

OD4.8

Structured portfolio of tested operational innovative tools and protocols for policy and management purposes of coastal flooding risks.





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PART I: INTRODUCTION



PRESENTATION OF THE DELIVERABLE AND ITS CONTEXT

WP4 AND OD 4.8 AS IT APPEARS IN THESEUS' DOW

THESEUS' DOW page 7-8 states:

“The general aim of WP4 is to analyse and develop the contributions of social science and economics at addressing the challenges of transforming the concept of resilience into a portfolio of tested operational innovative tools for policy and management purposes of coastal flooding risks. More specific objectives are: to analyse the design of insurance scheme geared at contributing to coastal areas resilience (WT 4.1); to analyse how land use planning can support coastal areas resilience (WT 4.2); to analyse and develop existing and potential business strategies geared at reducing the business sector need for coastal defence and their sensitivity to coastal flooding risks (WT 4.3); to develop protocols for the proper integration of post crisis response management (WT 4.4); to develop protocols for coastal flooding risk related research communication and use for risk governance (WT 4.5); to develop protocols for evacuation plans (WT 4.6). The objectives of WP 4 are measurable and verifiable as the WP can show steady progression from innovative concepts through the development of a general method for on-site surveys (see Milestone 4.1) to the analysis of results obtained by field activities in order to provide a tested portfolio of innovative tools for policy and management purposes (see Milestone 4.2). Throughout this process verifiable methodology for tuning on-site specific tools for promotion of social and economic resilience will be documented.”

Furthermore WP4 consists of the following work tasks: WT 4.1 Insurance programs; WT 4.2 Impact on urbanization and spatial planning; WT 4.3 Damage to businesses and rapidity of recovery; WT 4.4 Post-crisis response; WT 4.5 Risk communication and science for building resilience; WT 4.6 Evacuation plans.

OD4.8 is presented in the DOW as a Structured portfolio of tested operational innovative tools and protocols for policy and management purposes of coastal flooding risks. Guidelines on coastal areas insurability; Guidelines for planning and urbanisation policies and practices; Guidelines for business enterprises enabling an enhancement of their ability to recover of the potential impacts of coastal hazards in the future; Post crisis management guideline; Guidelines on coastal risk perception management and indicator portfolio use.



COHERENCE BUILDING WITHIN WP4

In such a WP it was felt critical that the joining-up of WT based approaches transcends the sum of individual components. The first deliverable (OD4.1, “General framing document for the development of a coherent portfolio of risk management approaches) was thus conceived as the initial step to guarantee such a resilience building coherent portfolio of approaches. Furthermore, the mitigation options envisioned in WP4 are to be tested within THESEUS DSS. It was therefore felt necessary that, for the options that are concerned, the characteristics for the inclusion of these options in the DSS should be developed as an initial starting point to feed WP5. Through extensive fieldwork these options have been ground tested. This ground testing is thus presented, its conclusion forming an important part of this document.

It was thus agreed the content of this deliverable will work at the dovetailing of WP4 various WTs through (1) operationalizing of the resilience concept, (2) presenting the DSS inclusion and, (3) presenting and taking stock of the field work that has been conducted, and (4) the development of guidelines.

STRUCTURE OF THIS DELIVERABLE.

This deliverable is structured around WP4 various Work Tasks. Innovative insurance are presented first as a mitigation option allowing for a temporal and/or spatial redistribution of risk. Thereafter Land-use planning and its potential for innovation is presented. Business continuity planning follows, the focus of this mitigation option lies in creating the speed of recovery after business disruption. Post crisis management is presented followed by guidelines for risk perception management and the use of knowledge. Finally evacuation planning is presented.

Each of these sections is structured the following way. First, the general context is briefly presented (more detailed contexts elements are available in THESEUS’ OD 4.1 “General framing document for the development of a coherent portfolio of risk management approaches”). Then the mitigation option is framed in terms of its inclusion into the DSS and in terms of its contribution to resilience. Ground testing procedures and results are presented. Finally guidelines for implementation are given.

FLOODING, EROSION AND RISK GOVERNANCE WHERE DOES WP4 STANDS, WHERE DOES RISK GOVERNANCE STANDS WITHIN THESEUS

Risk governance is the application of governance principle to risk and risk related activities. Governance should be understood here as “structures and processes for collective decision making” and as such may involve the state, economic interests, civil society and academia, this at various institutional scales. At the core of the principle of governance lie the concepts of horizontal (i.e., between state, economic interests, civil society and academia) integration and vertical (i.e., between the local, regional, national and global scales) integration.

Risk governance is composed of five elements: pre-assessment, appraisal, characterization/evaluation, Management, and communication (Renn 2008). The first four elements

are sequential and may be iterative, while the fifth element, communication interacts with all (see Figure 1, below).

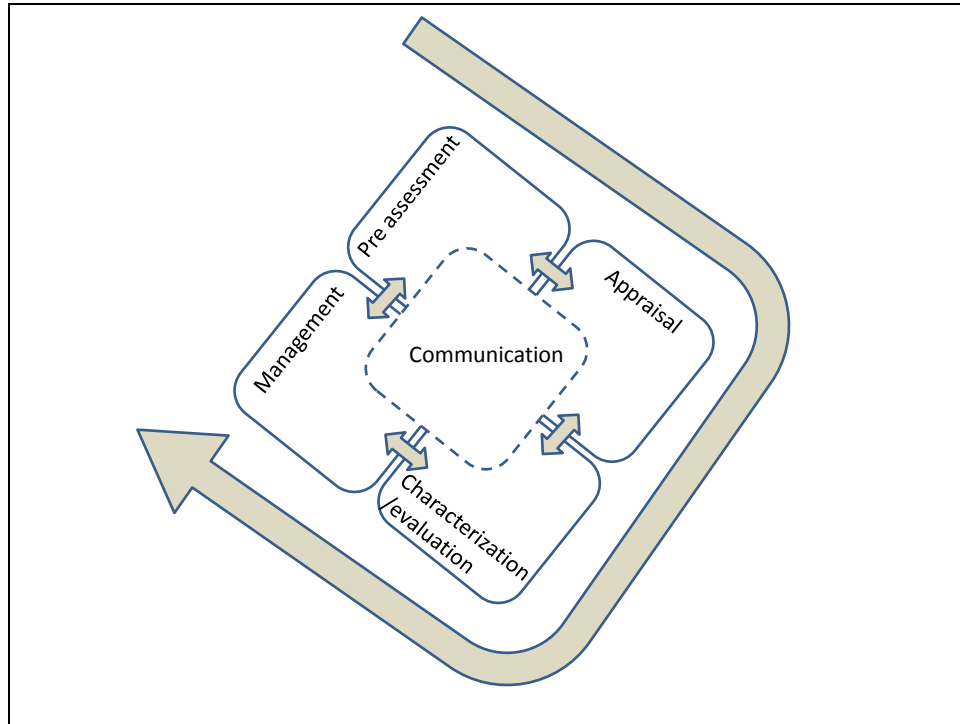


Figure 1: The five elements of risk governance (adapted from ICRG, by and in Renn, 2008, p.48)

Within THESEUS, the overarching goal of “Safer European coasts” can generally be framed as a contribution to flooding and erosion risk governance principles. The structure of THESEUS and some of its founding principles (interdisciplinary research, multi-scale work, stakeholder participation in some work packages) are clearly aligned with governance principles of vertical and horizontal integration. Yet THESEUS has the particularity of being a science based and science centred project, articulating its activities within specific study sites. As such its activities will not necessarily cover all the elements of risk governance and will be dominated by a specific stakeholder group: members of academia.

Within WP4, the same characteristics apply. Yet the focus of WP 4 being social sciences, governance as an object of enquiry will be much more present. Here below we review some key characteristics of the various phases of risk governance.

THE PRE ASSESSMENT PHASE OF RISK GOVERNANCE

Pre assessment is composed of four key elements:

1. Problem framing,
2. Early warning,



3. Screening, and
4. Establishing scientific conventions for risk assessment and concern assessment.

Within THESEUS scientific conventions have mostly been established in THESEUS' DOW relying on the extensive experience and expertise of THESEUS' consortium members. Within THESEUS as well the Screening has been partly defined ex ante (i.e. flooding and erosion risks have been chosen as pertinent risk to address in order to contribute to safer European coasts) and is partly, but to a much lesser extent, dovetailed within the first four WP. Early warning, understood here as the systematic search for new hazards, is integrated into WP1.

Finally, the framing of THESEUS' risk management contribution lies at the core of WT1.7, in which most of the WP4 participants are involved. Results from WT1.7 have shown that there is within THESEUS' high probabilities of dissent both

- in terms of risk selection rules (i.e., members of the consortium and members of affected communities may not have the same risk selection rules, the latter putting a more important weight on ethical issues), and
- in terms of relevance of evidence (i.e., members of the consortium and members of affected communities may not rely on the same information, the latter putting a more important weight personal and collective heuristics).

THE APPRAISAL PHASE OF RISK GOVERNANCE

Risk appraisal consists of two major components:

1. The scientific assessment of risk to human and nature, and
2. The scientific assessment of related concerns.

A carefully conducted risk appraisal will produce high quality (best available?) scientific estimate of the physical, environmental, social and economic impacts of a risk source. Appraisal is thus often divided into two distinct phases: risk assessment and concern assessment.

Risk assessment consists broadly of three elements: hazard estimation, exposure and/or vulnerability assessment and, estimation of risk, combining likelihood and severity of consequences in physical terms. Risk concerns assessment consists, six factors are generally identified in the "risk concerns" sphere (see THESEUS' ID 1.5 for a detailed discussion): (1) perception of familiarity with the hazard, (2) understanding of the hazard and its connection to consequences, (3) risk effects on equity, (4) perception of fear and dread associated with the hazard, (5) perceptions of control over the risk and, (6) degree of trust in risk management organizations.

In THESEUS the appraisal phase is the major undertaking of WP1.

A critical dimension of risk appraisal lies in its scientific nature. Yet appraisal will be used for the purpose of managing a particular risk that entails social and political support for the management option that will be chosen. This support will be based on a different knowledge base, originating



from personal and collective heuristics. It is therefore highly desirable that the appraisal be somehow integrated to the personal and collective heuristics of those that will be impacted by risk and its management (see THESEUS' ID1.5 for empirical validation and discussion of this).

THE RISK CHARACTERIZATION AND EVALUATION PHASE

Risk characterization consists of establishing the risk profile, judging the seriousness of the risk under scrutiny, and establishing the need for risk reduction. This characterization is partly established in the site analysis conducted in the course of the project preparation and is thus included in the DOW, yet most of this work is being established through study site application of the progresses made in WP1.

Risk evaluation consists in establishing the level of a specific risk's acceptability/tolerability, and in establishing the need for risk reduction measures. Again this phase, in THESEUS, is the product of study site level work for WP1.

THE RISK MANAGEMENT PHASE OF RISK GOVERNANCE.

Risk management consists of the major components decision-making and implementation. Due to the nature of THESEUS' as whole and due to nature of WP4 we focus here on decision-making.

Decision-making lays obviously at the core of THESEUS various contributions. The innovative nature of THESEUS lies mostly in its commitment to generating new risk mitigation options, be it engineering options in WP2, ecosystem based options in WP3 or socio-economic based in WP4. The assessment of these innovative options is integral part of the relevant WPs. The second key innovative development of TESEUS lies in the integration of the options and the application of truly integrated multi criteria Decision Support System that includes option assessment.

THE COMMUNICATIVE DIMENSION OF RISK GOVERNANCE

This dimension is the focus of WT 4.5. The critical component here is to remind oneself that communication must be present at all phases of risk governance.



PART II: THE GOVERNANCE BASED MITIGATION OPTION IN THESEUS



INNOVATIVE INSURANCE SCHEME AS A MITIGATION OPTION REDISTRIBUTING RISK (PHOEBE KOUNDOURI, ANNA MAVROGIORGIN, MARIANNA MOUSULIDOU, MARVA STITHOU, OSIEL GONZÁLEZ DÁVILA, BENEDICTE RULLEAU)

GENERAL CONTEXT

In order to explore the role and effectiveness of insurance as a flood risk management measure it is important to keep in mind the definition of risk. Risk of flooding in European water management is defined as a function of the probability of a flood event and its potential effect (expected damage in terms of monetary damage and human casualties) (Rijkswaterstaat, 2005):

$$\text{Coastal flood risk} = P_{\text{flooding}} \times E(D)$$

As a result risk equals probability times consequence (Gouldby and Samuels, 2005) and this is the expected annual average damage of flooding, which covers economic, social as well as environmental negative consequences.

As it is presented in the following figures (Figures 2 and 3) there are different ways to deal with flood risk that can be categorized in two main groups. On the one hand, we observe structural measures (engineering constructions, e.g. dykes, barriers etc. or run-off reduction and storage interventions) that aim to reduce flood hazard and the probability of flooding and on the other hand, non-structural measures (land-use planning, insurance schemes etc.) that aim to reduce flood vulnerability.



Summary of flood risk management measures.

Intervention	Effect of action	Potential modification of risk calculation (Eq. (2))
Climate change mitigation	Mitigation of greenhouse gases will lead to less significant changes in the climate.	Different climate change mitigation strategies are considered through alteration of the probability of a given loading through time.
River and coastal engineering measures	Hard engineering measures (e.g. river conveyance, defences, and engineered storage) reduce the probability of flooding by providing more efficient mechanisms of removing water from the system, or increasing the capacity to withhold greater quantities of water. 'Soft' engineering measures (e.g. beach nourishment and vegetation management) reduce the vulnerability of defences through dissipation of energy.	The effectiveness of flood defences may be considered through appropriate alteration of the probability of flooding at the time they are implemented.
Rural runoff reduction and storage	Reduce flood severity from altered runoff properties through changing the infiltration, storage and conveyancing properties of catchments and floodplains.	Alters the probability of flooding.
Urban runoff reduction and storage	Reduce the probability of flooding using a combination of storage, infiltration, conveyancing and drainage capacity management.	Alters the probability of flooding.
Flood incident management	Flood-forecasting and warning systems provide information to flood risk managers, local authorities and emergency services which is subsequently disseminated to the public in order to sufficient time that they can take effective mitigative actions before the flood arrives. Proactive pre-incident activities ensure that the public, emergency services and other key stakeholders are well prepared and able to act sensibly, and understand information on flood warnings, during and just before the flood.	Most flood incident measures act to change the depth-damage relationship of floods (if followed by appropriate action by the public) and increase public safety and reduced health impacts of flooding. However, some flood-fighting actions (e.g. reinforcing failing defences) can reduce the probability of flooding and their success is tied to timely responses to specific flood events.
Flood-proofing	Reduce flood damage.	Flood-proofing measures change the depth-damage relationship for the properties in which they are implemented. These could be retrofitted to old properties or designed into new builds.
Land-use planning	Limit construction of buildings and infrastructure in the flood plain, hence controlled increase in vulnerability.	Land-use planning measures change the overall damage function through time by altering the rate of floodplain development.
Building codes	Reduced flood damage. In new buildings it is possible to implement flood proofing measures that are more reliable than retrofitted properties. For example, raising buildings on stilts.	Flood-proofing measures change the depth-damage relationship for newly built properties in which they are implemented.
Risk spreading (e.g. insurance)	Redistribution of the cost of damage across the population and through time.	As well as redistributing risk, insurance is a potent means of communicating flood risk through an economic signal so it can change the overall damage function through time by providing a mechanism for discouraging development in high risk areas.
Health and social measures	Reduced social, health and associated economic impacts of flooding.	Health and social measures could be incorporated if an appropriate health/social, or secondary economic impact damage function was available.

Figure 2: Summary of flood risk management measures (Dawson et al., 2011)

Hence, insurance market is one of these non-structural measures that can contribute to flood risk management.

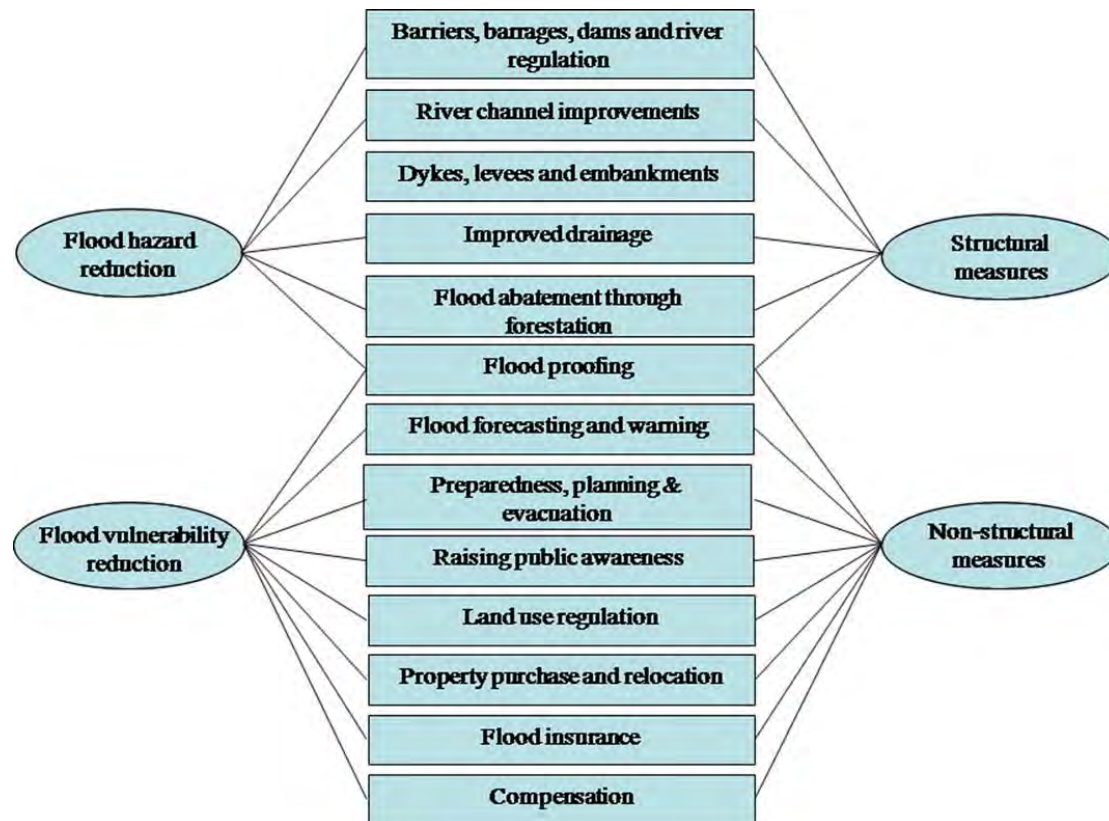


Figure 3: A categorization of flood risk management measures into structural and non-structural (Parker (2007) in Harries and Penning Rowsell (2011))

As it has been noted “hazard management has shifted away from physical processes alone and has, in turn, embraced its socio-economic, political and behavioural underpinnings” (Treby et al., 2006, p.352), thus focusing not only to the natural physical hazard but also to the socio-economic vulnerability of the affected population (Figure 4). Crichton (2008, p.123) emphasizes that “risk management must recognize that controlling exposure and vulnerability can be much more cost-effective than simply trying to control the hazard”.

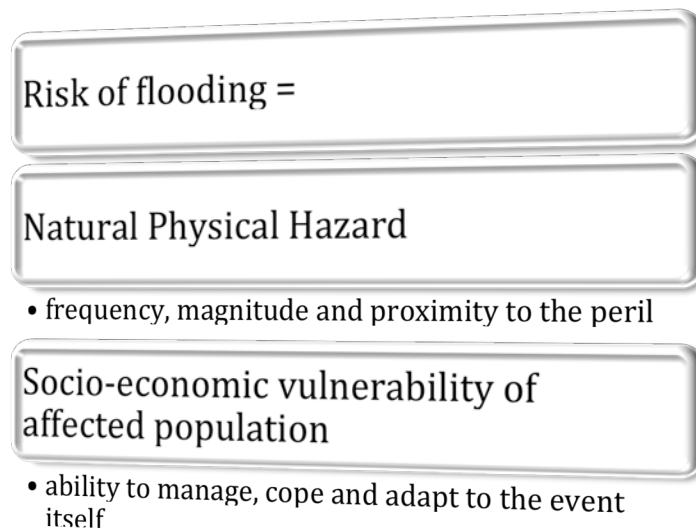


Figure 4: Risk of flooding

Regarding vulnerability Liverman (2001, p. 4657) points out that “vulnerability is conditioned by both biophysical and social conditions, including topography, poverty, access to information and insurance, gender, and ethnicity, and involves both external structural factors and individual capacity to cope with extreme events”. As a result, it is acknowledged that there is a distribution of sensitivity and resilience to hazards across geographic space, and between social sectors that should be taken into consideration by policy-makers.

