densities and different planning and building regulation standards. Respondents were of the view that built environment has an important role to play in minimising the effects of natural disasters. Accordingly, a thorough understanding of the environmental factors and their influence is needed by the policy makers, professionals and communities. A broader understanding of the forces of nature and the forces of environment is proposed to be highly important by the respondents. As an example it is mentioned that Taiwan has more frequent earthquakes since they built the tallest building. However it was not studied and proved the correlation between them. Further it was acknowledged that Indian Ocean is the least studied Ocean which led to a huge devastation by 2004 tsunami. One possible reasoning for this might be that the countries around the Indian Ocean are less economically developed. Finally the respondents indicated that building regulations should be based on proper vulnerability analysis of the environment.

Legal factors

Implementation of law is identified as a major shortcoming by most of the respondents. Even so there are already developed policies related to the impact mitigation of disasters, the implementation of those policies is found to be lacking. Furthermore, the laws which do not address the humanitarian aspect of disaster management have become unsuccessful in its implementation. For instance the 200m buffer zone which was regulated after the 2004 tsunami in Sri Lanka was unsuccessful as it was not taken into consideration the livelihood needs of the affected community. As a result, the fishing community re-constructed their houses within the buffer zone in order to safeguard their livelihood needs. Within disaster context it is highly unlikely to execute laws which cover the every aspect of disasters as they encounter new circumstances which are not encountered before. Therefore it is contended that disaster related laws should be updated regularly.

Economical factors

Economic planning measures: Risk assessment or vulnerability analysis of country's wealth generation mechanism is accepted as a more prominent part of long term economic planning by the respondents. However, it is found that lack of investment hampers this process. For example, though many developing countries' infrastructure facilities are instrumental to communities, governments do not invest enough on them. As a result the impact could be magnified if a disaster happens. Therefore interviewees suggested that the vulnerability assessment of country's wealth generation mechanism should be an integral part of the country's financial model. At the same time they argued that long term reconstruction should focus on both recovering the damaged infrastructure and looking for alternatives, rather than focusing only on repairing the existing facilities. As an example, as Sri Lanka had only one international airport, attacks were so eminent and crucial during the war. Even though its security was consolidated, a second air port was not built.

Financial aspect: As relief stage attracts more funding, management of finance during the relief stage is considered vitally important by the respondents. Rigid policies in handling money hinder rapid decision making in the aftermath of disasters. Therefore, respondents highlighted the need of flexible systems which allow fluid decision making. They claimed that reconstruction and preparedness/mitigation phases attract less finance on the contrary to relief stage. According to the views of the respondents, one possible reason for this is disaster management not getting priority in allocation of finance. However as proactive approaches to disaster management could bring much benefit, investments in reconstruction and preparedness/mitigation phases should be prioritised. Financial mismanagement is another issue experienced during reconstruction stage. The government organisations are claimed to re-invent the wheel in managing finance. Respondents indicated that the disconnection between investment or insurance companies and public sector is restrained public sector learning from insurance companies on how to manage finance effectively. As respondents stated, the accountability of post disaster reconstruction should be improved, yet not adhering to the conventional financial accounting systems, as conventional financing accounting systems are developed on the basis that there are very well defined requirements and outputs. Nonetheless, in a disaster situation things are not certain and it needs much more flexible accounting system.

Operational/managerial factors

According to the respondents' views, improvement is needed in decision making process of disaster management. Parties to the decision making process, speed of the decision making and innovativeness of decisions are some of the areas considered by the respondents. For example, community participation in decision making process is highly promoted in disaster context as it helps to identify their real needs. Slow decision making is identified as a main reason for delay in reconstruction work. As an example, despite the urgency, it is reported that most of government institutions still follow the traditional tendering system by giving priority to the lowest bid. As every disaster brings some uniqueness, the role of innovative decision making is highlighted.

As viewed by the respondents, reasons for some failures in disaster management were down to the quality of leadership. Choosing the correct leadership style is one aspect which needs more attention. Respondents described that participatory style of leadership may appropriate for certain contexts while autocratic style may convenient for certain contexts. Also the communication among affected communities and between the affected communities and policy makers should be enhanced. In order to avoid receiving inappropriate relief goods, the process of collecting goods should be driven by the requirements. For instance, the Disaster Emergency Committee (DEC) which operates in UK sends money in a disaster emergency instead of goods which may be not appropriate or useful. Moreover, providing the required training and necessary resources including financial, time and manpower were identified as essentials in managing the disasters successfully by the respondents. Training people to be innovative is another social factor which needs consideration. Though people have knowledge and know the best practices in managing disasters, transfer of knowledge to the right person at the right time is identified as lacking. A considerable gap exists between what is known and what is done in practice. Another area which needs attention is developing a common vocabulary that could bring together various disciplines in the disaster management field. As an example, terminologies used by engineers are different from GIS specialists or public officials and this may hamper the communication between them. Similarly there are various tools used in different sectors, yet those tools are not inter-communicating. For instance GIS maps and drawings may not be used in vulnerability analysis as information cannot be exchanged between tools. Therefore, knowledge based standardisation tools that could link different organisations and platforms need to be developed.

Institutional factors

Interviewees claimed that proper institutional formation and integration are vitally important in managing disasters successfully. Hence they indicated that the capacity of these institutions need be reviewed and empowered according to the needs. Particularly the disaster related knowledge and skills need to be improved. In addition a centralised institution which monitors and oversees all the other institutions need to be formed. For example once hurricane Katrina hit USA, for a couple of weeks it was not known who should be responded, whether it is the state of Louisiana or the federal government.

Political factors

Studies on political expectations in context of disaster management are recommended to minimise the mismatches between political agendas and disaster management agendas. Most importantly it is highlighted that the long term perspectives of disaster management should not be dominated by the short term political perspectives.

7. Discussion and way forward

This paper has presented benefits and challenges of disaster knowledge factors in managing disasters. Respondents viewed the detection and warning systems and resilient built structures as key benefits of technological factors. While detection and warning systems help to save lives, resilient built structures supports to minimise the effects of disasters. With regard to the social factors, respondents indicated that technology can provide only the information and it would be the human beings who will have to react for disasters. Hence they highlighted the benefits of education, training and awareness raising to enhance the level of preparedness. The benefits of existing natural environmental barriers are highly recognised by the all respondents. Support of legal factors to implement disaster mitigation measures is also highlighted by the respondents. In terms of economical factors, benefits of long term economic planning measures were stressed by the respondents. In addition they viewed the financial, operational/managerial and institutional factors as essentials to manage disasters.

Among key challenges, the lack of detection and warning systems, the need for effective education, training and awareness raising programmes, the need for regular updating of disaster related laws, lack of funds for economic planning measures, poor planning, poor communication, poor leadership, lack of knowledge management and poor institutional arrangement were highlighted by most of the respondents. These clearly show that most of challenges are related to the operational/managerial factors. In order to enhance the management of disasters, these challenges need to be addressed.

These findings are based on the interviews conducted with disaster management experts and these will be further supported by an extensive questionnaire survey. Thereafter the knowledge map which highlights key disaster knowledge factors will be finalised.

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