

Decision–Support System Portal as a tool for mainstreaming DRR into urban decision making

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ABSTRACT: Recent disasters such as Super Storm Sandy, the Haitian Earthquake and extensive floods across the United Kingdom have highlighted the fragility of cities to a range of hazards and threats thus emphasizing the increasing importance of resilience and disaster risk reduction (DRR) and the influences of such concepts upon the management of the built environment. While this makes the role of planning, design and construction stakeholders crucial in implementing the principles of DRR, tensions exist regarding the extent to which DRR measures should be implemented during planning, design and construction process; in particular who should be responsible for the implementation of such measures. This paper presents a web-based Decision-Support System Portal (DSSP) developed during a four-year European Union-funded project which is examining the design and planning of safer urban spaces. Central to the project is an integrated security and resilience (ISR) design framework that engages local stakeholders for identifying vulnerabilities and improving urban spaces with respect to ‘security threats’. The DSSP helps end-users better understand the vulnerabilities and design possibilities of the proposed site by allowing users to pursue decision-support scenarios of secure urban design and planning.

Keywords: decision-support system, decision making, online tool, disaster risk reduction, urban spaces

1. INTRODUCTION

There is growing concern about the increasing complexity of disasters and the impacts they can pose to society, with the fragility and vulnerability of the built environment being particularly highlighted (Boshier, 2008). In order to reduce disaster risks, disaster risk reduction (DRR) approaches have been proposed that can systematically analyse and manage the casual factors of disasters ‘through reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events’ (UNISDR, 2011). Spatial planning is increasingly becoming an attractive and important approach for DRR, as it presents an opportunity to regulate long-term use of space through which exposure to natural hazards and human-induced threats can be minimized (Coaffee et al., 2008; Sutanta et al., 2010;).

A number of recent extreme weather events and man-made threats have shown that timely and effective reactive measures (i.e. emergency response and recovery) are not sufficient in keeping the built environment safe; it is vital to deal with hazards and threats proactively, with the wide range of the stakeholders being involved (Chmutina et al. 2014). Stakeholders’ engagement is however often affected by the lack of understanding that the risks can potentially be minimized or even prevented if DRR measures are thought of at an early enough stage of the design, planning, operation and construction process.

There is an increasing amount of information and guidance on how natural hazards can be eliminated/reduced/mitigated/designed-out through urban planning and design interventions; such information is supported by a variety of online-based open access tools aimed at assessing security and resilience of urban spaces. The aim of this paper is to introduce a web-based Decision-Support System Portal (DSSP) developed during a four-year European Union-funded project which is examining the design and planning of safer urban spaces. The DSSP is a multi-hazard open access tool that helps stakeholders involved in design, planning, construction and operation as well as local authorities to better understand the vulnerabilities and design possibilities of the proposed site by allowing users to pursue decision-support scenarios of secure urban design and planning.

2. OVERVIEW OF THE INTEGRATED SECURITY AND RESILIENCE (ISR) DESIGN FRAMEWORK PROCESS

The ISR framework has been designed to help users to design safer urban spaces, through a stage-by-stage process, and acts as the core of the DSSP tool. The DSSP covers both natural hazards and man-made threats including: floods and storms; earthquakes; terrorism and crime; and crowded events. Central to the development of the ISR framework has been the adherence to, and further development from, an international standard on risk management (British Standards Institution, 2009; 2011). The international risk management standard ISO 31000 'Risk management – Principles and guidelines' (British Standards Institution, 2009; 2011) presents four stages, those being risk identification, assessment, evaluation, and treatment. In the ISR framework, 'treatment' has been expanded into two stages, to aid end users to 'identify' what measures can be used, and to 'prioritise' them in relation to their effectiveness (see Bosher, 2014).

From the end-user point of view, the ISR addresses the following: helps in decision making; provides a structure in which to understand hazards, threats and risks; illustrates why the suggested steps should be taken; offers a method of understanding the threats, hazards and risks the end-user faces in the designed space; provides examples of how each risk can be reduced or eliminated; and offers a paper trail that will provide a record of which steps could be/have been taken by the end user. The following sub-sections will present a stage-by-stage 'walk-through' process that informs the logic behind the DSSP.

2.1 Stage 1: What are the hazards/threats to this site?

The aim of this stage is to help the end-user begin recognising the threats and hazards to which the chosen project space is exposed. This may sound like a straightforward requirement but research has found that this critical stage is too often overlooked by key decision makers (see Bosher et al. 2007; Fisher et al. 2012) This is achieved through the description and identification of the hazards and threats provided by the end user. This stage involves two steps: identification of hazards and threats, and a range of possible and likely impacts of identified hazards and threats.

After completing this (and each following stages), the end-user will be presented with a set of outputs for each hazard/ threat identified. The outputs include hazard/ threat impact rating; the exemplar case studies illustrating good (i.e. where the hazard has been identified and the benefits of this) and bad (i.e. where a hazard was not identified) practice; the list of documents that illustrate how to identify potential threats and hazards; and a list of online based open access tools useful at this stage for the identified hazard/ threat.

2.2 Stage 2: Assess the vulnerability of the space to the identified threats/ hazards

At this stage the end-users identify how vulnerable their project site is based on its location and design. This will be done in two steps: 1) Identification of site vulnerabilities, and 2) Identification of design vulnerabilities. The categories against which the vulnerabilities will be scored are still under development, but preliminary categories include: urban planning issues; architectural and industrial design issues; site management and monitoring; structural issues; material issues; maintenance; hazard mitigation; emergency response; and stakeholder involvement. Overall vulnerability will be determined as a combination of a highest design vulnerability score and the highest site vulnerability score.