NATURE OF THE MITIGATION OPTION THAT IS PROPOSED

Regarding insurance, we could identify three main types of schemes related to flooding: private, public insurance and mixed. Private insurance is related more to resilience building and is characterized as simple recursive. On the other hand, public insurance deals with the diffusion impact of natural disasters such as flooding which is deeply uncertain since it is not very clear how long the boundaries of the impact are.

The Insurance Information Institute (III) provides an overview of flood coverage in USA and other countries. According to III: “there are two basic methods of providing flood insurance in developed countries. Under the first, the optional system, insurers extend their standard policy to include supplemental coverage for flood damage on payment of additional premium. The coverage tends to be expensive due to the fact that only those most likely to be flooded, and therefore to file claims, purchase it, a situation known in the insurance industry as adverse selection. Among the countries with optional coverage are Germany, Italy and the Netherlands. The other method is “bundling.” Under this system, flood coverage is combined with coverage for other perils such as fire and windstorm, thus spreading the risk of flood losses across a large geographical area and greatly increasing the percentage of the population covered for flood damage. Countries that have adopted this method include the UK, Spain and Japan. In addition, in some countries such as France and Spain there are government compensation programs for major disasters, including flooding, that take

effect when the cost of a disaster reaches a certain level. The system in the United States is unique in that the government underwrites the coverage and private insurers act as administrators bearing no actual flood risk”¹.

The following figure (Figure 5) presents different approaches to flood insurance that can be considered along two axes: the degree of bundling and the level of state support.

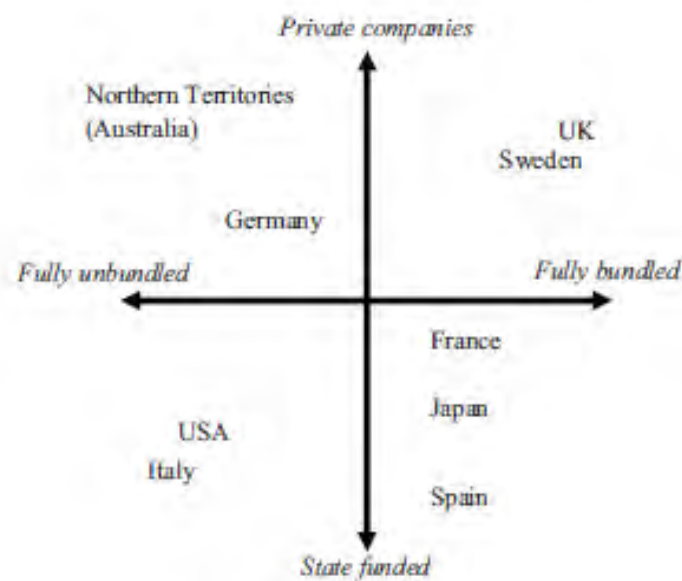


Figure 5: Mix of state and private intervention on the insurance market vs. flood bundled or not with other risks, by countries (Dawson et al. 2011)

As the authors note unbundling is common in insurance markets with some companies to specialise in offering specific insurance for risks considered too high by others. Furthermore, within a single company, the pricing of policies and setting of excess/deductible values may vary.

On the other hand, national systems of flood insurance also vary considerably in respect of the type and degree of government intervention. Hence, in the USA the Federal Emergency Management Agency (FEMA) allows property owners in participating communities to purchase flood insurance as a protection against flood losses as long as the state and local community implement floodplain management regulations, while in many European countries the government is the insurer of last resort, but there is a great variety of approaches. For example, there may be the case of no insurance at all (as in the Netherlands), through state-sponsored and mediated insurance systems with varying degrees of private sector involvement: for example, France, Germany and Spain, to the fully private UK mode.

¹ http://www.iii.org/issues_updates/flood-insurance.html



In general, it is observed that, in order to make sure that insurance markets can better absorb catastrophe losses and also provide affordable insurance; innovative approaches have been developed to structuring risk sharing. Hence, it has been observed the establishment of public-private or national-international partnerships in order for local insurance companies to cope with huge losses. Furthermore, advancements in global financial and insurance/reinsurance markets have increased the ability to spread weather risks across countries. As a result new instruments, as mentioned before, such as catastrophe bonds and weather insurance contracts (i.e. ARTs) have a considerable potential for local insurers and governments. Hence, it should be also acknowledged that governments and bilateral/multilateral financial institutions could contribute to the development of sustainable structures. The advantage of these novel methods of increasing capacity and protecting businesses from catastrophic losses apart from reducing the price of reinsurance through sharing risk among a pool of international investors is that it is geographically flexible (Sturm and Oh, 2010). ARTs emerged in the late 1990s in response to declining profits and increasing costs of catastrophic losses and catastrophe bonds (or “cat bonds”) are the most commonly issued type of ART.

A particular challenge for insurance companies in the light of climate change is how to deal with a situation where key epistemological dimension of climate change lies in its “never happened before” dimension.

As it has been commented also in the report *Adaptation Lessons from Past Experience* (AfDB et al., 2003, p.23) that: “An important challenge to developing weather insurance of this kind is the availability of reliable and verifiable data on weather patterns. Weather stations with appropriate hardware systems need to be put in place to ensure reliable readings on insured events. However, weather events can also vary spatially, so the existence of microclimates and localized disasters needs to be taken into account. In some cases, weather events show a trend. ... Hence, while insurance schemes can help to spread the risk of climate impacts, their limitations need to be carefully considered, particularly because climate change may cause changes in climate variability and the occurrence of extreme events in a region, and past experiences may not apply to the future”.

At this stage of global climate change, Mills presents two options for the insurers: “*insurers+ may rise to the occasion and become more proactive players in improving the science and crafting responses. Or, they may retreat from oncoming risks, thereby shifting a greater burden to governments and individuals” (Mills, 2005, p. 1043).

Without neglecting the challenges mentioned above, overall the main effect of insurance, as an intervention mechanism in the context of flooding, is the redistribution of the cost of damage across the population and through time. However, apart from the redistribution effect, a potential modification of risk calculation in the equation above could be achieved through insurance.

A short-run impact of insurance is to reduce the flood damage by changing the depth-damage relationship if its policy is linked to mitigation measures for the properties (old or new buildings) in which they are implemented (short-run risk impact).

A long-run impact is the change in the overall damage function through time by providing a mechanism (communicating flood risk through an economic signal) for discouraging development in high-risk areas (long-run risk impact).

Overall, the contribution of insurance in flood risk management can be multi-dimensional in a sense that it can transfer risk, enhance risk awareness, contribute to the reduction of flood vulnerability in the short and long run and support the rebound of socio-economic systems and hence the resilience of coastal communities. Therefore, the role of insurance is of critical importance to the manager and to the society (Clark, 1998).

In schematic way flood insurance could be analysed by considering the Risk Triangle of Figure 6. As presented in this figure risk encompasses a combination of hazard, exposure and vulnerability and it is articulated as the area of the triangle, the sides of which represent hazard, vulnerability and exposure. In this framework if any one element (side of the triangle) increases/decreases, then the amount of risk will increase/decrease accordingly (Crichton, 2001).

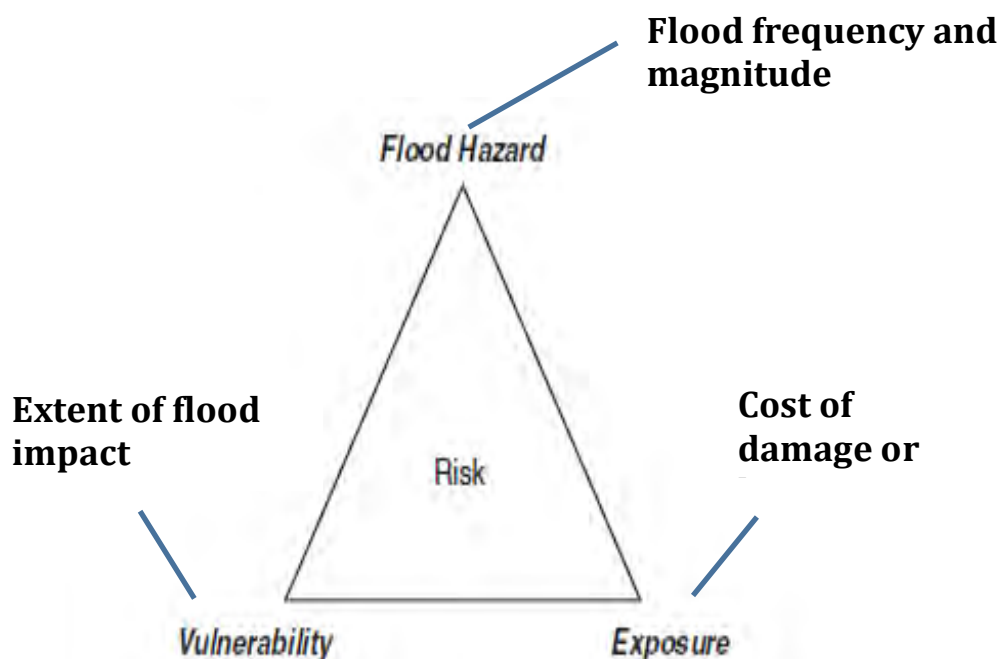


Figure 6: The risk triangle (Crichton and Mounsey, 1997)

Crichton and Mounsey (1997) offering this insurance industry perspective, argue that the hazard is the probable frequency and severity of the peril occurring in a particular geographical area, and thus relates to the natural process (flood) frequency and magnitude. As the authors emphasize, although hazard cannot directly be managed by insurers, it can be at a greater or less extent predicted and managed by sea defence activities. As vulnerability indicates the extent to which a given hazard would impact on a property by reason of its materials or its layout, it is regarded that insurance can impact on vulnerability by introducing a condition on coverage/policy condition (e.g., keeping valuable items above flood level, constructing flood proofed buildings). In addition, as vulnerability is related to location, insurers can invest on institutional attempts to restrict development in hazard



zones. The other dimension of risk, exposure from insurance perspective, is a function of the value of the asset/property at risk and the cost of its being damaged or lost. Hence, exposure is being translated in cost of damage or loss. As authors stress out exposure is modified by insurance excesses or removal of property to a safe location on receipt of a flood warning.

In an attempt to define the most important implementation guidelines for insurance as a vulnerability reduction measure from the above it can be concluded that it is important for insurance to provide the right incentives/disincentives to the residents of the coastal areas so as to change their behaviour in relation to risk.

Insurance arrangements for flood risk may require households to undertake measures that mitigate damage or stimulate households to undertake precautionary measures voluntarily (Kunreuther and Pauly, 2006). These mitigation measures may limit damage during floods and thus be complementary to traditional flood protection (Botzen et al., 2009). In particular by linking premium to mitigation measures and offering for example lower premiums for properties that take action to reduce their exposure to flood risk, e.g. flood-proofing vulnerability can be decreased. A range of construction measures can be used to reduce the flooding risk at a site related to flood avoidance, flood resistance, flood resilience and flood repairable (Communities and Local Government, 2007). These measures are deemed to reduce the occurrence, severity or impact of a natural peril. With regard to flood resilience it is assumed that although water may enter the house its impact is reduced (for example with the use of water-proof wall plaster) and no permanent damage is caused, structural integrity is maintained and drying and cleaning are facilitated. Another form of flood resilience is the concept of flood repairable according to which elements that are damaged by floodwater can be easily repaired or replaced. Financial benefits of considering alternative methods of repair following a flood to increase the resistance to further damage and reduce further cost have been acknowledged by the insurance industry and related guidance has been produced (ABI, 2003). On the other hand, 'resistance measures' are those that aim to prevent floodwater reaching the inside of properties (for example door-guards) and can contribute to £10,000 - 50,000 cost of avoided damage depending on the flood depth (Bowker, 2007). Hence, if insurance is related to flood-proofing and resilience measures that bring changes to the depth-damage relationship for the properties in which they are implemented (old properties or designed into new builds) the impact of a flood on property and possessions is reduced and consequently the repair costs and the time that the property is uninhabitable. Mitigation can play a critical role in reducing exposure to future floods, which translates into lower flood insurance premiums if rates reflect risk (Czajkowski et al., 2012).

Considering the individual level of response conditional on insurance coverage, it is interesting to look at the results of Botzen's et al. (2009) study. In particular, the authors by running a survey examine the willingness of homeowners in the Netherlands to undertake measures that mitigate flood damage in exchange for benefits on hypothetical flood insurance policies. The results indicate that many homeowners are willing to make investments in mitigation (e.g., water barriers) due to the premium discount on the flood insurance policy, while reductions in (absolute) flood risk due to mitigation are especially large under climate change.



As a result, insurance can offer the potential of an *ex ante* mitigation mechanism through policy condition or through encouraging measures, which are deemed to reduce the occurrence, severity or impact of a natural peril. As noted previously insurance can also influence in the long run the structure and development of economic activity on coastal areas prone to flooding. Daswon et al. (2011) argue that market and planning instruments such as insurance, impact on flood plain geography and development preferences and hence on land use. The authors note that significant increases in the cost of flood insurance result in property blight for buildings in the highest risk areas.

In this context insurance can increase risk awareness if premium is linked to risk. Treby et al. (2006) criticizing the reality of insurance market in UK, notes that if a clear link is established between flood risk and property value, this information might be used to raise awareness and be an incentive for home owners and property transfer professions to take actions to mitigate their flood risk.

Similarly, Filatova et al. (2011) argue that in order to decrease risk of flooding in coastal zones, an important option is to increase individual coastal flood risk awareness, since even if there is knowledge about the probability of disaster that does not imply awareness about consequences. In this context, risk awareness can be positively influenced by personal experience, risk communication, financial mechanisms and technical engineering solutions. Insurance against flooding as a financial mechanism may serve as a measure to communicate this risk and to persuade people to integrate it in their decision making by making its purchase compulsory in flood prone zones. In particular, housing markets in the countries where flood insurance is present (mandatory) reveal a decrease of prices due to insurance pressure on individual budgets. In that way, flood insurance conveys risk information to participants in the coastal housing market.

By linking coverage to mitigation actions or by even not entering an area to provide coverage insurance impact creates incentives so as buildings and infrastructure to become more flood proofing but also to people and business activity who will have now either to adapt to insurance's prerequisite for mitigation (if available) or to bear totally the risk of flooding in case that coverage is not offered. In the last scenario, it is more likely that less risk-averse households and firms will chose establishing in flood prone areas.

Market incentives, as Natsios (1991 cited in Treby et al., 2006, p.356) suggests, are possibly the most effective way of changing social behaviour. Thus, flood insurers could play a critical role in risk reduction and avoidance (mitigation) via the use of financial (dis) incentives:

- Lower deductibles, i.e. lower premiums for properties that take action to reduce their exposure to flood risk, e.g. flood proofing.
- Bonuses for non-claims.
- Premium pricing related to risk—placing the onus on the client to assess their reaction to the known risk as highlighted by premiums that are high or indeed lacking.
- Resilient re-insurement: i.e., reconstruction undertaken as a result of insurance pay-outs that aims to reduce the risk of future losses (Arnell, 2000).
- Compensation and re-housing in an area of lower flood risk. However, for this (and the previous) strategy to be adopted would require a degree of government intervention.



Overall, insurance can be seen as a catastrophe recovery (promoting socio-economic resilience), cost limitation and management tool (Clark, 1998) by sharing risk and lowering the burden on tax-supported disaster relief programs, influencing decisions to locate in the floodplain and by encouraging the use of measures to minimize damage (Doornkamp, 1995; Arnell, 2000).

Finally, it is also worth citing that insurance can further reduce susceptibility to flooding by encouraging communities to adopt a broad range of flood loss reduction strategies. Such a program is the Community Rating System or CRS² that is voluntary and designed to give flood insurance premium rate reductions as an incentive in communities that implement comprehensive flood damage reduction programs. In this framework the three main goals of the CRS are to reduce flood losses, facilitate accurate insurance rating, and promote the awareness of flood insurance, while the types of activities a community can get credit for include public information, mapping and regulatory, flood damage reduction (for example, retrofitting or acquisition and relocation) and flood preparedness (e.g., establishing a warning system or implementing levee maintenance).

GROUND TESTING OF INSURANCE

METHOD USED FOR GROUND TESTING

In order to explore how society perceives risk of coastal hazards and insurance schemes semi-structured interviews were run in different EU case study areas (Spain, France, UK, and Italy). The aims of these interviews were exploratory rather than focused on obtaining definitive responses and data for statistical analyses. Therefore, it was decided to focus on insurers rather than property owners.

It should be noted that the heterogeneity of input coming from field work in the study sites is due to the difficulty of having direct access to insurance companies to answer the questionnaire in a way to reveal useful information. In some cases insurance against flooding was not even available.

RESULTS OBTAINED FROM THE GROUND TESTING

Results from the UK

This revised version of the insurance scheme survey guide has been arranged so as to reflect the overall aim of this task, which is the design of efficient insurance programs and the identification of the necessary incentives for their adoption by property owners, that will encourage loss reduction measures against natural hazards and provide recovery funds to disaster victims. Note: FCERM = Flood and Coastal Erosion Risk Management.

The survey was divided into the following four core themes and ten meta-questions:

Core Theme 1: Details of the insurance company

Meta question 1: Which are the main characteristics of your insurance schemes related to coastal flooding and shoreline erosion (bundled/unbundled, voluntary or not, addressed to households/businesses/farms other groups, type of damages covered etc)?

² <http://www.fema.gov/business/nfip/crs.shtm>



Core theme 2: Resilience ideas and the contribution of insurance schemes: direct reflections from insurance companies on resilience

Meta-question 2: Do you think that the resilience concept is useful to the development of insurance schemes and have you used resilience ideas in your insurance policies?

Core theme 3: The processes and attributes of efficient insurance schemes that might facilitate resilience to coastal flooding and erosion

Meta-question 3: Are there examples of your policy creating incentives to property owners (households/businesses/farms) (in the case study area) to encourage loss reduction measures against natural hazards? How could your policy be improved towards that direction?

Meta-question 4: What would you say are the main drivers and barriers for property owners (households/businesses/farms) (in the case study area) in acquiring insurance coverage against flood and coastal erosion?

Meta-question 5: In your view do insurance rates reflect the local property owners' perceived flood and flood related erosion risk and how do you evaluate the social perception of the flood and erosion risk in your area?

Meta-question 6: Is your insurance scheme closely developed in conjunction with other adaptation strategies (in the case study area) and how does this approach impacts on the effectiveness of the scheme?

Meta-question 7: How is your policy effective (in the case study area) in assuring and providing recovery funds to disaster victims? How could it be improved towards that direction?

Meta-question 8: Can you think of any specific barriers or facilitations to obtaining best outcomes for FCERM through insurance schemes?

Core theme 4: Other aspects on insurance's resilience and efficiency

Meta-question 9: In your opinion how much of problem is uncertainty to insurance companies and how do you deal with it?

Meta-question 10: What are the main advantages and disadvantages of a system of coastal flood/shoreline erosion insurance and how have you attempted to avoid/minimize the disadvantages (e.g., creating winners & losers, encourage development in high prone flooding areas etc) of such a system?

The general context

It should be noted that the insurance industry in the UK is extremely well developed. There are three basic components to this industry, as follows:

1. A system of brokers who sell insurance cover on a commission basis but take no risk. A system of brokers is slowly emerging which is specialist in nature, and some of these



specialize in flood insurance in areas with a significant risk of flooding, judged on an annual basis. In 2010 56% of all insurance sold in the UK (household and other) was sold through brokers; for commercial business insurance 80% was sold via brokers and 31% of personal business is sold directly with insurers via the telephone or internet. The traditional value of brokers was that they were able to provide some advice about the type of insurance to purchase and who to purchase from. However, this role has changed and has been diluted in recent years. Within the UK there is a rise of 'comparison websites' (e.g. www.confused.com; <http://www.comparethemarket.com>; www.gocompare.com) whereby users provide details via the Internet and the websites provided a listed comparison of insurance policies and prices. These sites began by offering information about vehicle insurance, however a number of different financial services are now included. These websites are viewed as a new type of brokerage system and their use continues to rise. It has been suggested that in 2009, 10% of household insurance was purchased in this way in 2009 and that this figure will likely double by 2011³

2. Insurance companies, who take the risk themselves, and generally provide cover across a range of services, and are large companies. It is important to note that in most cases these insurance companies do not only take on risk in the UK, but are large European or global insurance companies which have exposures to different types of risks in a variety of countries.
3. Reinsurance companies, generally operating internationally, from whom insurance companies buy reinsurance to protect themselves against major claims which would otherwise threaten the viability of their company.

The whole of the sector is composed of private companies operating in the commercial marketplace. In general there is no state subsidy or protection for insurance companies in the UK, although there are many agreements and a degree of regulation that controls the marketplace.

ANSWERS TO THE 42 QUESTIONS

Meta question 1: Which are the main characteristics of your insurance scheme related to coastal flooding and shoreline erosion?

Q 1. This questionnaire is 'answered' from the perspective of a retail insurance company or such companies generally. By this we at FHRC mean a company such as Aviva, often in the past known as Norwich Union. In the UK there are six main providers of flood insurance, of which Aviva is one of the largest. They each would have several million customers across a range of different risks and within many countries. For instance Aviva has 53 million customers in 28 countries. Their history goes back many decades, if not hundreds of years.

Q2. The Aviva Company certainly offers coastal flood cover. They do not offer insurance against erosion at the coast, as this is not available from any insurance company in the UK. There is no doubt that Aviva would provide flood cover to small businesses and residential

³ Datamonitor (2011) UK Personal Insurance Distribution 2011 (cited in ABI 2011 above)



properties in the Plymouth case study area. Other insurance companies will also be competing for business in the area, with much of the competition based on price.

Q3. The insurance cover for flooding is provided as a part of general household and business insurance. No insurance is available for erosion. Flood insurance is bundled in composite insurance policies along with fire, theft and other natural perils. This is the traditional pattern of UK flood insurance, and indeed domestic and retail insurance in the UK, and has been the situation for many years. All companies offer the same types of policy. In general, therefore, competition is not based on the type and extent of policies, but on price and other characteristics (for example, sometimes insurance companies give discounts when households insure all their policies with one company, including car, household and holiday health insurance or the size of the insurance excess may vary and increase or decrease the price). Insurance of domestic and commercial properties is completely voluntary, except where properties are the subject of a mortgage, when mortgage companies will make the requirement of taking on customers that they are covered with an insurance policy for the building. This is so that they are able to protect the asset for which the mortgage loan is secured and that any losses would be recouped if the property were destroyed or damaged.

Q4. Insurance is available through Aviva and other companies for all the categories you specify in this question, although again I would point out that no cover is available for coastal erosion. Farms are not usually covered in the same way as domestic property, and more research would be needed on insurance cover for farms to provide a definitive answer here. No insurance policies appear to be provided to communities at a community level, as a cooperative scheme. In this respect it may be confusing that one of the major players in insurance in UK is indeed a co-operative, namely the Co-operative Insurance Society (CIS). But this does not mean they issue policies at a community level. There may be circumstances where people get together to buy insurance for a group of properties, but this is not typical and as far as I know is not encouraged by insurance companies. However, there is the potential that there would be grouped exposure. For instance in cases whereby a local authority or a housing association owns many properties in one area, there is the potential that these may be insured under a larger policy agreement and/or by the same insurer. This may mean that they have a large exposure of properties within the same geographical area and if a flood were to occur they would be disproportionately exposed to losses.

Q5. It is likely that the coverage of flood insurance in the case study area is not untypical of general insurance penetration levels for the UK as a whole. In this case penetration of insurance for the fabric of the building is generally in the range of 60 to 65%, with many of these being insured because mortgage companies require this. However the penetration of household contents insurance is at a lower level, typically 75%. In both cases relatively poor people have less flood insurance than those who are more affluent, so for example we know that in the lowest decile of the income distribution in UK only some 50% of households have contents insurance. Along with insurance penetration, another significant factor in the UK is the number of households who are considered to be at risk from being underinsured for contents that the ABI estimate could be as high as 1 in 5 properties. This will of course reduce



the amount of losses able to be recouped following a flooding event and the resilience of the householder.

Q6. Insurance cover against flooding in the UK typically covers damage to the building and its contents. Importantly, these are offered as separate policies (although purchases may be offered a significant discount if they purchase both policies with the same company). It is possible for businesses to purchase business continuity/disruption insurance, but this is unlikely to be the case with many small businesses. Again please note that insurance is not available for coastal erosion, nor for the intangible losses from flood events, including health damage.

Q7. All kinds of damage to the fabric of the building can be covered in insurance policies, and domestic policies generally will cover any damage that is experienced. The insurance of commercial properties can be more selective, so that a policy might include just stock, or just the building, or any other component of the business, as negotiated separately between the business owner and the insurance company. That is to say business insurance is more often tailor-made to the business concerned, whereas domestic policies are sold as a mass product. Again, no insurance is available against erosion losses.

Additional points: It should be pointed out here that insurance companies in the UK are private companies, most of which are listed on the stock exchange. Their purpose is to make profits for the shareholders, and in general insurance is highly profitable in the UK, although that does not necessarily apply to the flood component of that insurance. Whilst insurance companies seek to make profits on all the cover they provide (shipping; flood; business continuity; aviation; etc) they do not necessarily do this in any one year. There is cross subsidization within the industry, so that one bad year for flooding may be compensated by one good year for motor insurance. This is the nature of the private sector.

An additional point is also that insurance companies are regulated by the Financial Services Authority (FSA) and have the Association of British insurers (ABI) as their trade organization. Many agreements with government are between the Association and government, and the FSA will require that insurance companies have certain levels of capital reserves so as to be viable in the marketplace. The Aviva Company is no different from any other company in this respect. The only different organization in the UK is Lloyds, which has a completely different character to other insurance companies, being effectively a co-operative of small companies who take on all liabilities for the cover they provide (that is to say they are not limited liability companies). Some flood insurance is provided through Lloyds, but this may be a specialist form, and in any case this would be a very small part of the market.

The relationship between government and the Association of British Insurers is currently governed by what is called the Statement of Principles. This is an important agreement, documented, which obligates the insurance companies to continue to offer cover where they currently do so, in exchange for the government agreeing to continue to provide investment to reduce the probability and extent of flooding. This Statement is up for renewal in 2013, and the insurance industry has been adamant that the current arrangements should not continue.



This is because the Statement does not cover new entrants into the marketplace who can therefore compete unfairly – as it is seen – with the traditional companies. This is subject to intense political debate.

Meta-question 2: Do you think that the resilience concept is useful to the development of insurance schemes and have you used resilience ideas in your insurance policies?

Q8. By ‘resilience’ I understand you mean an arrangement that is robust when threatened, with vulnerability minimized. It is not clear whether you mean resilient insurance arrangements or resilient communities at the coast. Both are important. With respect to whether the concept of resilience is useful when designing insurance schemes, we would agree that it is useful. Why is this the case? We need insurance arrangements to be robust, or insurance companies will fail if there are multiple claims. We also want coastal communities to be resilient and robust, in the sense that we do not want them to be abandoned if flooded or threatened by the risk of flooding. We also do not want these communities to be destabilized by a flood event, or the threat of such an event. Therefore it is helpful to insurance arrangements if coastal communities can maximize their own resilience, by wise spatial planning and building regulations, and sensible evacuation plans for use in the event of a flood requiring emergency response. We would hope to see coastal communities and government use the full range of adaptation measures so that coastal areas liable to flooding are as resilient as possible, not least because we know that flood defense standards are finite and at sometime in the future may be exceeded. It is perhaps particularly important that those resilience measures that the community can itself take are encouraged so that these communities are not solely dependent upon the actions of the state to maximize their ability to cope with unforeseen flood events. Indeed, the private insurance sector wishes to see government continue to invest substantially in resistance and resilience measures, and have communities complement these with their own efforts. This is central to the Statement of Principles, whereby government has agreed to maintain its expenditure on flood risk management in return for insurance companies continuing to offer cover in areas of significant flood risk.

Q9. There are two challenges here. The first is to seek to encourage policy owners to continue their efforts to protect themselves against flooding, and not rely solely on insurance cover to compensate them for the losses that they will incur. There is a danger that insurance becomes an excuse for inaction. The second challenge is ensuring that insurance companies are sound and will not fail when circumstances lead to multiple claims across a wide range of policy owners. This is partly the responsibility of the FSA, but companies must be responsible in the prices they charge and the risks that they take. The fulcrum of this challenge is to ensure that the insurance industry is strong, able to pay compensation where it is demanded, with sufficient reserves to cover all eventualities. So far, in the UK, we have a proud record of strong insurance, resilient companies, and no failure to pay when claims are made. This is what we mean by resilience.



Q10. The development of insurance schemes uses the concept of resilience both implicitly and explicitly. It is, we hope, explicit that proper claims from policy owners will be fully covered. The track record of insurance industry in the UK supports this. It is also, we hope, implicit that policy owners should not fail to take the necessary actions themselves, in respect of threats that face them, thereby maximizing claims unnecessarily. Moral hazard is always a danger in any insurance scheme, and the resilience of that scheme is threatened if it multiplies. Just as we expect car owners to ensure that their cars are properly serviced and roadworthy, so we expect coastal communities at least try to make their properties as resilient as possible, if resistance is impossible. Indeed, we see insurance as a partnership between the insurance company and a property owner, rather than a one-way bet for the latter.

Meta-question 3: Are there examples of our policy creating incentives to property owners to encourage loss reduction measures against natural hazards? How could your policy be improved towards that direction?

Q14. Undoubtedly the main driver for households adopting insurance coverage is the fact that the vast majority (if not all) mortgage companies require householders to insure their property against most perils, and without mortgage finance most people in the UK cannot afford to buy domestic properties. This applies at the moment to 11.2 million households in the UK. This motivation transcends all others that you have cited. Please note, once again, that is not possible to insure properties in the UK against erosion at the coast.

The motivation of businesses and farms will be different, presumably related to business continuity and the protection of assets at risk. The principal motivation of businesses taking out insurance for business continuity is "getting back to business" as soon as possible after some disturbing event.

This is a difficult question to answer with a composite policy. I would argue that another strong motivation for the purchasing of insurance policies is for the other coverage is provided; i.e. Policyholders want to be compensated for losses that occur due to theft or fire. In most cases the risk of losses from these sources is motivating the purchase of the composite policy, much more than because flooding cover is also provided (even though in some high risk flood areas the chances of having losses from flooding are statistically higher than suffering from fire related losses).

Q15. Given the situation in the UK where the vast majority of domestic properties are insured against flooding, the main barrier to adopting insurance cover against flooding appears to be the affordability of that cover. That is to say the main group who do not take out insurance against flooding (or any other eventuality) are those on limited means at the bottom of the income hierarchy. It is unlikely, therefore, that lack of flood memory or risk awareness is an important consideration in choosing to buy or not to buy flood insurance. It is simply the fact that those who do not buy insurance cannot afford to do so.

There will be a smaller number of people who struggle to obtain insurance for flooding because of their high risk status or because they have been previously impacted. In these



situations, they are either asked to pay a large premium (in which the barrier would be affordability of that premium), they are asked to pay a large excess (therefore a barrier would be the affordability of making a claim) or they would purchase cover which would exclude the flood component of the insurance (therefore availability of flood insurance is an issue). In the latter case there may be issues with mortgage lenders if a property at risk is not fully insured against all perils.

Meta-question 5: In your view do insurance rates reflect the local property owners' perceived flood and flood related erosion risk and how do you evaluate the social perception of the flood and erosion risk in your area?

Q16. The most important factors affecting premiums is the value of the property at risk. The risk of flooding and other such considerations are becoming more important, but within a bundled policy it is not easy to determine exactly which factors are most important. So for example in areas of high crime, that will determine premiums. In areas where subsidence has been important in the past (largely areas underlain by clay soils in lowland England) that fact has been important, because claims in subsidence cases can be very large indeed. Additionally, the situation of the market is also very important in influencing the overall premium cost. This may impact in one way via the number of other companies offering equivalent cover and therefore potentially driving prices of the composite policy down but also a volatile or poorly performing stock market may also drive prices up as insurers and their shareholders struggle to make profits through the investment of their premiums. More broadly, the situation of the reinsurance market and the cost of reinsurance premiums may also affect the overall cost of insurance premiums (e.g. they may increase or decrease in line with the cost of reinsurance. Though reinsurance premiums are rarely impacted directly by UK floods as usually the insurers absorb the losses without the need to cede to their reinsurance policies. Q17. This is an almost impossible question to answer. Research in other areas suggest that risk perception in areas of frequent flooding is high, but areas such as those protected by the Thames Barrier have a level of awareness of flooding which is low (and appropriately so). Please note, that the average insurance company would not have any information on public perception of risk.

Q18 It is generally the case in the UK that insurance rates reflect flood risk rather poorly, if at all. This is because so many insurance policies are sold that it would be an economic for insurance companies to have precise information about risk when setting premium levels. Such levels are set on an aggregate basis, for whole postcodes or other community designations. Again, premiums are set in conversations between householders and insurance companies, via telephone call centres where relatively untrained people set rates on a formulaic basis. This may appear to be an irrational process, but the costs of "hand stitching" insurance rates to small-scale variations in risk would make that operation uneconomic.

Q19. The simple answer this question is "no". We design our insurance policies so that the insurance company make profits for shareholders, and the public is generally satisfied with the services we provide. Obviously this means that those who are aware of risk and can afford



to do so, take out insurance cover. But we do not design policies with any psychological factors in mind, except I suppose we do design our policies such that those at risk are motivated to take out our cover.

Q20. It is not clear what this question means, and the average member of an insurance company simply could not understand it or answer it.

Meta-question 6: Is your insurance scheme closely developed in conjunction with other adaptation strategies and how does this approach impacts on the effectiveness of the scheme?

Q21. Here you should see the answer the question 18. It is simply not possible to devise insurance arrangements which are profitable which require this level of detail, except when providing cover for large businesses, where the procedure would be to conduct quite detailed site investigations and negotiate the terms and conditions of any cover with the owner or occupier of the site concerned. Insurance companies will take into consideration other adaptation mechanism (such as structural defences, spatial planning etc) but only in a very indirect way in terms of how they influence the risk of an area. Usually this will only be measured at the level of the postcode, whereby all properties within a postcode area being given the same level of risk. Indeed the last catastrophe in the UK to have an upward impact on insurance premiums were windstorms in Early 1990

Q22. It is not clear what is meant by this question. The effectiveness of an insurance scheme is only very indirectly related to adaptation strategies, insofar as they reduce claims. But this is not part of the design process for insurance arrangements, and it is not clear what you mean by conflicts of interests or win-win situations.

Meta-question 7: How is your policy efficient in assuring and providing recovery funds to disaster victims? How could it be improved towards that direction?

Q23. The insurance industry has a long record of cooperating with government, at all levels, in the cases of coastal flooding. There is no insurance for erosion in the UK.

Q24 Most UK insurance companies will take out reinsurance to cover natural perils. However the incidence of claims for flooding against reinsurance policies is virtually nil in the UK, only a very small proportion of losses in the Summer 2007 floods were passed on to the reinsurersvii. No flood has been of a sufficient size to warrant large reinsurance claims, but the possibility of a major catastrophe cannot be ruled out and this is why insurance companies buy reinsurance. We do not know of any case of the use of catastrophe bonds in the UK flooding insurance market.

Q25. It is not clear that improvement is needed here. All claims for flood insurance have been met in full, where they are warranted, in the past and the reputation of the insurance industry is very high in this respect. Improvement here would only be necessary if there were serious shortcomings in existing provision and the public acceptability of the conditions applied to their policies.



Q26. No. Insurance is provided by private companies, who generally seek the minimum of government interference.

Q27. Considerable effort has been expended in the last decade to ensure that claims are met speedily and with the minimum of disagreement. Obviously the situation is never perfect in the aftermath of the major flood, but insurance companies have brought in loss adjusters from abroad on occasions, to meet the need of rapid settlement of claims, which is an important marketing mechanism (i.e. reputation). This situation has been helped by the learning experiences we have had in major floods in the past, including 1998, 2000, 2003 and 2007. Insurance companies have polished their procedures considerably, in order to maintain reputation. In the past this has caused issues with the delaying of repairs when many properties were flooded and policyholders having to wait for builders to become available; this has improved in more recent years. Insurance companies are frequently unfairly blamed for the long times some policyholders have to spend away from their homes after flooding, however this is often due to the need to wait for the property to dry out rather than due to disputes over claims. In the past there were issues with insurance companies only permitting works to be undertaken by their designated and approved trades' people.

Meta-question 8: Can you think of any specific barriers or facilitations to obtaining best outcomes for FCERM through insurance schemes?

Q28. Insurance companies would now say that the main difficulty in currently designing efficient and effective flooding insurance schemes is the attitude of government towards the Statement of Principles. To some extent this is a smokescreen, but this is what they would say. They are quite happy with the current level of data on climate change, have developed/purchased some quite sophisticated risk models and are used to dealing with uncertainty (indeed without uncertainty, there would be no insurance). The main difficulty concerning the Statement of Principles is that there has been long-standing cross-subsidisation between those at low risk in favour of those at high risk. This cross-subsidisation is unwinding as information on risk gets more precise, but the Statement of Principles does not allow insurance companies to refuse cover to existing customers. Insurance companies would say that they do not have any significant difficulties in designing efficient and effective flooding insurance schemes, which they have been doing for many decades.

Q29. Probably the only situation in practice (as opposed to the formal situation in the Statement of Principles) where insurance companies currently refuse to provide insurance is domestic properties built in flood risk areas since 2009. Insurance companies are not obligated to take on new customers, so one way of "refusing" cover is to set the premium so high (or with such a large deductible) that the customer cannot afford that insurance, and probably looks elsewhere (to other companies).

Q30. It is not really clear what this question means. If it means how can we improve flood and coastal erosion risk management with the use of insurance, then one way forward would be to increase the penetration of insurance to nearer 100%. There must be considerable numbers of people of modest means living at the coast who are not insured, or are radically



under-insured, and this could well be a burden on the state if there is a major coastal flooding event causing catastrophic damage.

Q31. The most likely change in insurance policy in the future is as a result of a recasting of the Statement of Principles. The direction of change is towards more risk based pricing of insurance cover, and as data on risk improves the insurance companies can have greater faith that their policies and terms and conditions are appropriate for the risks that they cover. The exact timeframe for these changes cannot easily be specified; the change is likely to take place after 2013, when the current Statement of Principles is due to be terminated. The move towards risk-based pricing is a slow one, but considerable changes are likely over the next decade.

Meta-question 9: In your opinion how much of problem is uncertainty to designing efficient insurance schemes and how do you deal with it?

Q32 There is considerable uncertainty about the extent and frequency of flooding. However, the situation is much better than it was 10 years ago, and usually better than 10 years previously. Nevertheless, it must be recognised that without uncertainty there would be no insurance; if everyone knew precisely the risk that they faced, they would probably not choose to take out flood insurance cover, and instead at least partly self-insure. In terms of how this uncertainty affects insurance services, they have always lived with uncertainty and written cover such that companies are likely to be profitable whatever the circumstances. Therefore, in one sense, uncertainty is not a problem. Insurance companies are dealing with risk all the time, and uncertainty over risk is part of what they have dealt with for decades if not centuries.

Q33. Insurance companies deal with this uncertainty by ensuring that the number of policies they write is large, so that risk and uncertainty is spread over a large pool of income and claims. This is part of the stock-in-trade of insurance. The purchase of reinsurance also limits the very large losses.

Q34. They use the Environment Agency maps of flood risk, and also do extensive modelling of flood risk in aggregate, so as to ensure that their total portfolio of policies is not at risk. Catastrophe modelling is part of this exercise. Insurance companies are less concerned with risk at a particular location than with total risks overall, because it is these that threatened the nature of their business and its commercial viability. So, for example, in the Plymouth study area insurance companies will not necessarily look in detail at flood risk in individual locations/properties, but more look at the general pattern of flood risk overall. Nevertheless insurance companies have postcode information on flood risk for the whole of the UK, and that applies to Plymouth as well as anywhere else. For large commercial properties insurance companies would do site surveys to determine risk more accurately, because the potential for inaccurate estimation of risk is more dangerous with large commercial properties.

Q36. See above.



Q37. The simple answer is "no". Insurance in the UK is a commercial operation, and community participation is through the market and the choices people make. Insurance companies do not particularly encourage public participation in the development of their policies, not least because much information is commercially sensitive and should not be revealed to third parties.

Q38. Again the simple answer is "no". Insurance companies generally do not have policies for particular vulnerable groups, again because insurance in the UK is a commercial operation. There was at one point "pay-with-rent" schemes which permitted low income households to obtain insurance as part of their rental agreements and usually applied to those wanting content insurance and who resided in social housing. But I don't think that these are still available.

Q39. This time the answer is emphatically "no". Insurance companies would say it is the role of government to finance protection measures in flood risk areas, and not the role of commercial private insurance companies.

Meta-question 10: What are the main advantages and disadvantages of a system of coastal flood/shoreline erosion insurance and how have you attempted to avoid/minimize the disadvantages (e.g., creating winners & losers, encourage development in high prone flooding areas) of such a system?