2.3 Stage 3: Determining risk

The objective of this stage is to demonstrate the overall magnitude of risk per hazard/ threat type. This stage is based on the information drawn from Stages 1 and 2: a combination of the exposure to and impact (consequences) of a hazard and the likelihood (change of something happening) of a hazard. The scores from Stages 1 and 2 provide information for the determination of the risk.

2.4 Stages 4 and 5: Identifying ways to reduce the identified risks and prioritizing risk reduction measures

The aim of Stage 4 is to identify a course of action to address and treat the hazards/ threats and risks associated with them. Possible mitigation measures and suggestion of mitigation options appropriate for the identified hazard/ threat are provided to the end-user; these include: inherent safety; prevention of hazard/ threat; detection of hazard/ threat; control of hazard/ threat; mitigation of hazard/ threat; and emergency response. It is however important to bear in mind that the best options will invariably be context specific.

Once the potential course of action has been identified, it is important to prioritize the most suitable options. Thus the objective of Stage 5 is to assist in identifying the most suitable intervention for a given project. The prioritisation will depend on a number of factors individual to each project; these include (and are not limited to): cost vs. benefit of identified interventions; corporate social responsibility; business continuity; legal and statutory requirements; technical and social feasibility; proportionality of

identified interventions; complementarity with measures introduced to mitigate other hazards etc. At this stage the end users will be provided with the cases where, with hindsight, the correct or wrong options have been chosen.

Once all the stages are completed, the end-user will receive a report, which incorporates the results of all the stages including the following: Relevant bad and good practice case examples; Scores of the impact assessment and vulnerability assessment; Likelihood and exposure to risks; List of documents relevant for this particular case (including overview of both structural and non-structural risk reduction measures); and a List of tools relevant for this particular case with the emphasis on the tools developed by the project partners.

It has to be emphasized that the report will not provide the answers but that is not the intention of the report. Rather it is the case that the report and the process will help in decision making by illustrating various examples and signposting to most suitable tools and documents that can assist the decision-making process.

3. ADDED VALUE FOR THE POST 2015 FRAMEWORK FOR DISASTER RISK REDUCTION

In order to protect societies and economies it is important to understand the sensitivity of the built environment and the necessity to adapt it to the impacts of a multitude of hazards and threats. This can be achieved through pro-active DRR measures implemented during the design, planning, construction and operation process by the built environment professionals, whose knowledge and experience fits into DRR approaches (Bosher et al., 2007). The involvement of construction professionals in DRR has in the past largely been associated with a range of critical activities such as temporary shelter before and after the disaster as well as the restoration of public services (e.g. hospitals, schools power lines) (World Bank, 2001). In reality, however, construction experts have a much broader role to anticipate, assess, prevent, prepare, respond and recover (Keraminiyage et al. 2007).

The Hyogo Framework for Action (HFA) currently provides a comprehensive framework for public and private stakeholders to better understand disasters and take measures to reduce their impacts. It encourages not only to develop risk assessment tools and mechanism, but also 'to incorporate these methods into decision-making process at regional, national and local levels' (UNISDR, 2005; p.10) and in 'the urban planning and management' (UNISDR, 2005; p.12). The idea of mainstreaming and incorporating DRR will be taken further in the post 2015 framework. In addition, GAR2013 (UNISDR 2013) emphasises that in order for DRR to be mainstreamed, the engagement of private stakeholders is critical.

Being an open-access, multi-hazard online tool aimed at non-DRR experts, the DSSP offers an opportunity to increase awareness and understanding of disaster risks and impacts therefore providing a basis for more attention to be paid to disaster risk management. In addition, since the ISR framework is based upon an accepted international standard such as ISO 31000, it is anticipated that, being based on the ISR, the DSSP will provide suitable relevance (in functionality and terminology used) across Europe and globally and can be applicable to a range of urban contexts (i.e. city, building, organisation); a broad range of professions (i.e. planners, architects, security consultants, engineers, local authorities); and covering a range of countries (Pan-European and global). Its main aim goes in line with the HFA2 in that it promotes risk assessments and supports wider groups of stakeholders to relate disaster risk to broader urban environment issues.

4. CONCLUSIONS

This paper has presented an overview of a web-based Decision-Support System Portal (DSSP) developed during a four-year European Union-funded project which is examining the design and planning of safer urban spaces. Central to the project is an integrated security and resilience (ISR) design framework that engages local stakeholders for identifying vulnerabilities and improving urban spaces with respect to 'security threats'. There is a great variety of open access web-based tools that cover various threats and hazards, and that are of potential use to stakeholders involved in the planning, design, construction operation and maintenance of urban spaces. However the majority of such tools and guidance are context-specific and can only provide partial information that can be useful in disaster risk management. DSSP partially fills this gap: it is a multi-hazard tool that covers both natural hazards and man-made threats and is aimed at different levels of stakeholders, from construction professionals to local authorities. In addition, it can be used in conjunction with international documents and guidelines

As highlighted in this paper, the DSSP has the ability to engage the stakeholders who would not normally consider DRR and to aid their understanding of the vulnerabilities and design possibilities of the proposed site by allowing users to pursue decision-support scenarios of secure urban design and planning. Whilst the DSSP cannot accurately predict every threat or hazard and provide the solution for the prevention or mitigation, it helps various stakeholders to consider prior knowledge of existing hazards and threats in a local context and to recognise that too often disasters occur because risk reduction measures have not been considered or undertaken.

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