Q40. From a societal perspective, a system of coastal flood insurance has the advantage that those who could be afflicted by flooding are compensated for the damage that they incur and are probably able to recover more rapidly than otherwise would be the case. From an insurance company perspective a system of flood insurance at the coast builds on the system available nationally and makes it comprehensive. Obviously insurance companies make profits from the policies that they sell at the coast, and given that the incidence of coastal flooding in UK is extremely low (the last serious event was in 1990, at Towyn, in North Wales) the implication is that this area of cover is distinctly profitable. Please note again that no insurance cover is available against erosion at the coast.

Q41. Insurance itself does not create winners and losers, except in so far as some people choose to insure and others do not. Therefore the winners and losers are created not by the insurance companies but by people making choices in the marketplace. Whether the presence of insurance at the coast encourages development in high risk areas is not clear, but such development will bring societal gains from the use of valuable areas. Society should not discourage people from developing in flood risk areas; it should ensure that appropriate measures are in place to protect them from floods were they to occur. Therefore it is not clear that there are un-ambiguous disadvantages of insurance at the coast, at least at the level of society. Individuals, of course, may pay for flood insurance throughout their lives and never claim, but this is a choice that they make and is not one imposed upon them.

Q42. Not applicable (see the answer to question 41, above).



Results from Santander

It should be noted that in the case of the Santander study site, there is an Insurance Ministry that has the following features:

Function and Objective

It is the Consorcio's commitment to satisfy the indemnities deriving from extraordinary risks to those Insured persons who, having paid the corresponding surcharges, do not have cover for the extraordinary risk in question in the insurance policy contracted with a company in the market or, having contracted such cover, find that the insurance company cannot meet its indemnification obligations because it is bankrupt, in administration or is in liquidation.

The Consorcio's objective is to indemnify, by way of compensation, and in the cases mentioned above, those losses deriving from extraordinary events that take place in Spain and affect risks therein located. In the event of extraordinary risks that occur abroad, the Consorcio will compensate personal damage if the policy holder is resident in Spain.

Indemnifiable losses: Direct damage and loss of profits

For the purposes of the Consorcio cover, losses will be considered to be direct damage to persons and property, as well as the loss of profits when these are the result of said damages to property and represent an alteration of the normal results of the economic activity of the insured party and derive from the stoppage, suspension, or reduction of productive processes or the business of said activity.

Risks covered

It is characteristic of the Spanish system to define the catastrophic risks that are covered in consideration of the enormous loss potential that could be generated, but without conditioning the protection if there are occurrences that affect a great number of insured people or a wide expanse of territory, nor in the case of substantial damages that could lead to the event as being described as "catastrophic". It is possible that the event might only affect a sole insured party, who would have full rights to being indemnified but which, on the other hand, would not require the public authorities to issue an official declaration that there has been a "catastrophe" or that there is a "catastrophic area". The cover is automatic once one of the covered events has occurred, these being as follows:

Natural phenomena: Extraordinary floods, earthquake, seaquake, volcanic eruption, atypical cyclonic storms and the falling of astronomic (sidereal) bodies or meteorites.

The risk that causes most damage in Spain is flood and, for the purposes of the cover this is understood to be the flooding of ground as a result of rainfall or thawing snow; from water emanating from lakes with a natural outlet, from estuaries or rivers or natural surface water courses when these break their normal channels. Likewise, the cover includes the battering of coastal waters, even if there is no flooding. However, not included in this concept of flooding are the results of rainfall falling directly on the insured risk, or that collected by its roof or roof



terrace, its drainage network or its patios, and neither is that flooding which is occasioned by the breakage of dams, canals, sewerage systems, water collectors or other artificial subterranean water courses, unless such breakage has come about as a direct consequence of an extraordinary event covered by the Consorcio. The cover for atypical cyclonic storm includes, amongst others, tornadoes and extraordinary winds (gusts exceeding 120 Km/hr.), in accordance with the Extraordinary Risks Insurance Regulations.

- a. Those occasioned violently
- b. As a consequence of terrorism, rebellion, sedition, riot and popular uprising.
- c. Deeds of or actions by the Armed Forces or the Security Forces in times of peace.

In Santander study site, the following responses related to insurance during face to face interviews with different stakeholders were obtained:

Quote 1

The beaches have certain slope, and the water rises and falls as much as 50m. As far as I know there is no insurance device. Here it has always rained so much... I do not see any trauma to society, and also professionally. Have there been changes in the architectural design? Not really.

Maybe there are more storms and the strongest "Gale" was about 10 years ago. It entered on December the 28th with winds up to 178km/h destroying trees... or the famous Chiqui Restaurant wave five years ago, but they are very specific things.

Quote 2

It appears that there is no insurance plan. Always, the civil subsidiary responsible is the administration, ha, ha, ha ... in case that you've done some kind of action. If you have not done anything you will get nothing.

Quote 3

I am not sure if there is an insurance plan. The emissaries are insured. If you consult emissaries experts they will inform you properly. The Insurance companies often cover risks during construction for cover. I don't know how it works exactly.

Here in the in north of Spain there are emergency funds to resolve the problem immediately. We have "Confederaciones Hidrográficas" (administrative agencies) and one of their functions is to develop land use planning both in rivers and in the coast, in order to deal with flooding, erosion and when an emergency emerges state funds are earmarked for this purpose and the rest is made under this plan. This is how this works here.

Quote 4



I think that there are no insurance mechanisms. I don't think so, neither flood insurance for Somo dwellings. This damage will occur in specific cases and would be "catastrophic risk". In this case is the consortium who responds, not even the insurance companies are involved.

As far as I know there is no evacuation plan. There is a study that we are doing. We are trying to hire a University Department to determine measures to be considered, protocols in cases of floods that come from water in Cantabria. The Coastal Department is conducting a similar one for all Spain for heavy storms effects.

Quote 5

If there are more extreme events, this will force the construction of new facilities. We store things and that means preserve. We store agrifood products, fertilizers and alloy linings. That means we should have better maintained facilities (if possible) to minimize the risk of loss. Presumably insurance cost will be much higher and with more exclusions. Now the dialogue with the insurance companies is ... what we have noticed is that in recent years we are having more damages and almost all "consorciables" (covered by the consortium), exceeding certain threshold levels, which have been revised upwards now because we have more events, bigger and with a franchise of 7% in the best case. As the financial situation deteriorates worldwide, excuses for not paying claims are becoming more and more unexpected.

We had a case that ... we preferred to get along with the company than to get into a dispute, where you have to wait for the High Court Tribunal 7-8 years. My client will not wait 7-8 years for me to pay or, if he does, he will start working with another, which you have to get the money coming out of nowhere ... and ¿how it will affect? As I understand insurance will be more expensive, will have more exclusions on grounds of force majeure and that will force us to be more diligent and go with concepts of self-insurance, go with 10,000 eyes (increase prevention and being cautious) and ...insurance is something you have to hire legally but you'd better not count on them. Some companies will not be able to respond to the customer, we have a case with Yara, 48% of the world's market quota in fertilizer suppliers, we have worked with them for 17 years now and we are their exclusive supplier and other port services. We have had an accident and the client has become very hard. The company and the consortium have been stalling things, this has led to a situation in which I had to give 100.000 euros. The company and the consortium offered me a deal, with that pact I met 80% of the requirements of my client, missing cover 100,000 euros. I tried to convince, claim in the tribunals, this was nonsense, the technical criterions offered did not hold against logic, there is not a single argument that supports the underinsurance we are being applied ... "for how long?" I don't know ... 2 years. But if they use a lot of legal tricks, I will not be here two years waiting to see if you're right. At the end either you have a lawsuit and you lose the client, or the client is preserved who is who will give me business opportunities and someday we will be even and we will win money... The insurance company is conscious of my situation; they know that you are sensitive to delay... I put this paper aside and it will be improved over alone... The customer concept is relative in insurance companies by the very nature of the business. Unless you have a really large size it allows you to dilute the ratio of premiums paid and



claims. In one of these big claims we put a shock to the insurance company that will not to recover in life. Think of 700,000 euros in a bad afternoon, with a well-maintained warehouse ... This is very complicated and certainly this will change because the risk ratio will go up tremendously. What we have done with this client is to pay but we said that we could not take a franchise again. You are operating in Spain where the law says that insurance covers 97% and that's part of conditions, on the insurance exigencies. A problem of service prevents me of taking the franchise. My service is to unload the boat, I store it, I transport it to the consumption area and for all that I charge 25euros per tonne depending on the destination. The fertilizer has a value per tonne between 400 and 700 euros, so the value of your product, 7% of the franchise in the price would be the same as for everything else, the only possibility is to find a product in the insurance market that covers it ... and I know that, I can not afford that risk and they were convinced that this existed but not really. I have not found changes in the insurance business, and at the end, if you have a huge loss they are scrambling you for not paying and then you are invited to eat. I have not found huge differences between companies.

In the port area we have constant information updates. The information comes from the services coordination centre of the port authority; this affects the time of arrival of the ships, unloading or not depends on the type of product it is, but this changes little ... My accident was in that store over there, what I can do? Close? It is closed, Maintenance? If I do that, I can not think what I can do to minimize risks ... Life is a risk.

Quote 6

The issue of insurance against what you can do, apart from what may come from a wave or a hurricane that are excluded from coverage and will be refunded by the Consortium. But below that there are insurance products that I know ... It should be distinguished, (the insurance world is infinite), the damage to the environment derived from your activity itself. Since the creation of the Environmental Insurance Agent risk, products that include environmental specific damage following the 2007 law on environmental protection are being offered for the repair and restoration of environmental damage. I know of no example here in Cantabria ... it is very complex; it is not developed as it should. After April this year it should be mandatory to have the insurance but the ministry and insurance agents do not agree on how to measure and monetize that risk. Committees are being created, industry documents are created by agents the MIRAT etc ... but the truth is that it is not being demanded. When the public administration requires it everyone does it in order to avoid penalties. When it is in the law but it has not direct consequences, then no one does anything.

There was a discharge of ammonia but that goes more in criminal and criminal is not covered by insurance. Then companies I know have very large insurance but it has not been materialized in harm. I don't know how we haven't had a lot of dead fish or water with a huge pH.



The activity that filled the bay at the time was not only legal, but promoted by the State. Years ago, when filling a marsh you were promoted Marquis and now you are put in jail for a small pool cover. This is the Spanish model of all or nothing.

Quote 7

At the municipal level there is no insurance system, all people have home insurance. In theory flooding for a specific cause, a jam, yes, but not for natural disasters, no insurance covers. So ... I think of that, but at the level of what I managed in the municipality, there can be sized to exceptional reasons. It does not compensate financially or environmentally because investments would be so great ... In relation to the interaction in the bay, I think we are 7 municipalities. This worked very well in the past, the conservation partnership RIA make a campaign in town to see the problems and hence the port is present, we have presence, all users are represented and each municipality, in shipyards and camargo they have problems of industrial discharges at the time and well, this estuary conservation and associated ecosystems are subject to a mix of concern. This is something that has to be kept, and used.

About the bay right now everything is affected by the public domain and you cannot do anything. The Central Ministry is considering areas to recover not consolidated areas. There's an interesting study of the Santander Bay as it was before. Now, all institutions, governments, businesses, industries, neighbours and municipalities they are understanding that is important to retain a value beyond the climate change, that the life of all that surrounds the bay is related to the bay and you cannot keep on loading (with human activity). Actually, at management level this is very complex. This depends on the Ministry of Environment, confederations (if you have a river), municipalities, port authorities (that depends on the central government), the Environmental Council that is autonomous ... Then it becomes too complicated to manage.

Quote 8

Insurance companies have everything to do, because there is a law of corporate environmental responsibility... The companies are required to be insured against potential contaminants, then individuals have their insurance for private goods.... the concept of extraordinary or exceptional needs to be replaced, the statistical exceptionality varies from year to year and when companies will be taking responsibility and the consortium will face many more payments, the citizen start to see the wolf's ears (i.e. the real problems they face) begin to see the risk and begin to ensure their property and they are unsure about what risks are relevant. But they know that this happens more and more frequently in meteorological phenomena, and perhaps they do not relate this to climate change but the insurance increases. The Insurance companies have not yet internalized the risks variation over time and as the consortium compensation insurance will have to keep in mind that each time will face more charges. We can say this... public goods are not insured and neither a formal recovery plan. The recent floods have shown the intention to alleviate the effects. But what happens? The development office repairs roads, ports, harbours and we the water supply and sanitation



... there is a protocol for ex-post, about the one for the ex-ante. Civil protection has a coordination protocol of all the authorities and has the ability to predict an exceptional event.

Let's see what is related to weather events. There is a protocol: AEMET, where the Spanish Meteorological Agency passes daily information for 72h forecasts to the Civil Protection Directorate. PC is responsible for notifying the state forces, national police and fire-fighters and gives information through the media to society in general.

Quote 9

I imagine that insurers do not cover risks in one area unless you pay a good fee. I do not think so. What happens? That is than regional governments more than the insurance who reacts. Right now there is a controversy because the affected claim to the regional government. For that you have to declare the area as catastrophic. Then it is possible to compensate, but it has not yet been declared a disaster area ... That is what we are working for: if there is a catastrophe everything is already planned and if there is an important flooding you should never have a house there. When there is a consolidated urban plan some aid could serve too, anyhow.

Quote 10

I am not aware that insurance companies have a product. We know that in other countries where there is construction in high-risk areas it is controlled through insurance and loaded into their accounts. But people in Spain claim to have the right to have their house anywhere. In relation to the insurance, I do not think there is a big difference between having the house here or having it there.

Results from Gironde

In the Gironde study site, the following responses related to insurance during face to face interviews with different stakeholders were obtained:

[ACADEMIC]

- I have no idea for the businesses' insurance but some questions related to individuals' insurance has emerged especially during the storm "Xynthia"; It seems that only when the event occurs that questions arises.

- Insurance regulations seem not to be sufficiently clear for individuals.

[risk manager]

- The risk prevention group "Groupe de Prévention des Risques" maintains close contacts with insurance and reinsurance companies. As we deal with the risk issues (how to manage the regulatory and the technical aspects on the territory), we are involved to intervene, amongst other things, through our risk club which is primarily opened to the state (government) institutions: for example,



we explain the prevention policies, the “Barnier fund”, the compensations questions and the PPRI constraints. If some people are not covered by insurance, public institutions, which are focused on the risk studies, have some relationship with them.

- The risk prevention group maintains close contacts with insurance companies.

-people should ask public risk studies institutions to evolve their own knowledge about risk insurance.

[risk manager]

- The insurance companies have their own knowledge and approaches; they are especially interested for a risk mapping to identify risk at the territory level. Besides, insurance companies work tightly with the Risk Prevention Group minister estimate the population at the flood risk areas ...etc. Those actions might increase knowledge at a national scale while the insurance companies are pooling risks (cooperative management of risks) if the event occurs.

[risk manager]

For instance, i have been damaged personally during “Xynthia” storm and the MAIF (insurance company), located at Grenoble (i.e: not at the Gironde region) takes charge on my file. Then, when the event occurs, the insurance companies have their own cooperative management (pooling of resources) even we did not some similar actions with our “risk club” much more dedicated to the government institutions. It is, thus, an interesting action to be implementing the pooling (cooperatvie management), to share some kind of tools and knowledge as the state disengagement is increasingly important towards collectivities and local stakeholders.

[risk manager]

The insurance role, at the local level, seems to be relatively marginal. As there is no one main axe for the actions to implement, the challenge is to drive the whole stakeholders to focus in only one direction which is the estuary one.

[administrator]

-are there any insurance system?

We are still facing the dilemma of insurance system need on one hand and the opposite effect of insurance system to empower people on the other hand (any way, personally, I am covered by insurance company). People have not understood yet that insurance compensations source is simply the whole membership contribution for the insurance company. Finally, is the collectivity who pay at last.

[harbor administrator]

It is necessary in our approach to fix a threshold as, widely; we will have a risk control at a first part level where we could use land and spaces without risk damages AND a second part where we will set up a special insurance regulations which are not supportable by all the population as the risk by



definition is focused only on a small fraction of population. The rest of the population could, then, be involved through the solidarity process for this small fraction to reach equilibrium.

[harbor administrator]

-Is there any insurance example at the port?

The port is like any company, and all companies are covered contrarily of particulars.

We have a dredger, we own some nautical engines and we hold risk insurance for nautical engines as we hold risk insurance for our cars. We hold insurance also for our buildings and materials: gantry cranes ...etc. It is like any insurance, we select insurance depending of the cost to decide if we hold or not insurance.

[harbor administrator]

At the present time, we have no insurance for operational breakdown failure. We are not covered by insurance if, somehow, an accident makes us not able to continue functioning and generate incomes. The reason is that the insurance cost for any breakdown failure is too prohibitive. There is no secret, as the current risks are huge, the premiums are, thus, consequently high. Basically, the insurer prefers to cover low risk events. Nevertheless, when the risk is higher, the premium increases consequently and not necessarily in a proportional manner. That is what happens at the port scale and, I think, at all companies and others activities.

[harbor administrator]

The TV reporting on the Tsunami catastrophe shown no kind of assurance is provided for people. The reliefs (state aid) are provided to industry for the economical recovery rather than for the people. Besides, state aid are made for economical recovery and not for people.

[Flood Risk Planner]

The insurance companies' role become increasingly important. They aware their insurance holders (memberships) to how to act if a flooding event occurs (I have got from my company a brochure with precautions to face the risk occurrence);

[Flood Risk Planner]

After Xynthia, i have a hundred of communes with almost similar damages (not a big gap between the flood consequences in those hundred communes). At those communes concerned by the flood damages, and except that we act by expropriation procedure in one commune located at a most risk area, we own no quantitative balance of the money accounts resulting to the event. We hold only some balances, the collectivity cost, but not the costs of the associated storms for example. Also, we are not informed about a big part of the balances, the costs of dykes' reparation and also about what insurances companies have paid (compensated).

- There is no share of the available knowledge according to the compensation accounts balance resulting of the flood event.



[Flood Risk Planner]

- In a certain way, people mostly estimate the risk. Even they would like to protect themselves they are not aware about the territory vulnerability. For many of them, they had no past experience with the risk. Also, there is some optimism in regard of the flood event “that already happens”. For some elected mayors, the flood is a constraint. There is a gap between the flood perception as a constraint and some false sense of security that could result by holding a good insurance “full insurance”.
- The insurance as a tool for the flood risk management could affect the awareness of people who can own a very good insurance.

[Flood Risk planner]

Even there are funds of compensation at the insurance companies’ level; a damaged company will not be served well. Currently, the insurance system, named Cat Nat (catastrophes naturelles), calculate the direct damages but not the indirect ones. At the present time, particularly, the population is much more vulnerable to face the flood of 1900 at Bordeaux or 1910 at Paris: at the past it was sufficient to re paint the walls after the flood, there was only 3 clothing boxes damaged and the people was not affected by the flood. BUT, at the present time, the damages are huge, electricity and many other things. We are much more vulnerable because of our current kind of life. We are developed because the cities are increasingly greater in the entire globe.

- The insurance system based in quantitative approach to calculate only the direct damages of the flood event could not always help for recovery for the businesses affected.
- The current vulnerability, resulting of the huge damages of the flood impact, is due to the huge value and goods existing at the coastal areas (financial vulnerability is due to a social kind of life).

[Director of NGO]

We should not live in a risky area; in that case, the insurance companies are expansive or will not agree to cover you. Mostly they will refuse to cover you. The insurance companies look at the zoning of the territory map... this is a large source of revenue for insurance company.

- The insurance company prefers, for their own interests, to cover people located at low risk area.
- People should not urbanize the most risk areas.

[Director of NGO]

To recover from the flood, the mayors should implement actions to help the populations impacted by the event. For example, in the Charente, during Xynthia storm, temporary roofs have been provided but also people have been relocated. I do not know if they were helped to find their goods, or helped financially. To recover from the trauma, the psychological aid is more critical than the financial or material help. In addition, the psychological help is undoubtedly cheaper than the financial one. The psychological monitoring must be taken into account easily. An immediate aid is provided while i am not sure that will be continued in a long term.



[Risk Manager]

If you are located at risk area where there is no PPRI (predictable flooding risk prevention plans) and you are flooded 4 or 5 times, the principle is that insurance companies could apply a weighty extra premium for those flood risk areas. We have faced this recently, where one house has been flooded 4 or 5 times and there were no PPRI at this area level. The insurance company could apply a weighty extra premium and that is the regulation. What is the goal of this regulation for the legislator? if you no PPRI is made, you will pay too much. Contrarily, if you PPRI are made, your house will not be destroyed and we will just ask you to avoid some misbehaves and to do some precautions. Nevertheless, you are covered by insurance and you will not be submitted to an weighty extra premium if flooded: it is the win-win principle.

[Environmental planner]

Insurance arrangements exist for the agricultural farming but not for the forest; there is no insurance arrangement for the forest. Even the foresters have claimed for an insurance law dedicated to the forest till to get the law of agricultural modernization in 2010, they are still absolutely not satisfied. Therefore, the foresters' insurance purchase will be too low as the insurance premium is too high but also because the insurance companies would not like to cover high risk areas. In regard of the forest insurance regulations, the process has begun, but we did not get too many results (achievements).

- The exploiters of the forest are not satisfied about the insurance arrangement of the law of 2012 (high premiums) and the situation seems to be jammed at this scale.

[Rural Planner]

People have 3 solutions: stay here, to displace to another place or build in illegal way in regard of the current regulations.

- People living at PPRI areas are constraint by the PPRI: they cannot build new houses or extend their present houses. Therefore, they have 3 solutions: accept those regulations and keep living here, to displace to another place with less constraint or to build against the PPRI regulations. In the last case, the insurance companies will not accept to cover them as they built in illegality in regard of PPRI regulations.

Results from Cesenatico

Before presenting the results it should be noted that insurance against flooding is not available in Cesenatico. Data are derived from a survey that aimed to explore risk perception and risk preparedness related to coastal flooding and erosion in Cesenatico, Italy. A five pages questionnaire was distributed in Cesenatico during March 2011, and requested 15 minutes for being completed. The majority of participants were recruited in the Porto Canale area with direct contact in the streets, on the seaside, or in the shops according to the methodological features of "intercept interviews". In most cases the questionnaire has been self – compiled (N=159), while in some cases the compilation has been done toward interview transcription with the permission of participants (N=32). A ticket for the coach has been released as gift for the collaboration to the research.



Respondents were all citizens of Cesenatico: 191 questionnaires were collected, 58.6% of the sample were males, whereas mean age was 39.3(SD=14.1). The 25.1% of the participants had a medium school diploma, the 62% an high school diploma and only a minority of 12,8% a degree. The 31.4% of the sample was owner of commercial activity near the seaside, while a 45,5% worked in those kind of activities. A large 44.8% was composed of residents near the seaside.

Respondents reported that they did not feel adequately informed about flooding risk in Cesenatico. Furthermore, participants did not feel adequately prepared to cope with flood risk in Cesenatico. However, despite the quite low perceived risk preparedness, respondents reported that they felt more able to protect themselves and their family during hypothetical flood in Cesenatico. About one out of three participants reported that they did not know evacuation routes in case of a flood. Alert warning system by mobile phone (SMS) was known only by a small minority of citizens (18%); however it were rated useful by most of the participants.

Risk perception of coastal erosion scores were above the midpoint. Therefore, participants felt that this risk was significant. Moreover, the risk involving coastal erosion is perceived to be very long lasting, since most participants reported that it will affect future generations. Coastal erosion risk is perceived as a risk with visible and severe consequences, relatively controllable and dreadful, and an old and known risk. Citizens feel that to be moderately exposed to this risk and the fell moderately knowledgeable on that risk.

Participants reported that the main risks related to coastal erosion was damage to tourism and beach recreations (29%), damage to ecosystem (28%), flooding in the city center (23%), and salt water ingress in ground water (15%). Sand nourishment was the most perceived effective coastal defense, followed by transversal barriers, and submerged breakwaters. Harbor gates (in Cesenatico Vincian gates) were not perceived as an effective coastal defence. Participants also perceived some benefits of coastal erosion, more specifically: new coastal defences (23%) and change in natural environment (15%).

In that section of the questionnaire that aimed to reveal respondents' preferences for different strategies in order to manage in the future coastal erosion and flooding, respondents were given the chance to express their degree of agreement regarding three different strategies (insurance, restrictive land use planning, retreat from coastline) in a 5 point likert scale, ranging from 'I completely disagree' to 'I completely agree'.

Insurance Question: How much do you agree with the strategy of insurance coverage in case of damages for managing in the future the problem of coastal erosion and the risk of coastal flooding?

Answer: 1-Absolutly disagree, 2- Partly disagree, 3- Neutral, 4- Partly agree, 5- Absolutely agree

Insurance coverage was considered as the most effective innovative mitigation option followed by restrictive land use planning, while converting bathing establishment and retreat from the coastline were not perceived as effective as the other mitigation options.

Furthermore, people who had experienced personally a flooding and they faced financial damages as a result of flooding they were more likely to agree for a strategy of insurance coverage in case of



damages for managing in the future the problem of coastal erosion and the risk of coastal flooding. Other findings showed that the insurance coverage was positively associated with the strategy of a more restricted spatial planning as a future management strategy in order to reduce the problem of coastal flooding and erosion, while a negative association was revealed among those residents who believed that existing structural measures were efficient to reduce the risk of coastal flooding and erosion.

Overall, it seems that insurance against flooding would be well received and adopted by Cesenatico residents if it becomes available. Furthermore, perception of risk, individual and collective preparation, past experience and counter measures are associated with the preferences of adopting an insurance scheme.

INSURANCE AS A MITIGATION OPTION INCLUDED IN THESEUS' DSS

INSURANCE AND SPRC STRUCTURE

THESEUS suggests a risk assessment based on a system's understanding of flooding. Underlying this approach is the Source-Pathway-Receptor-Consequences (S-P-R-C) model which defines the links between system components thus potentially giving a better understanding of the flooding system as a whole. Specifically, the S-P-R-C approach is being used to evaluate how the Sources (waves, tide, storm surge, mean sea level, river discharge, run-off) through the Pathways (coastal defence units) affect the Receptor (inland system) generating Consequences (economical, social, environmental, affected population, land losses). The purpose of S-P-R-C is to provide (i) a clear definition of the flood system and (ii) a conceptual map showing the inherent, causal relationships and interdependencies that will need to be represented in the analytical flood assessment framework. Use of this methodology encourages clarification of underlying or implicit assumptions and local knowledge which will provide significant benefit later in the project, particularly the assessment of whether the greatest benefit for management techniques should be focused on reducing the probability of the event at either the source or pathway stage, or altering the magnitude of exposure to the event by managing the receptors. Hence, unlike many earlier flood assessments, THESEUS is considering the consequences of flooding on both the human and natural systems.

The S-P-R-C model initially defines the baseline or current situation, while the steps required for the S-P-R-C model are:

1. Define case study boundaries and flood system components
2. Define which sources and mechanisms of flooding are important for the site (Sources)
3. Define the existing management practices
4. Define the areas of interest (potential Receptors)
5. Define the impacts of interest (potential Consequences)
6. Define the routes for flood water between 2, 4 and 6 (Pathways)

Trying to integrate insurance schemes in this context, in order to assess their effectiveness, the most obvious link is the impact of insurance market on consequences. In particular, by increasing risk awareness (linking premium to risk) and creating incentives for mitigation actions there is a direct impact on the consequences and in particular on the expected damages and number of people



flooded through the reduction of the vulnerability and exposure in flood prone areas. Insurance arrangements for flood risk may require households to undertake measures that mitigate damage or stimulate households to undertake precautionary measures voluntarily (Kunreuther and Pauly, 2006). These mitigation measures may limit damage during floods and thus be complementary to traditional flood protection (Botzen et al., 2009). Finally, insurance schemes impact also on consequences by even not entering an area to provide coverage making it more likely that less risk-averse households and firms will chose establishing in flood prone areas.

As a result insurance schemes reduce the consequences through policy condition or through encouraging measures, which are deemed to reduce the occurrence, severity or impact of a natural peril but also by influencing the structure and development of economic activity on coastal areas prone to flooding.

INCLUDING INSURANCE WITHIN THESEUS DSS

As stated before, insurance has been introduced in THESEUS considering the direct link to SPRC through the Consequences. As also emphasised in previous sections insurance is expected to reduce property owners' vulnerability and exposure to flood hazard from flooding due to changes in behaviours and attitudes, contribute to speedy recovery and resilience while it redistributes the costs of damage across the population and through time.

This section aims to present the introduction of an efficient insurance scheme for the inhabitants in the coastal area with various redistribution effects.

In order to achieve that the focus was on adopting a risk-based premium that is probabilistic in nature reflecting therefore an efficient insurance scheme. Apart from this characteristic the other innovative feature of the methodology is the investigation of the redistribution of the cost of damage from local to regional or national level. This is to be presented with the help of a "spillover box" which will allow exploring the redistribution effects of different insurance schemes.

Hence, this methodology allows estimating the impact of insurance on the cost of damage through the identification of a risk based premium and exploring insurance's redistribution effects at different scales by reporting a "spill over box" which presents the redistribution of cost of damage under different insurance regimes/schemes that alter the redistribution parameters. Furthermore, the possibility to explore the impact on cost of damage with and without insurance is offered.

According to the employed methodology "pure" insurance premium (IP) (Czjakowski et al., 2012) is a proportion of the maximum yearly exposure, either on property values (direct impacts) or on business activities (indirect values) or on both. Data needed to calculate these were the value of the property and related damage, the duration and depth of flooding and the probability of flooding.

In this framework of analysis, the overall consequences of flood in terms of flood and flood duration:

$$v_{ij} * b_j \text{ duration} + v_{ij} * a_j \text{ depth}$$

is replaced by:



$IP^*(v_{ij} * b_j \text{ Average duration} + v_{ij} * a_j \sqrt{\text{Average depth}})$

Where:

Average duration = Average depth / storm sewer capacity, the storm sewer capacity is assumed to be 0.2 m per hour, v_{ij} are the values of land uses in euro/sqm per year. In other words, the concave function as dependent on flood depth becomes a horizontal line (i.e. a fixed level) as independent on flood depth

In order to explore the redistribution effects and report the “spillover boxes” the following information was deemed necessary:

1. Information on % of the damage currently recovered at local, regional and national level (redistribution parameters in %). For some past floods: 5% households, N.A. firms, 34% household damages and 42% firm damage by region.
2. Information on future policy changes under discussion for diversifying the existing insurance regimes (redistribution parameters in %) in each case study area/country (it should be noted that there are no future policies for Cesenatico)

The outputs of this methodology are the estimated IP (€) per property, the cost of damage (€) per property with and without insurance and the spill over effect defined as the redistribution of cost of damage from local to regional or national level (% of cost recovered by flood victims from the national level insurance pool and % at regional/local level).

The assumptions that have been made to apply the suggested methodology are the following:

1. An heterogeneous agent (individual) (as opposed to representative) perspective and a financial (as opposed to economic) approach are adopted. In particular, the standpoint of the individual household or organization involved, at local rather than at national level, allowed us to avoid underestimation of damages.
2. Insurance schemes are assumed to be compulsory
3. Full insurance coverage against damage from the disaster is available
4. Not all damage can be located locally as the damage costs are transferred to the insurance pool
5. Insurance regimes are different across study areas/countries generating different redistribution effects

It should be also kept in mind that the following limitations apply:

1. IP could depend on flood frequency. Moreover, insurance is useful provided is sufficiently small in terms of observed flood depth and duration. Finally, economic losses are spread (by the same insurance company) over insured people in different places and for different risks.
2. If we want to determine the final premium it is important to add to the “pure premium” the costs an insurer will incur when selling flood insurance. All these costs (loading) will have then to be levied against the policyholders. The availability of this information may be limited.



3. It may be difficult to compare the pure premium (probabilistic risk related) with the premium that insurer charges as the latter includes also other costs of the insurer such as taxes, reinsurance fees etc. or be bundled in a general insurance package.
4. Potential limitations related to data: (i) there are also other factors that characterise the vulnerability of residences e.g., construction type, number of stories, the age of structure these cannot be fully accounted for (ii) financial losses we include at this stage only direct losses. However, there are indirect/secondary damages that are less easy to determine and is assumed that insurance does not cover, for example stress on families.
5. It is important to consider that in general if this measure was not compulsory its implementation would be conditional on risk perception and risk aversion.

Finally, it should be noted that the effectiveness of the suggested mitigation measure will be conditional on the existence of other mitigation options such as for example structural measures (e.g., dikes) and non-structural measures (e.g., existence of an evacuation plan) that impact on the probability of flooding and exposure respectively and hence on the expected damage/risk. It is also reminded that in each study site the methodology described will differ in terms of input data and current insurance regime while the application of different IPs in different areas according to different economic incomes or activities may be deemed necessary in order to account for equity.

INSURANCE AS A RESILIENCY ENHANCEMENT LEVER

Enhancement of the resilience of coastal communities under uncertainty, due to socio-economic and climate change is of paramount importance. The following sections present how insurance can contribute to resiliency.

INSURANCE'S CONTRIBUTION TO RESILIENCY

The approach adopted in Work Task 4.1 is to investigate the resilience of coastal systems with respect to flood insurance. Our conclusion would be that the availability of flood insurance significantly enhances the resilience of coastal communities. However, it is not simply a question of initiating an insurance scheme where flood risk is significant, because one cannot have flood insurance without many other areas of insurance operating side-by-side. Flood insurance can only be part (and a small part) of a general insurance industry, not least because flood insurance is liable to cause companies to fail if there are large simultaneous claims. This is well documented in the research literature. Therefore in any decision support system to enhance coastal resilience, insurance cannot be a simple "we will have it" or "we will not have it" button within the system. You cannot turn it on and turn it off just like that! So, any decision support system has to be designed with this in mind, or else it will falsely represent the situation that it is trying to characterise.

In the interviews with the stakeholders in the UK it was asked if they think that the resilience concept is useful to the development of insurance schemes and if they have used resilience ideas in your insurance policies. They answered that by 'resilience' they understand an arrangement that is robust when threatened, with vulnerability minimised. It is not clear whether the interviewer meant resilient insurance arrangements or resilient communities at the coast. The interviewee considered that both are important. With respect to whether the concept of resilience is useful when designing insurance schemes, they stakeholder agreed that it is useful because they need insurance



arrangements to be robust, or insurance companies will fail if there are multiple claims. They also want coastal communities to be resilient and robust, in the sense that they do not want them to be abandoned if flooded or threatened by the risk of flooding. They also do not want these communities to be destabilised by a flood event, or the threat of such an event. Therefore the stakeholder considers that it is helpful to insurance arrangements if coastal communities can maximise their own resilience, by wise spatial planning and building regulations, and sensible evacuation plans for use in the event of a flood requiring emergency response. The interviewee would hope to see coastal communities and government use the full range of adaptation measures so that coastal areas liable to flooding are as resilient as possible, not least because he knows that flood defence standards are finite and at sometime in the future may be exceeded. It is perhaps particularly important that those resilience measures that the community can itself take are encouraged so that these communities are not solely dependent upon the actions of the state to maximise their ability to cope with unforeseen flood events. Indeed, the private insurance sector wishes to see government continue to invest substantially in resistance and resilience measures, and have communities complement these with their own efforts. This is central to the Statement of Principles, whereby government has agreed to maintain its expenditure on flood risk management in return for insurance companies continuing to offer cover in areas of significant flood risk.

A particular interesting approach to climate change adaptation under uncertainty is offered by Wardekker et al. (2009) who suggest that local actors could apply principles of resilience in order to make the system less prone to disturbances and to enable quick and flexible responses. The authors argue that the resilience approach is better capable of dealing with surprises than traditional predictive approaches as it is a more flexible approach to adaptation that can be more suitable and tailored to local situations than rigid top-down regulations.

Following resilience principles as identified in Wardekker et al. (2009) and relating them to insurance, it is regarded that the former can be achieved through: the monitoring capacity of insurance schemes, their ability to use local participation, cooperate with local authorities, allocate part of the insurance fees in order to finance protection measures in the most affected areas, promote cohesion of social network and emphasize on the priority of safety measures, allocate payouts giving priority to the most affected or according to social criteria (e.g. income), collaborate with other insurance companies to hedge against a huge shock, link premium to risk reduction measures that promote buffering (e.g. flooding-resistant functions on ground level), capacity to offer “risk pool” policies for communities, firms etc.

Insurance can be seen as having an important social contribution in promoting coastal resilience in the aftermath of disaster by accelerating the economical and social recovery. As emphasized by Clark (1998, p.333): “in terms of coastal zone management, insurance has another potential role which assists recovery by minimizing death, loss and damage in the first place, by focusing attention on risk (the extent and cost of available cover indicates a professional assessment of risk), and by placing the burden of that risk on the hazard zone dwellers (actuarially-effective premiums, possibly linked specifically to flood, remove liability from non-floodplain dwellers)”.



According to Crichton (2007), the insurance industry will have an increasingly important role in helping society to adapt and become more resilient. Some ways in which insurers can help are (Crichton, 2008):

1. Assistance with identifying areas at risk.
2. Catastrophe modelling.
3. Economic incentives to discourage construction in the flood plain.
4. Collection of data on the costs of flood damage to feed into benefit cost appraisals for flood management schemes.
5. Promotion of resilient reinstatement techniques.
6. Promotion of temporary defence solutions.

Although the role of insurance as a vulnerability reduction and resilience enchantment mechanism has been emphasized it should be also acknowledged that its effectiveness is conditional on a number of parameters such as socio-economic and physical changes and governance arrangements.

Crichton (2008) argued that the success of insurance schemes depend on how flood insurance cover is arranged within a country, how sophisticated the country's insurers are in mapping flood risks and how much the insurers are regulated by government.

Similarly, Botzen's et al. (2009) study indicates that apart from the premium discount on the flood insurance, policy existing arrangements for compensating flood damage (the role of government), risk awareness and perceptions, and geographical characteristics are more important determinants in the decision to undertake mitigation than the socioeconomic characteristics. In this framework, government's intervention is of crucial importance as policies interact with the formation of risk behaviour and are capable of creating incentives to both households and investors.

Regarding the government intervention and insurance it is noted that Government's efforts have an important role to play before and after an event of flooding and the scale of intervention is also conditional on the existence or not of an insurance market or on how competitive such a market is but also on the frequency and magnitude of the event. Kunreuther and Heal (2003) noted that government intervention may be deemed important when the evaluation of adopting a specific mitigation measure by the public is underestimated. One way for the government to enforce its regulations is to turn to the private sector for assistance. More specifically, third party inspections coupled with insurance protection can encourage divisions in firms to reduce their risks from accidents and disasters.

An example of the relationship between state and insurance industry is provided by Sturm and Oh (2010). The authors taking the case of Hurricane Katrina stress out that although raising premiums following a high-loss year is probably the simplest and most obvious response to high reinsurance rates for primary insurers, in order to do so, insurers must first apply for such increases to regulators in every state in which they want to raise premiums. The authors regard that the impact of



government regulations can be negative even if successful applications for rate increases have been accomplished, if state regulators continue to maintain premiums caps that remain well below what insurance companies need to charge based on their actuarial calculations. That was the case in States after Katrina leaving insurers little financial reason to offer coverage and causing the exodus of primary insurers from risky markets. Hence, it has been expressed the view that regulations and subsidies need to be lifted so that insurers can charge premiums that give the right signal of actual risk of living in a particular area. In that way it will not be necessary for insurers to raise their rates in lower-risk states.

Drawing conclusions from the UK experience Harries and Penning-Rowsell (2011) demonstrate that the development and effectiveness of insurance market or of other non-structural measures is related to the degree of exposure of decision-makers to the victims of the hazards and hence to the emotional involvement with flood victims. More importantly authors argue that it is cultures and rationalities that have become embedded within organizations tasked with managing societal exposure to environmental risks as a result of previous, more narrowly defined, policies according to which structural, engineered approaches were the norm. This latter attitude is that limits the ability of society to respond flexibly and with fairness to climate change. Furthermore, this bias towards structural measures was enhanced by UK Government. As the authors state a high-profile agreement between the government and the Association of British Insurers (ABI) asserts that ABI members will continue to offer insurance to high-risk households only if the Environment Agency instigates “greater investment in defences”. Furthermore, ABI members promise to offer cover to new customers only if their home is not at “significant risk” of flooding. Hence, institutional and cultural barriers put the emphasis on flood defences and in this context risk is defined in terms of probability while reduction of vulnerability is not a priority.

At this point it is worth referring also to the case of USA where flood recovery and resilience relies on the States federal flood insurance that is only available where local governments have adopted adequate flood plain management regulations for their floodplain areas as set out by the National Flood Insurance Program (NFIP). Criticisms of this system of organization include that setting (compulsory) mitigation standards contributed to reduce flood losses on new structures but on the other hand, the NFIP program failed to restrain development in flood plains, which may be the case because many premiums are not risk based but partly subsidized, reducing the cost of insurance premiums (Burby, 2001).

Filatova et al. (2011) comment on the experience of Netherlands in order to show that that due to the lack of instruments to share the responsibility for flood risk reduction between government and individuals the Dutch government creates all the motives for urban development to be skewed toward coastal development promoting economic inefficiency. The authors argue that insurance is an example of a shared responsibility arrangement for flood protection between governments and individuals. Such a notion could be applied in Netherlands where a collective responsibility (society as a whole is responsible but nobody in particular) doesn't encourage risk awareness and it even increases coastal flood risk. The authors note that in the case of Netherland that defence measures are financed via the tax system which does not differentiate between risk levels in the location of



taxpayers and actual tax payment, the introduction of an insurance against flooding that implies a partially individual responsibility for flood risk seems to make the Dutch very reluctant to it.

Furthermore, as Clark (1998) observes, long-term environmental change such as climate change and short-term variation in the intervention of socio-economic systems in physical systems (i.e. coastal defence) both confound the attempt to find simple predictive models. Hence, in this context the perception of the hazard may be misleading. According to the author the implications are detrimental to both the insured and the insurer: underestimation of hazard exposes the company to future heavy burdens of unexpected claims, while overestimation of hazard and vulnerability is equally damaging to commercial effectiveness in that it leads to excessive laying off of exposure onto reinsurers or ultimately progressive withdrawal from potentially profitable business.

It should be noted that decisions of individuals on whether they will get some protection or on the type of protection that they choose are highly diffused among individuals since they depend on a plethora of factors that affect human behaviour. Apart from the economic status, crucial role in the decision making regarding how people will respond to natural hazards play personal experience. People who have suffered a disaster tend to be more willing to adapt precautionary measures. As a result, socioeconomic and personality characteristics of individuals as well as knowledge and experience of previous events can influence views and adjustments to hazards such as flood (Kates, 1962). Focusing on the experience of flood insurance in States in '90s, where most individuals in high-prone areas do not purchase coverage voluntarily Kunreuther and White (1994) highlight some principal reasons that could explain this behaviour. Among these are that individual underestimate the probability of a future disaster if they have not personally experienced the event, view such expenditures as poor investments if they have not made a claim on their policy in previous years and calculation of benefits is based on very short time horizons so that the cost of investment appears large relative to the returns that are calculated over just the next year or two. Dawson et al. (2011) comment on the fact of under-insurance in flood risk areas, showing that household's response is also conditional on different factors. Explanations include that people may ignore, knowingly or not, low probability but high consequence events. On the other hand, others may be aware but are priced out of the insurance market by high premiums or deductibles or the risk is underestimated because of overconfidence in 'hard' measures such as dikes. Of course, as authors point out the existence of an insurance market and the offer of insurance from all potential providers are critical factors for householders' ability to obtain cover.

In the light of behavioral irrationalities Kunreuther and Pauly (2006) suggest various remedies among which the necessity to formulate a policy with respect to disasters before disasters have occurred to ensure efficient behaviour on the part of those exposed to the risk, and on the decisions of those who are not yet exposed, but who could be depending on their locational choice. Furthermore, the authors recommend mandatory disaster insurance so that individuals will be required to have insurance coverage and that people should internalize the financial risks of disasters *ex ante* and to subsidize low-income residents who cannot afford coverage rather than the current largely *ex post* public disaster relief program.



Strict zoning coupled with mandatory insurance for those exposed to natural hazards was also suggested by Lave and Apt (2006) as well as a benefit-cost framework to the design of disaster policies accounting for the interdependence of government protection and private investment responses. Another contribution of Lave and Apt to policy recommendations is the potential role of information. The authors argued that people do not have well-formulated, accurate risk beliefs concerning the low-probability, high-loss events associated with disasters and therefore the government could provide more information to people and foster more rational risk taking decisions.

Kunreuther (2001) stressed the importance of private insurance as a catalyst for reducing losses in the future and covering much of the losses from catastrophic risks such as natural disasters. The author suggested a combination of building codes, reinsurance and indexed cat bonds that can form a useful strategy for reducing losses to property owners as well as insurers and the investment community. Kunreuther also argued that the success of a disaster management program requires the active involvement of a number of interested parties from the private sector such as insurers, banks and financial institutions, realtors, builders and contractors. Focusing on the public sector he argued that agencies have a role in providing assistance to low-income families so that they can adopt cost-effective mitigation measures, and so that they can recover after a disaster. Furthermore, the government may want to provide catastrophic reinsurance to insurers if the private sector does not offer sufficient coverage. Finally, it is noted that public sector damage from catastrophic events such as natural disasters often results in a substantial cost to taxpayers. Government officials should be encouraged to purchase insurance for public structures and invest in cost-effective mitigation measures. With respect to natural disasters one way to do this is to change legislation so that recovery funds would not be available unless municipalities implemented cost-effective mitigation measures. Another way would be to levy property taxes on all community residents to cover losses to public structures from catastrophic losses forming a community-based insurance, with all residents paying a share in proportion to the value of their property.

From the insurance industry perspective apart from solvency, insurers must guarantee that there is adequate demand for their policies. Consequently, they must monitor the premium rate, the deductible level and the insurance cap level. It should not be underestimated that insurance discourages investment in security if insurers face moral hazard problems due to their inability to detect careless behaviour on the part of the insured agents. If moral hazard problems can be eliminated through the terms of the contract (e.g. deductibles, coinsurance) and/or through monitoring and inspection, then insurance with actually fair premiums encourages a risk averse individual or firm operating in isolation to adopt protection whenever the cost of the measure is less than the reduction in the expected losses⁴.

Treby et al. (2006) put the emphasis on a need for more understanding of the reality of flood risk, not only by the public, but all responsible parties. Another also important point is that it should be admitted that Government (central and local) and associated agencies, house transfer professionals, insurance industry, housing industry and the public all have an element of personal responsibility.

⁴ <http://www.disaster-info.net/lideres/spanish/mexico/biblio/eng/doc6542/doc6542-1a.pdf>



However, in any case it is recognized that it is the government, not commercial bodies such as insurers who have the role of ensuring social rights and constructing expectations and hence they have a role in alleviating pressure from the insurers. Finally, Clark (1998, p.343) argues “that insurance can survive as a management support to coastal resilience only if governments, scientists and insurers combine to manage the natural risks without removing them.”

SYNTHESIS : GUIDELINES FOR IMPLEMENTATION

As emphasised above effectiveness of insurance as mitigation measure depends on a range of factors some of which are outlined below, that the decision maker should consider when evaluating insurance schemes:

- Existence of actuarially-effective premiums
- How much the insurers are regulated by government
- Policy existing arrangements for compensating flood damage
- Factors that affect human behaviour and form individual’s risk perception and awareness
- Whether insurance provides the right incentives/disincentives to the residents of the coastal areas so as to change their behaviour in relation to risk
- Overconfidence in ‘hard’ measures such as dikes resulting in the phenomenon of under-insurance in flood risk areas
- Early warning systems and evacuation plans could reduce flood damages and consequently flood insurance claims
- The degree of exposure of decision-makers to the victims of the hazards and hence to the emotional involvement with flood victims
- Participation of communities in measures of flood preparedness (e.g., establishing a system to detect floods and warn people about them) and risk communication within a Community Rating System that could enable them to acquire credits and achieve flood insurance premium rate reductions

As previously mentioned, in order to explore how society perceives risk of coastal hazards and insurance schemes, questionnaire surveys were run in different EU case study areas. In general, the difficulty was to access insurance companies for interviewing as well as the non-existence of insurance schemes in specific countries. The insurance scheme survey guide was constructed to identify the design of efficient insurance programs and the identification of the necessary incentives for their adoption that will encourage loss reduction measures against natural hazards and provide recovery funds to disaster victims. The insurance industry in the UK is extremely well developed. The whole of the sector is composed of private companies operating in the commercial marketplace. In general there is no state subsidy or protection for insurance companies in the UK, although there are many agreements and a degree of regulation that controls the marketplace. In the case of the



Santander study site, there is an Insurance Ministry. Its objective is to indemnify, by way of compensation, and in the cases mentioned above, those losses deriving from extraordinary events that take place in Spain and affect risks therein located. In the event of extraordinary risks that occur abroad, the Consorcio will compensate personal damage if the policyholder is resident in Spain. On the other hand, insurance against flooding is not available in Cesenatico. Finally, in Gironde, there is an insurance system, named Cat Nat (catastrophes naturelles). It calculates the direct damages but not the indirect ones. The insurance companies' role has become increasingly important. They advise their insurance holders on how to act if a flooding event occurs (through brochures for example). Nevertheless, Insurance regulations seem not to be sufficiently clear for individuals and companies.

Insurance impacts on consequences in a S-P-R-C framework/model (dual role on the cost of damage from the perspective of the property owner and on the distribution of this cost from local to regional or national level) and that an efficient insurance scheme should be closely developed in conjunction with adaptation strategies and local conditions and this is what we have done in DSS by calculating a probabilistic premium.

In order to explore the redistribution effects and report the “spillover boxes” the following information was deemed necessary:

1. Information on % of the damage currently recovered at local, regional and national level (redistribution parameters in %)
2. Information on future policy changes under discussion for diversifying the existing insurance regimes (redistribution parameters in %) in each case study area/country

The outputs of this methodology are the estimated IP (€) per property, the cost of damage (€) per property with and without insurance and the spillover effect defined as the redistribution of cost of damage from local to regional or national level (% of cost recovered by flood victims from the national level insurance pool and % at regional/local level).

The assumptions that have been made to apply the suggested methodology are the following:

1. An heterogeneous agent (individual) (as opposed to representative) perspective and a financial (as opposed to economic) approach are adopted. In particular, the standpoint of the individual household or organization involved, at local rather than at national level, allowed us to avoid underestimation of damages.
2. Insurance schemes are assumed to be compulsory
3. Full insurance coverage against damage from the disaster is available
4. Not all damage can be located locally as the damage costs are transferred to the insurance pool
5. Insurance regimes are different across study areas/countries generating different redistribution effects

It should be also kept in mind that the following limitations apply:



1. IP could depend on flood frequency. Moreover, insurance is useful provided is sufficiently small in terms of observed flood depth and duration. Finally, economic losses are spread (by the same insurance company) over insured people in different places and for different risks.
2. If we want to determine the final premium it is important to add to the “pure premium” the costs an insurer will incur when selling flood insurance. All these costs (loading) will have then to be levied against the policyholders. The availability of this information may be limited.
3. It may be difficult to compare the pure premium (probabilistic risk related) with the premium that insurer charges as the latter includes also other costs of the insurer such as taxes, reinsurance fees etc. or be bundled in a general insurance package.
4. Potential limitations related to data: (i) there are also other factors that characterise the vulnerability of residences e.g., construction type, number of stories, the age of structure these cannot be fully accounted for (ii) financial losses we include at this stage only direct losses. However, there are indirect/secondary damages that are less easy to determine and is assumed that insurance does not cover, for example stress on families.
5. It is important to consider that in general if this measure was not compulsory its implementation would be conditional on risk perception and risk aversion.

Finally, it should be noted that the effectiveness of the suggested mitigation measure will be conditional on the existence of other mitigation options such as for example structural measures (e.g., dikes) and non-structural measures (e.g., existence of an evacuation plan) that impact on the probability of flooding and exposure respectively and hence on the expected damage/risk. It is also reminded that in each study site the methodology described will differ in terms of input data and current insurance regime while the application of different IPs in different areas according to different economic incomes or activities may be deemed necessary in order to account for equity.

IMPLEMENTATION GUIDELINES FOR THE VULNERABILITY REDUCTION MEASURES ASSOCIATED WITH INSURANCE

The different measures to deal with flood risk can be categorized in two main groups. On the one hand, we observe structural measures (engineering constructions, e.g., dykes, barriers etc.) that aim to reduce flood hazard and the probability of flooding, and on the other hand non-structural measures (land-use planning, insurance schemes etc.) that aim to reduce flood vulnerability. In order to explore the role and effectiveness of insurance as a flood risk management measure it is important to keep in mind the definition of risk. Risk of flooding in European water management is defined as a function of the probability of a flood event and its potential effect (expected damage in terms of monetary damage and human casualties) (Rijkswaterstaat, 2005):

Coastal flood risk = P flooding x E (D)

As a result risk equals Probability * Consequence (Gouldby and Samuels, 2005) and this is the expected annual average damage of flooding, which covers economic, social as well as environmental negative consequences.



However, it has been noted that “hazard management has shifted away from physical processes alone and has, in turn, embraced its socio-economic, political and behavioral underpinnings” (Treby et al., 2006, p.352), thus focusing not only to the natural physical hazard but also to the socio-economic vulnerability of the affected population as shown in Figure 7. Crichton (2008, p.123) emphasizes that “risk management must recognize that controlling exposure and vulnerability can be much more cost-effective than simply trying to control the hazard”.

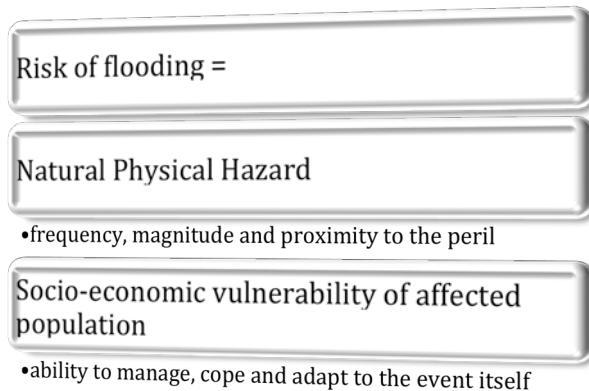


Figure 7: Risk of flooding

Regarding vulnerability Liverman (2001, p. 4657) points out that “vulnerability is conditioned by both biophysical and social conditions, including topography, poverty, access to information and insurance, gender, and ethnicity, and involves both external structural factors and individual capacity to cope with extreme events”. Thus, there is a distribution of sensitivity and resilience to hazards across geographic space, and between social sectors that should be taken into consideration by policy-makers.

The main effect of insurance as an intervention mechanism in the context of flooding is the redistribution of the cost of damage across the population and through time. However, apart from the redistribution effect, a potential modification of risk calculation in the equation above could be achieved through insurance.

A short-run impact of insurance is to reduce the flood damage by changing the depth-damage relationship if its policy is linked to mitigation measures for the properties (old or new buildings) in which they are implemented (short-run risk impact). A long-run impact is the change in the overall damage function through time by providing a mechanism (communicating flood risk through an economic signal) for discouraging development in high risk areas (long-run risk impact).

Overall, the contribution of insurance in flood risk management can be multi-dimensional in a sense that it can transfer risk, enhance risk awareness, contribute to the reduction of flood vulnerability in the short and long run and support the rebound of socio-economic systems and hence the resilience of coastal communities. Therefore, the role of insurance is of critical importance to the manager and to the society (Clark, 1998).

In schematic way flood insurance could be analysed by considering the Risk Triangle of Figure 8. As presented in this figure risk encompasses a combination of hazard, exposure and vulnerability and it is articulated as the area of the triangle, the sides of which represent hazard, vulnerability and exposure. In this framework if any one element (side of the triangle) increases/decreases, then the amount of risk will increase/decrease accordingly (Crichton, 2001).

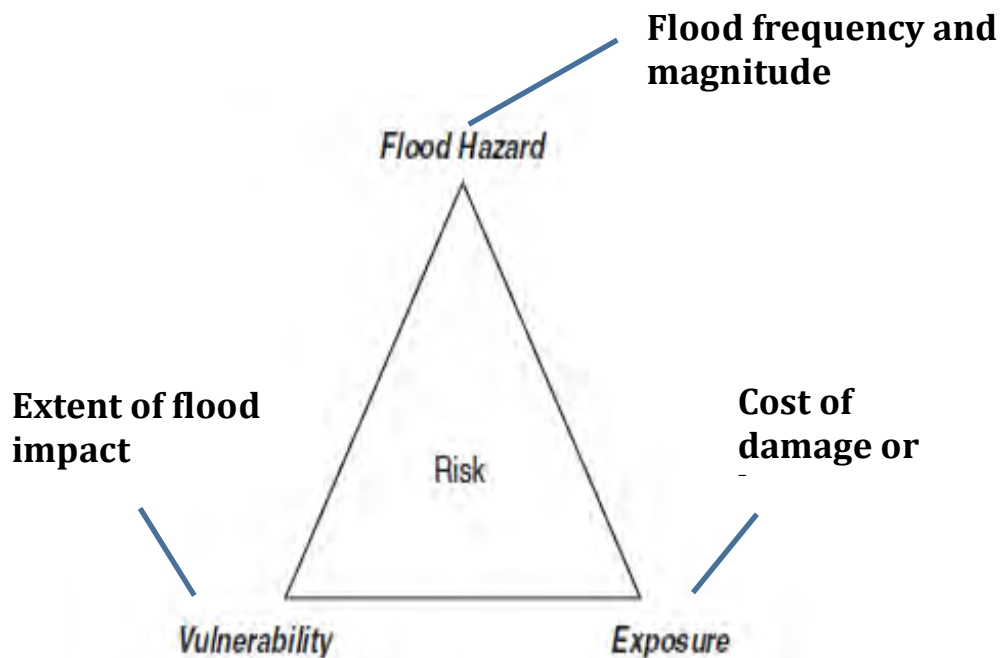


Figure 8: The risk triangle (Crichton and Mounsey)

Crichton and Mounsey (1997) offering this insurance industry perspective, argue that the hazard is the probable frequency and severity of the peril occurring in a particular geographical area, and thus relates to the natural process (flood) frequency and magnitude. As vulnerability indicates the extent to which a given hazard would impact on a property by reason of its materials or its layout, it is regarded that insurance can impact on vulnerability by introducing a condition on coverage/policy condition (e.g., keeping valuable items above flood level, etc.). In addition, as vulnerability is related to location, insurers can invest on institutional attempts to restrict development in hazard zones. The other dimension of risk, exposure from insurance perspective, is a function of the value of the asset/property at risk and the cost of its being damaged or lost. Hence, exposure it being translated in cost of damage or loss.

Insurance can offer the potential of an ex ante mitigation mechanism through policy condition or through encouraging measures, which are deemed to reduce the occurrence, severity or impact of a natural peril.

Market incentives, as Natsios (1991 cited in Treby et al., 2006, p.356) suggests, are possibly the most effective way of changing social behaviour. Thus, flood insurers could play a critical role in risk reduction and avoidance (mitigation) via the use of financial (dis) incentives:



1. Lower deductibles, i.e. lower premiums for properties that take action to reduce their exposure to flood risk, e.g. flood proofing.
2. Bonuses for non-claims.

Premium pricing related to risk—placing the onus on the client to assess their reaction to the known risk as highlighted by premiums that are high or indeed lacking.

Resilient re-insatement. i.e. reconstruction undertaken as a result of insurance payouts that aims to reduce the risk of future losses (Arnell, 2000).

It can be concluded that it is important for insurance to provide the right incentives/disincentives to the residents of the coastal areas so as to change their behavior in relation to risk.

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LAND USE PLANNING AND ITS POTENTIAL FOR INNOVATION AS A MITIGATION OPTION (TRACEY COATES, EDMUND PENNING-ROWSELL, LORAIN MCFADDEN)

GENERAL CONTEXT

This research considers how spatial planning can contribute to building more resilient coastal futures. Spatial planning has the potential to reduce future impacts through controlling the type and extent of property built in flood or erosion risk areas. The aim of the project is to investigate the role that innovative methods of using spatial planning and controlled urbanisation could play in restricting the impact that hazards bring at the coast (For example through reducing inappropriate future development or by changing the standards or future use of current development). Such measures could reduce the need for, or the design standards of, the kinds of major coastal defence structures that are now common, and which would need to become more widespread with future climate-change induced sea level rise.

The objective of this first section is to provide a review of spatial planning and urbanisation policies in EU countries (WT4.2). This review focuses in the first instance within the UK, and more specifically England. However, it extends where possible to include some review of policy and practice within the five WT 4.2 Case study sites (Bulgaria, France, Poland and Spain - hereafter Theseus case study countries), to other EU countries involved in the Theseus project (hereafter other Theseus countries) and occasionally to other EU countries. Additionally the review aims to take note of themes within the literature on contributions of spatial planning to resilience building in relation to flood and coastal erosion risk management (FCERM). The review also played an important role in informing and shaping the questions asked in the ground testing of how spatial planning may be used in mitigating flooding and erosion problems at the coast and so contribute to building more resilient coastal futures?

RESILIENCE AT THE COAST

It can be argued that the power of the resilience concept lies in its effectiveness as an envisioning tool. In this respect the partnership between resilience thinking and spatial planning is critical to navigating challenges of 21st century flood risk management in the context of environmental and social change. The resilience concept is most useful in this capacity for two primary reasons.

Firstly, resilience is a relative concept. It is relative in terms that the social and physical environment being managed for resilience is defined by choices of actors regarding what are considered to be desirable attributes of the system. Measures of resilience are therefore a function of a normative statement on the desirability of particular conditions and as a result different and conflicting notions of resilience are largely inevitable. Arguably what is most important is mapping these conflicting notions of resilience, and thus the collision of interests, to create the most useful insights into managing complex systems and risks.



In the second place, the challenges of social and environmental change mean that our use of resilience ideas must extend beyond the limits of recovering from shock. The application of resilience has to a large extent focused on enhancing the capacity of actors to adapt through learning and adjusting internal processes. This definition allows for temporary changes in functioning and dynamics, as long as the system remains within the same stability domain. However, resilience is also about the opportunities that perturbations open up in terms of recombination of evolved structures and processes, renewal of the system and emergence of new trajectories of change. The resilience paradigm could have the capacity to produce significant shifts in our normative vision of the future: such transformations might actually be critical to the sustainability of threatened coasts.

The process of using resilience to equip decision-makers and communities with alternative social and environmental futures could be facilitated by innovative spatial planning. Due to the medium and long-term character of spatial plans and the persistence of spatial structures, spatial planning cannot react spontaneously to sudden threats or impacts. However, spatial planning might be considered an important vehicle for enabling communities to navigate through uncertainties and for facilitating cross-scale interactions in moving towards new coastal futures. Transforming threatened coasts is an increasing global challenge and advances facilitated by spatial planning could be of significant international consequence.

The literature specifically focusing on resilience is profuse, opening a field in which a wide range of concepts reside. However, following the discussion above and in line with the systems approach and literature on adaptive or resilience socio-ecological systems (e.g. Folke *et al.*, 2002; Walker *et al.*, 2004; Berkes, 2007), a number of strategic interdependencies can be identified as benchmarks for enhancing and facilitating resilience building: 1) engagement across individuals, communities or organisations that have some claim to involvement in the decision-making processes, facilitating a social process in which stakeholders argue, debate and negotiate values, this includes sharing management power and responsibility, 2) combining different types of knowledge with cooperation across disciplinary boundaries and building links between science and traditional knowledge and 3) linking management across the range of spatial and temporal perturbations within the system. This latter point involves taking a long-term perspective, in which learning is central and where iterative cycles in a strategy process provide a vehicle for modifying the process. These benchmarks link with many of the issues of debate and the principles guiding spatial planning (see section 1.4 below)

In practical terms, it should be noted that erosion at the coast presents a special and different challenge to considering the role of spatial planning in resilience building as compared with flood risk. Floods impose economic, social and psychological costs on communities but they do not necessarily, and indeed rather rarely, involve complete loss or abandonment of property and businesses, the exception being where there is very frequent flooding of property. Coastal erosion by contrast can involve in the long term total loss of property. Resilience and the kinds of adaptation involved thus may have very different meanings for flooding and coastal erosion.



INNOVATIVE RESILIENCE ENHANCEMENT, SOCIAL INNOVATION AND SPATIAL PLANNING

The following literature review contextualises spatial planning in terms of the formal hierarchical planning processes through which policies and plans are developed and applied in all EC countries (see section 1.6). The discussion moves from higher-scale planning processes through to exploring spatial planning at the local-level. However, it is important to be aware that resilience and innovation are themes which cut across the formal hierarchical scales of spatial planning. The local scale is the level at which innovation is most likely to occur and therefore the local level is likely to be the key scale for understanding resilience building processes.

One of the key messages of Work Package 4 is that technical innovation for coastal flood and erosion risk management depends on social innovation. That is, any new approach, practice or intervention, any new product designed to improve or resolve a social problem, is only successful under the condition that it is adopted by institutions, organisations, or communities. Therefore a key theme underpinning the analysis within this work task is the identification of barriers and enablers to the implementation of resilience building processes in spatial planning. The following literature review outlines the main formal processes within spatial planning which might exert constraints or opportunities for implementation and where possible identifies specific barriers to adopting innovative methods.

Social innovation for resilience building requires a number of other conditions to be met in order facilitate the adoption of risk-reducing strategies and options. One theme relates to the importance of the social problem being perceived by the adopter of the proposed innovation. In response to this issue, the literature review has focused on interactions and inter-relations between spatial planning and flood and coastal erosion risk management across the different management scales.

A final theme within the review is the means whereby resilience building ideas might be mobilised within spatial planning for coastal risk management. The three resilience themes identified in the section above (see section 1.2) act as a broad guide to three basic benchmarks of a resilience and adaptive approach. We have used these benchmarks as a broad guide to the review of spatial planning in the incoming sections. That is, when reviewing each of the formal hierarchical processes of planning, the following questions have been asked:

- Is there information relevant to this scale on the role and importance of stakeholder engagement?
- Is there evidence of the existence and use of professional knowledge networks to allow integration of information on a range of system behaviours and functionalities of relevant to spatial planning decisions?
- Do current spatial planning processes facilitate iterative decision-making: is there evidence of creating capacity for increasing learning and building memory to learn from past events?

Where relevant, the literature review seeks to identify issues related to these themes. This broad range of information exploring: knowledge of the problem, perceptions of the role of spatial



planning, means of building resilience and barriers and enablers to mobilizing resilience ideas, provided the broad framework in which 'options' for innovative spatial planning were developed.

SPATIAL PLANNING DATA SOURCES AND LITERATURE

Literature searches indicate that there has been a surge of interest in spatial planning across the European Union (EU) from the 1990s. The European Spatial Development Perspective (1999) both reflects and has further stimulated this interest in spatial planning within the European Union.

The Directorate General for Regional Policy and Cohesion of the EC produced 'The European Compendium of Spatial Planning Systems' (EC 1997) comparing and contrasting spatial planning in the EU on the basis of 15 Member State reports on their spatial planning systems and policies. There are also country reports for the member states. It provides an authoritative and comparable reference work. However, it covers systems and policies as they were up to 1st January 1994. Thus, although the broad outlines of the planning systems described may be the same, much of this data may be out of date. As Healy (2004) notes in relation to strategic planning in European settings spatial planning ideas are dynamic and change in response to changes in institutional and political contexts.

A key data source is the European Spatial Planning Research and Information Data Base (ESPRID) a web-based information source for researchers and policy-makers concerned with Strategic Spatial Planning in a European context supported by the EU and, England's Communities and Local Government (CLG), the department responsible for planning in England (<http://www.esprid.org/>). It contains varied and updated material from a wide range of sources, academic books and journals, policy reports, plans and policy statements, databases and websites. It also includes information on relevant experts. It has been designed to be particularly helpful to those involved in INTERREG programmes and ESPON 2006, and to those developing spatial strategies across Europe.

The ESPON Programme (European Spatial Planning Observation Network) seeks to support Europe-wide policy development in relation to the aim for territorial cohesion and harmonious development across Europe. It funds research projects and produces reports on issues for development within the EU as a whole (The ESPON 2013 Programme 2010). This reports on issues in Europe-wide spatial planning rather than about spatial planning systems and offers a form of Europe-wide spatial planning in the absence of a formal Europe-wide spatial planning system.

The Virtual Environmental Planning Project supported through the INTERREG IIIB North West Europe Programme, and other funders ran from 2003 until March 2008. It successfully developed and demonstrated interactive, 3D web applications to help lay people understand proposed planning developments and share their views about them online. It also provided brief summary information on spatial planning in four European countries, France, Germany, Netherlands, and England.

There is an extensive academic literature focused on European spatial planning and a good representation of comparative academic studies on spatial planning in European countries and a large number of academic journals on spatial planning and some specialist journals including several devoted to European planning: e.g. 'European Planning Studies'. However, many of the academic studies accessed focus on case study comparisons of particular plans in selected countries



(Healy and Khakee 1997; Healy 2004; Adams et al. 2006; Albrechts et al. 2001), on particular aspects of planning such as Newman and Thornley's examination of urban planning in Europe (2002) and the comparative studies of city-regions by Salet, Thornley and Kreukels, (eds). (2003). There are also comparisons involving a limited number of countries, for example, only two countries, such as France and Britain across the whole planning systems (Booth et al. 2007) or aspects of planning systems. Other studies have focused on sectoral comparisons such as Marshall's work on infrastructure and spatial planning in four European case studies (Marshall 2009 a & b).

There are some academic studies that focus on spatial planning in relation to FCERM. Pottier et al. (2005) examined development and flood risk and spatial planning in France and Britain. In England studies by Tunstall et al. (2010) and Pardoe et al 2011 (submitted) show through detailed case studies how flood risk is addressed in the planning system. Some EU supported projects have examined spatial planning systems in various EU countries in a coastal context. For example, 'Vision and Strategies 2010 around the Baltic' reports on the spatial planning systems and policies of eleven Baltic coastal countries including Germany and Poland. The COREPOINT project has looked at the potential role of regions and spatial planning for improving the capacity for Integrated Coastal Zone Management (ICZM) in North West Europe in relation to COREPOINT sites in England, Wales, Scotland, Ireland, France and Belgium (Ballinger, 2008). In the UK there has been research interest in the extent to which spatial planning at national, regional or local level provides a means of addressing coastal management issues (Allmendinger et al 2002; Ballinger et al. 2006; Tyldesley 2005; Taussik 1996; 1997; 2007). Other studies have considered the potential links between ICZM and spatial planning for example Rabski (2004) on Poland whose coastal zone was significantly extended by boundary changes between 1939 and 1945.

This review has severe limitations partly due to time constraints in dealing with such complex source material. The review has also been constrained by the following key issues relating to knowledge and information on spatial planning in Europe:

- The diversity and complexity of spatial planning systems across Europe and the difficulty in the terminology used and of knowing that like is being compared with like.
- Data has needed to be accessed for the most part in English. Therefore, much material of interest may not be used. It has proved impossible to access many key planning documents such as planning acts or guidance documents because they were not available in English.
- The difficulty in finding up to date information and the uncertainty as to the date of some material. Planning systems are dynamic and changeable. A limitation of the academic literature is that due to the slowness of the academic publishing process many journal articles and books are based on research conducted some years earlier and may not reflect the current situation. In England, changes in government tend to bring changes in planning doctrine and fundamental reassessment and rearrangement of the planning system. This can be seen in change from the market led approach of the 1980s to the plan-led approach of the 1990s and changes introduced following the election of a Labour Government in 1997. This is evident in the changes that the 2010 Coalition government intend to introduce to the planning system.



- This review has had to make use of grey literature, often undated, available on the internet; much of it generated by EC projects and initiatives because other sources were not available or could not be accessed in time. It would have been preferable to have accessed more authoritative sources had these been readily available.
- The potential gap between strategies, plans and policies and their implementation on the ground. For example, Richards et al. 2008 have argued that there may be a gap between England's national policy on development and flood risk (Planning Policy Guidance 25 (PPG 25) on development and Flood Risk at the time) and its implementation. It is more difficult to find out about how policies and plans are actually interpreted and carried out. Data gathering within these case studies may help to reveal this. Another possible source of information on implementation could be evaluations of spatial planning performance where they exist. For example, In England and Wales, the Environment Agency in collaboration with local planning authorities has been required since 2000 to report annually to central government on spatial planning and development management and flood risk issues (see for example, the most recent report, Environment Agency 2011).

There is a growing literature on spatial planning theory and an international academic journal devoted to this topic, 'Planning Theory'. However it is beyond the scope of the review for Theseus to engage extensively with this literature and the review will be focus on spatial planning structures, legislation, policies, plans, and practice. Even with this restriction, the literature on European spatial planning and on planning within specific EU countries is extensive and this literature review can only touch on some of the key similarities and differences in systems and highlight issues relating to spatial planning at the coast.

MEANING OF SPATIAL PLANNING IN EU COUNTRIES

Spatial planning is a contested and ill-defined concept. Certainly in the UK context, the meaning of the term remains ambiguous to key participants in the planning process (Royal Town Planning Institute 2007). 'Spatial planning' has different meanings in different EU countries even when the terms used to describe it are the same. The use and meaning of terms have developed over time and reflect history the particular legal, socio-economic, political and cultural forces at work in each country and indeed in some cases regions (European Commission 1997 (EC 1997)).

In France the idea of *aménagement du territoire* is linked to the administrative and political traditions of the country. It is concerned with the regional economic planning of territory at the broadest level. The same terms are used in Belgium and Luxemburg but have a different meaning. In the Netherlands the term *ruimtelijke* is closely associated with the traditions of managing a scarce land source and has connotations of major public sector activity in the development process (EC 1997).

Some countries have relatively stable spatial planning systems that have evolved over time. In England, the system has developed with some, mostly minor, changes over a period of more than 50 years since the Town and Country Planning Act 1947. In contrast, the planning systems of the new EU accession countries such as Bulgaria have undergone major change in recent decades. In Bulgaria, following democratic changes that took place in Eastern Europe in the 1980s, the



centralised planning system was abandoned and it took some time for an alternative system to be developed in its place through the Regional Development Act 1999 and the Spatial Planning Act 2001.

Furthermore spatial planning has different meanings in different EU countries simply as a result of geography and population. What spatial planning involves clearly varies when we compare a densely populated and highly urbanised country such as England with Bulgaria with a small sparse population (Table 1). Terms used in relation to spatial planning such as ‘region’ and ‘local’ again have very different meanings depending on the geography, population and political and administrative arrangements in different countries.

Table 1: Population and density in theseus countries

Theseus case study countries	Km² in thousands (a)	Population in millions January 1 2010 estimates (b)	Population density per km² (c)
Bulgaria	110.9	7.8	70
England	130.3	51.5	395
France (d)	547.0	62.6	114
Poland	312.7	38.1	122
Spain	504.9	46.7	92
Other Theseus countries			
Belgium	30.5	10.8	354
Germany	357.0	82.1	230
Italy	301.2	60.6	201

(a) Wikipedia apart from England: ONS

(b) Europe in Figures: Eurostat Year Book 2010

(c) Calculated from (a) and (b)

(d) Metropolitan France

CONTEMPORARY DEBATES ON SPATIAL PLANNING

Contemporary debates on spatial planning have focused on the four key issues discussed below. These address the following in relation to spatial planning: fundamental principles, scope, scale and systems.

THE FUNDAMENTAL PRINCIPLES ON WHICH SPATIAL PLANNING IS BASED.

Here it is possible to identify three fundamental notions:

First, land use planning at its most basic embodies notions concerning the relationship between the state and the citizen, in particular citizens as land and property owners. The state at national, regional or local level through planning assumes powers to regulate the use of land and property. Planning, although it presents itself as a neutral, apolitical process is inevitably political reflecting changing political values and policies in particular the relationship between the public and private spheres as well as changing planning doctrines. This can be seen in the shifting objectives, processes,



scale and scope of UK post 1947 spatial planning documented by Allmendinger and Haughton (2007) and is probably evident in other European countries. The political transformations, which took place in Poland after 1989, which led to a significant revision of the then existing system of spatial planning (BSR INTERREG PROJECT B III Project Poland undated) are another example.

Second, spatial planning in Europe according to the European Spatial Development Perspective (ESPD) (EC 1999) and other EU spatial planning initiatives is intended to support the three key objectives of the EU for economic and social cohesion, conservation of natural and heritage resources and a more balanced competitiveness across EU territory. It is also intended to promote balanced and sustainable development. The extent to which these principles are embodied in EU member states' spatial planning and the enthusiasm with which they are embraced may vary. Certainly sustainable development: balancing economic, social and environmental concerns has been recognised as a guiding principle in UK spatial planning and remains so under the Decentralisation and Localism Bill 2010. Spatial planning thus essentially involves seeking a balance between competing interests, activities and actors.

Third, spatial planning in EU countries should be conducted according to the Aarhus Convention principles. European law makes the principles of 'good governance' that is openness, participation, accountability, effectiveness and coherence – a legal requirement for decision making. Thus spatial planning should involve not simply information provision and formal consultation processes but also real engagement, deliberative processes and visioning involving a range of actors. The extent to which this principle is acted on in spatial planning in EU countries at different levels and circumstances and the effectiveness of engagement activities are issues that requires investigation at strategic and local levels. Allmendinger and Haughton (2009a) comment that advocates of spatial planning share a naivety about the nature of contested spaces and the role of planning. They argue that such advocates assume (and they are making an assumption here) that spatial planning if it is undertaken in an open, transparent, and collaborative way will lead to consensus and ultimately to better development. They note on the basis of their research experience that deliberation may ease tensions at the strategic document level, only for them to surface again at the implementation stage.

THE SCOPE OF SPATIAL PLANNING

A second issue of debate relates to what is, or should be, the range of different sectors and interests involved in spatial planning and the extent to which spatial planning acts as an integrative process involving a range of actors and sectors. The shift in planning terminology in England from 'land-use planning' focused on the regulation of the use of land to 'spatial planning' was intended to signal a shift to a more all-embracing form of planning involving the integration of a wide variety of policy sectors in relation to a given space or place: economic development, transport, the environment including the water environment, education, health, and their interactions. Spatial planning is not a precisely defined concept and has a variety of meanings and applications and this will be evident across Europe. For England, at least, some commentators (Allmendinger and Haughton 2009a; Kunzman 2009) have questioned the extent to which shift in terminology towards 'spatial planning' reflected a marked change in practice.



SCALE ISSUES IN SPATIAL PLANNING

Linked to the issue of scope is the issue of scale. Here the debate centres on space or place, that is, the most appropriate territorial units for spatial planning and the relative importance and power of national, regional, sub regional and local level planning. Allmendinger and Houghton (2009b) argue that this does not simply involve a shift of emphasis across existing national, regional, sub-regional and local scales but an insertion of new scales for planning interventions initially at least through 'fuzzy boundaries. Such 'soft planning', they argue, is needed if planning is to reflect the complex relational world of associated relationships that extend across formal boundaries and involve a range of geographies. Formal planning has mainly taken place, and they concede, will continue to take place within regional or local administrative boundaries. However these boundaries may not be the most appropriate given certain physical, social and economic problems and opportunities affecting development. For example, at the coast, coastal cells might offer a better basis for planning and overcome problems of co-ordinating numbers of maritime local authorities. Certainly in the U.K spatial planning takes place beyond the formal spatial planning system and these other forms of spatial planning are likely to exist in other EU countries.

SYSTEMS, INSTITUTIONS AND MECHANISMS FOR SPATIAL PLANNING.

There is a huge diversity in the systems, processes and mechanisms used in spatial planning across Europe. Debates concern the 'best' approach for achieving spatial planning objectives. For example, whether rigid zoning or more flexible guidance is most appropriate and effective methods for development management and control. Another example would be the mechanisms used to ensure conformity with plans and planning decisions: the planning system or the legal system.

COMPONENTS OF SPATIAL PLANNING: EXTENT AND TYPE OF PLANNING AT DIFFERENT LEVELS

Despite variations, it is possible to identify common components of formal spatial planning systems across EU member states. It is important, however, to be aware that there may be significant informal spatial planning processes taking place as well as the formal ones. In almost all EU countries the following are to be found:

- **International and Europe-wide planning**
- **National planning:** at national level, a legislative framework, spatial plans or policies to guide lower level plans, strategies, or policies and decisions
- **Regional planning:** at regional level, spatial planning policies or plans to provide a reference for lower level planning and to co-ordinate inter-regional policy.
- **Local planning:** local level plans and policies relevant to the local area. All the Theseus case study countries have some spatial or development plans and planning at this level.
- **Mechanisms for site specific land use regulation** and for site specific decision making on spatial developments. Here there may be wide differences in what types of development or type of development in particular regions is regulated.
- **Enforcement:** mechanisms to ensure the compliance and enforcement of plans, policies and regulations at all levels. The mechanisms available for enforcement and compliance and extent to which the mechanisms are used may vary across case study areas.



Formal spatial planning is generally hierarchical and compliance with the policies and plans at the higher levels is usually a requirement at lower levels. However exactly how stringently this is applied will vary. The following sections will explore these components of formal spatial planning and their implications for planning at the coast.

INTERNATIONAL AND EUROPE WIDE INFLUENCES ON SPATIAL PLANNING

EU Directives and policies and international treaties relevant to spatial planning

Summarised below - **Key EU Directives and policies and international treaties relevant to spatial planning**

Table 2: Key EU directives and policies and international treaties relevant to spatial planning

<p>Nature and heritage conservation</p> <ul style="list-style-type: none"> • Ramsar Convention 1971 which designated wetland sites of international importance. Ratified in UK in 1976 • ‘Birds Directive’ (79/409/EEC) 1979; and its codification (2009/147/EC) establishes Special Protection Areas (SPAs). • ‘Habitats Directive’ (92/43/EEC) 1992 establishes Special Areas of Conservation (SACs) for animals, plants and habitats. • European Marine sites: the collective term for SACs and SPAs that are covered by tidal waters and protect specific marine and coastal habitats. • Bonn Convention 1979 on the conservation of migratory species came into force in 1983 • World Heritage sites (WHS): places of outstanding universal value. Only three in the UK relate to coastal environments: Dorset and East Devon Coast WHS 2001; Cornwall and West Devon Mining Landscape (WHS) and the Giants Causeway and Causeway Coast in Northern Ireland. • The Strategic Environmental Assessment Directive (SEA) Directive
<p>Water and floods</p> <ul style="list-style-type: none"> • Water Framework Directive (WFD) (Directive 2000/60/EC) for improving the quality of water bodies through river basin planning. • ‘Floods Directive’ (Directive 2007/60/EC) 2007 to reduce the risks that floods pose to human health, environment, cultural heritage and economic activity through assessment, mapping and flood risk management in river basins and on the coast.
<p>Coastal Management</p> <ul style="list-style-type: none"> • May 2002, EU adopted a recommendation on implementing Integrated Coastal Zone Management (ICZM) in Europe, asking members to review legislation and institutions and stakeholders involved in the management of the coast to develop strategies for delivering ICZM. • Marine Strategy Framework Directive (MSFD 2008/56/EC) to achieve good status in the marine environment by 2020
<p>Public consultation and engagement</p> <ul style="list-style-type: none"> • UNECE Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters 1998 • Directive 2003/4/EC on public access to information • Directive 2003/35/EC on public participation in Environmental decision-making.



Other selected EU policies relevant to spatial planning

- CEMAT Guiding Principles for Sustainable Development of the European Continent (2000)
- Third report on Economic and Social Cohesion (2004)
Fourth Report on Economic and Social Cohesion (May 2007). This included increased coverage of environmental issues and their impact on different regions and the impact of climate change.

There is as yet there is no Europe wide spatial planning law and spatial planning has remained within the competence of the member states. However (as outlined in section above) there has been a growing interest in spatial development planning within the EU. Furthermore there are many EU Directives and international treaties that are relevant and influential in relation to spatial planning in member states including spatial planning at the coast. Table 2 presents some key examples. There are also many EU policies for example, policies relating to transport, agriculture, trade, industrial development, social inclusion and competition and energy policies that have an influence on spatial planning (Roberts and Beresford, 2003).

There are four EU policies that have particular importance for FCERM and spatial planning at the coast: the Floods Directive in relation to coastal flooding, the Water Framework Directive as it is related to coastal waters, the Marine Strategy Framework Directive and the Recommendations on ICZM. The mechanisms for, and progress in, implementing the Directives and in acting on the recommendations may vary across the member states.

The Marine Strategy Framework Directive (MSFD) has been the focus of recent policy development within and between member states where marine regions involve more than one member state (Douvere 2008). Marine spatial planning like spatial planning on land is seen as a tool for integrating and managing economic, social and ecosystem-based objectives for the marine environment. The Netherlands, Belgium (Douvere et al. 2006), Germany and the UK have all been active in developing marine spatial planning. In the UK the recently established Marine Management Organisation will take responsibility for the development of marine plans to guide decisions affecting the marine environment in England and for designating with environmental bodies Marine Protection Areas (Douvere 2008).

The extent to which, and the ways in which, these four planning processes have been or will be separated from or integrated with spatial planning for the land in each the EU member states is an issue that needs to be investigated. How the different policies are to be co-ordinated with each other is also unclear. The MSFD document (EC 2008) suggests that this Directive should be linked to the WFD and should cover the material not covered by the WFD on coastal waters. It does not specify the relationship of marine spatial planning to ICZM or spatial planning at the coast.

There is as yet no EU Directive on coastal erosion risk management akin to the Floods Directive although erosion is covered by the ICZM recommendations. The EuroSION Project (EC 2004) estimates that about 20% of the coast of member states is facing serious erosion impacts. The EuroSION study recommends that coastal erosion hazards and risk mapping should be incorporated



into long term regional and local spatial planning so that development can be guided away from such risk areas.

The European Spatial Development Perspective and its influence

The European Spatial Development Perspective (ESDP), the culmination of many years of informal discussion on Europe wide spatial planning (Faludi and Waterhout, 2002) was adopted in 1999 in Potsdam by the Ministers responsible for Spatial/Regional Planning in EU Member States. It represents a landmark attempt to develop a spatial planning approach at European level. It supports an integrated and multi-sectoral approach and balanced and sustainable development across the European territory. It is intended to meet the three fundamental goals of EU policy:

- Economic and social cohesion,
- Conservation and management of natural resources and cultural heritage,
- And a more balanced competitiveness across the EU territory.

There have been further steps in EU spatial development policy. A recent document, 'Territorial Agenda for the European Union: Towards a More Competitive and Sustainable Europe of Diverse Regions' agreed in Leipzig in May 2007 (European Commission 2007) updates the 1999 ESDP in the light of the EU enlargement of 2004 and 2007 to 27 members and emphasises strengthening territorial cohesion as a key task. It also seeks to increase the global competitiveness and sustainability of all regions in Europe. The guidelines of European spatial policy remain as in the ESDP:

- Developing a balanced and polycentric urban system and a new urban-rural relationship.
- Securing parity of access to infrastructure and knowledge.
- Sustainable development and wise management and protection of natural and cultural heritage.

The key focus in European spatial planning is upon the region. The overall principle underlying the spatial policy appears to be to reduce disparities between regions within countries through policy for urban and rural areas. The aim appears to be to redress the 1999 situation in which the agglomerations of London, Paris, Milan, Munich and Hamburg accounted for 40% of population and 50% of EU GDP.

The concept of polycentric urban development has obtained widespread currency in debates among academics and professionals in planning and policy makers since the 1980s (Romein 2004). Polycentric spatial development promotes the establishment of multi-centred, balanced development foci as well as dynamic and competitive cities and urbanised regions and the development of productive rural areas. It recognises the functional linkages between urban and rural areas and the role of urban clusters and gateways to achieving balanced development (Ballinger 2008). This form of urban development has been contrasted with other theoretical urban spatial forms: the dispersed city and the compact or sustainable city (Salas Olmedo 2008).

The third element in the ESDP, 'wise management and protection of natural and cultural heritage' is highly relevant to coasts and Integrated Coastal Zone Management (ICZM) is noted as providing



a way of managing the many challenges at the approximately 90,000 km of coast of the EU countries included at that time.

Although, a notable feature of EU spatial planning thinking is the focus on regions, another initiative which culminated in the Leipzig Charter, May 2007 focused on Sustainable European Cities recognising the importance of cities and their role for the overall economic development of the EU. This is based on the fact that currently over three quarters of the EU population live in towns and cities of more than 50,000 people. The recent report 'Follow-up of the territorial Agenda and Leipzig Charter: Towards a European Action Programme for Spatial Development and Territorial Cohesion' December 2007 (European Parliament 2007) provides an action plan to take forward the objectives of the two documents.

The ESPD and European spatial planning policy have generated a substantial academic literature and debate along three lines. Some critical discussion has focused on the content and process proposed in the ESPD and on its key proposal for the polycentric form of development (e.g. Richardson and Jensen 2000). There has also been consideration of the ESPD policy making process and on its political and institutional implications (e.g. Williams 2000; Faludi and Waterhout 2002). Further studies have examined European spatial planning in specific regional contexts (e.g. Tewdwr-Jones and Williams 2001; Janin Rivolin 2003)

Although the ESDP, has no binding legal status and the EU has no formal authority for spatial planning, many commentators believe that this document has influenced spatial planning in member states and has placed the co-ordination of EU spatial planning on the political agenda.

The ESPD and its implications for spatial planning at the coast

The ESPD's integrated and regionally focused approach appears to be well suited to, and supportive of, Integrated Coastal Zone Management (ICZM). Although the EU's work on ESPD and ICZM (the Commission's ICZM Demonstration Programme 1996-99; publication of the EU Strategy on ICZM, 1999; 2000) proceeded separately but in parallel, they have not been pursued in isolation (Kidd et al 2003). Furthermore, the concept of integrated action to achieve balanced and sustainable development is central to both the ESPD and ICZM. In May 2002, the EU adopted a recommendation on implementing Integrated Coastal Zone Management (ICZM) in Europe, asking members to review legislation and the institutions and stakeholders involved in the management of the coast and to develop strategies for delivering ICZM. The EU has now launched a review of the ICZM Recommendations with a view to a follow up proposal by the end of 2011. In 2010 the EU had taken a step forward in strengthening the legal framework for ICZM in the Mediterranean. However, the recommendations of 2002 propose ICZM as a process distinct from spatial planning and state that 'An integrated coastal zone management involves multiple factors among which town and country planning and land use are only accessorially concerned' (European Parliament and Council 2002).

NATIONAL SPATIAL PLANNING

This section considers some of the factors affecting spatial planning in EU countries at the national level.



Constitutional law and government structures

Constitutional Law

Constitutional law is of interest in relation to spatial planning for two reasons. First, in some cases a country's written constitution defines individual or government rights or responsibilities, for example, the rights or responsibilities of governments or property owners in relation to land ownership and property. These rights and responsibilities in turn influence the organisation, priorities and operation of spatial planning. The Compendium (EC 1997) cites the example of Netherlands and Spain, whose constitutions grant the right to a decent home for all citizens. This explains in part the importance attached in both countries to housing provision. In Italy, the constitution addresses the claim of all citizens to jobs and homes. In Germany, the constitutional principle of equal living conditions throughout the country is reflected in mechanisms for redistribution of resources between Lander. Constitutional law in the Netherlands goes further, requiring local authorities to ensure good living conditions and to protect and improve the environment (EU 1997) and of the constitutions of Finland and Portugal which effectively grants landowners the right to build on their land (EU 1997). The UK at the extreme has no written constitution and responsibilities are defined by legislation rather than a constitution.

A second issue is the structure of government that the constitution establishes and how the constitution allocates responsibilities for spatial planning. Some countries have constitutions that do not contain provisions relevant to spatial planning. In the UK, with no written constitution, the form structure of government is established by legislation. For example, spatial planning has become the responsibility of the national governments of England, Wales, Scotland and Northern Ireland as a result of devolution through legislation.

Government Structures

Government structures vary across the EU and thence where spatial planning legislation can be enacted also varies. In **unitary** states, such as the Netherlands, Bulgaria, Poland and France the national government makes the law in relation to spatial planning although certain responsibilities may be delegated to regional or local government. In the UK, under devolution responsibility for spatial planning law and guidance rests with the national governments in England, Wales, Scotland and Northern Ireland. In the remainder of this report, the discussion of UK spatial planning will be focused on England.

At the other extreme are some **federal** states where power is shared between national government and another level, for example the Federal government and the 16 lander in Germany. In Belgium the national government has no explicit competence in spatial planning although the basic principles of the Spatial Organisation and Town Planning Act 1962 still apply. It can be argued that there is no national Belgian planning system but three independent systems in the geographic regions: the Flemish Region, the Walloon Region and the Region of Brussels-Capital are responsible via their regional governments and administrations.

In between, are **regionalised** countries such as Spain and Italy where power lies both with national government and with tiers below as determined by the constitution or legislation. These countries have strong regional structures and the regions have powers to make laws within the national



government's legislation framework. In both Italy and Spain the autonomy of the regional governments varies from one to another. In Italy, five of the Regions have special status and more extensive powers to govern themselves. In Spain similarly there are four regions that have special status and wider powers. Thus in these countries the situation is very complex and depends on the particular region of interest (EC 1997). In Spain, the constitution provides for a quasi-federal system and for spatial planning to be the responsibility of 17 regions with their own planning legislation.

Table 3: The national level: spatial planning and flood and coastal erosion risk management: key agencies responsibility⁵

National level	Spatial Planning	FCERM Coastal and marine management and planning	Disaster/Emergency Management
Belgium	None	None	None
Bulgaria	Council of Ministers (guiding principles for Spatial Planning); Minister of Regional Development and Public works (implementation) National Construction Control Directorate National expert board on spatial planning and regional policy	Two ICZM offices within the Ministry for Regional Development and Construction are responsible for coastal zone management implementation Also the Ministry of Environment and Water	Disaster Management Ministry
England	Department for Communities and Local Government (CLG) Planning Inspectorate	Department for the Environment Food and Rural Affairs Environment Agency Marine Management Organisation	Cabinet office Environment Agency
France	Interministerial Agency for Spatial Planning and Competitiveness (DIACT)	Secretariat General de la mer Minister of Ecology, Sustainable Development, Transport and Housing	The Ministry of the Interior, Overseas France, local authorities and immigration
Germany	Ministry of Transport, Building and Housing	Ministry of Transport, Building and Housing responsible for coastal planning issues	Federal Government: disaster management and civil protection agencies
Poland	Government Centre for Strategic Studies ; Housing and Urban Development Office	Coastal zone management: Maritime Office under Ministry of Infrastructure	Government Emergency Management Team
Spain	None	General Directorate of Coasts, Ministry of the Environment	<i>Information to be gained through case-study interviews</i>



The scope of spatial planning and co-ordination at national level

The range of policy topics over which the spatial planning system has some competence or influence and the degree of integration between spatial planning and social, economic and environmental planning may vary. Austria, France, Germany, Finland and the Netherlands all display some features of integration while England has only relatively recently moved away from a traditional narrow 'land use planning' to more broadly based spatial planning approach (EC 1997).

How responsibilities are divided between different departments or ministerial authorities at national level varies. In England, spatial planning is the responsibility of the Department for Communities and Local Government (CLG) while flood and coastal erosion risk management (FCERM) are the responsibility of another department, the Department for the Environment, Food and Rural Affairs (Defra) and the Environment Agency which has an overall supervisory role on flood defence. In many countries, responsibilities for FCERM and spatial planning are also divided between ministries and agencies (Table 2). This may make co-ordination at national level of spatial planning policy and coastal management policy problematic and may make it more difficult for national spatial planning policy to adequately address FCERM. However, in England, Defra's strategy for flood and coastal erosion risk management, Making Space for Water (Defra 2004) and its follow up documents (Defra 2005, 2006) clearly recognise the importance of spatial planning to FCERM. Furthermore, CLG's spatial planning guidance documents on development and flood risk, Planning Policy Guidance 25 and Planning Policy Statement 25 and its supplement were drawn up in close consultation with Defra and the Environment Agency. Thus, institutional separation does not necessarily result in incoherent policy.

In France, the Minister of Ecology, Sustainable Development, Transport and Housing embraces many of the topics that are relevant to spatial planning: housing, transport and sustainable development but also the prevention of risks such as flooding. Spatial planning, however, remains the responsibility of DIACT.

Bulgaria appears to have the advantageous situation where offices with responsibility for ICZM are located within the Ministry with responsibility for urban and land use planning and development and construction on the coast. However, problems and constraints on the development of ICZM in Bulgaria such as insufficient and ineffective definition of responsibilities of state and other agencies and lack of co-ordination have been reported (Onderstal 2000).

National principles, policies and plans

Most EU member states have some kind of explicit spatial planning policy statements at the national level. These provide a framework and general direction for plan making and regulation at lower levels. EU countries differ in the extent to which they set national level spatial planning principles, policies and guidance and in how detailed and prescriptive these may be (Table 2).

Belgium as a federal country has no national instruments. In Spain, spatial planning is devolved to 17 regions that produce their own policies and plans. The German Federal government confines itself to setting out national principles and broad policies.



Planning at national, regional and local level in EU countries is constrained by international treaties and by EU designated sites (see section 2.1 above). In addition national governments and national conservation and heritage bodies may confer national designations to protect areas that have particular value which then place special restrictions on planning and development within them both at regional and local levels. For example, in England the Marine and Coastal Access Act 2009, established Marine Protection Areas covering, coastal SACs and SPAs established by EU Directives, Ramsar sites, nationally designated Sites of Special Scientific Interest (SSSIs), and new Marine Conservation Zones. In addition there are national landscape designations: Areas of Outstanding Natural Beauty (AONBs).

Table 4: Spatial planning principles, plans and policies

National level	State	Spatial planning principles, plans and policies
Belgium	Federal	No national spatial planning principles, policies or plans as spatial planning is devolved fully to its three regions (Flemish, Walloon and Brussels-Capital)
Bulgaria	Unitary	The Spatial Planning Act 2001 sets out the principles and processes of the planning system. A national Integrated Development Scheme which specifies how national planning objectives may be achieved
England	Unitary	There is no national spatial plan. But national Planning Policy Statements (PPS) and Guides set out the arrangements for the planning system and for specific policy areas including development and flood risk (PPS25) and the coast (PPS25 Supplement).
France	Unitary	National Schemas de Services Collectifs (SSC) covering 8 topics, culture, health, education, information, transport, energy, sport and natural and rural areas
Germany	Federal	Federal Republic does not produce a comprehensive, legally binding national plan but confines itself to setting out fundamental principles (Leitbilder) for spatial planning (raumordnung) and spatial planning policy in Germany in a 'Raumordnungspolitischen Handlungsrahmen.
Poland	Unitary	Outline of the national policy of spatial (physical) development: a strategic and open document and planning process through which a document: Spatial Development Policy is produced and amended. The policy covers all Poland divided into regions.
Spain	Regionalised	No national plan or policies: spatial planning is the responsibility of the autonomous communities.

REGIONAL SPATIAL PLANNING

The ESDP and European spatial planning policy have a strong focus on planning at regional level. This is reflected within most European countries and in all the 5 Theseus case study areas apart from England. Regional planning is an important part of spatial planning. Many countries not only have regional planning but also sub-regional planning as well (Table 4).

England

England under the Coalition Government is out of line with much of Europe. In its 'Decentralisation and Localism Bill' published in December 2010, the government plans to reverse the policy for



statutory regional spatial planning introduced in 2004 in the Planning and Compulsory Purchase Act of 2004. Under this, Regional Spatial Strategies (RSS) were produced by nine English Regional Planning Bodies including London. This strategic level planning will no longer take place when the new legislation is enacted in England's eight regions, although the intention is that there should be some voluntary grouping for planning purposes. London, however, will continue to produce a strategic London Plan. There is also no longer any general formal spatial planning at sub regional level as county Structure Plans were abolished under the planning act of 2004.

The process of creating RSS has been criticised as cumbersome and the outcomes have attracted criticism from local authorities and communities as out of line with local aspirations (House of Commons Select Committee on Communities and Local Government 2011). The Coalition Government has argued that regional planning creates an unnecessary layer of bureaucracy. However, the abolition itself has been criticised as creating a planning void and the need for a strategic level of planning above the local level has been strongly asserted (House of Commons Select Committee on Communities and Local Government 2011).

As part of the RSS process, regional planning bodies were required to produce Regional Flood Risk Appraisals which embodied a strategic overview of flood risk within the region in relation to river and coastal flooding. RSS also contained regional policies on flood risk which were important because local authority policies and plans had to be compliant with the policies within the RSS.

At the coast in England and Wales, the need for a strategic approach to coastal change and other coastal issues has long been recognised and 16 non-statutory groupings based on coastal cells were established for England and Wales in the 1980s. These have been replaced by 7 bigger non-statutory strategic coastal groups in England. The intention is that the groups should have a stronger role in the future planning for FCERM (Environment Agency 2008). Their role is stated as to provide a source of expertise on the coast and to advise the EA and Regional Flood Defence Committees on coastal matters including advice on the leadership of SMPs. Their membership includes representatives from maritime local authorities, port authorities, Natural England (for nature conservation), the EA and other key bodies. It is possible that these groups, together with SMPs and other sub-regional coastal management groups such as estuary management planning groups will go some way towards providing a regional perspective on coastal issues for local authority spatial planners.

SMPs and other non-statutory plans for estuaries and coasts had been seen as feeding into and providing the evidence base for both RSS and local level spatial plans.

**Table 5: A guide to regional level spatial plans and policies**

	Regional level /Sub-regional	Plans and policies
Belgium	3 autonomous regions	Flanders: Flemish Regional Structure plan and Flemish regional implementation Plan Wallonia: Walloon regional structure plan regional urban ordinance, Wallon sub-regional Plan Brussels: Regional development plan; regional destination plan; regional spatial ordinances.
	Flanders 5 provinces,	<i>The only autonomous region with a coastline</i>
Bulgaria	6 Regions	<i>Information to be gathered during case-study interviews</i>
	28 Districts	District Development schemes
England	9 former Regions	Regional spatial strategies no longer to be produced in 8 regions
	32 English county councils	The only county council spatial planning responsibilities since the abolition of structure plans in 2004 are for minerals and waste plans
France	22 Regions	Regional Spatial Planning and Development Scheme (Schemas Regionaux d' Aménagement et de Développement du Territoire (SRADT)) for a 20 year period
	96 Departements	<i>Information to be gathered during case-study interviews</i>
Germany	16 Lander	Regional development plans (landesentwicklungsplan/programme)
Poland	16 Regions	Two different processes and documents: Strategies for regional development and regional spatial development plans
Spain	17 Regions	Regional planning (Planeamiento territorial)

Other Theseus countries

In France, regions are a relatively recent local government unit, instituted by the decentralisation legislation of the 1980s. The Regions are responsible for producing Regional Spatial Planning and Development Blueprints or Schemas Regionaux d' Aménagement et de Développement du Territoire (SRADT). These set out the basic guidelines for sustainable development in the region in the medium term. They are intended to shape the contracts between central and regional government.

The contractual approach is a critical tool for implementing spatial policy in France. There are Planning contracts between central government and regional governments which outline agreed strategic priorities for spatial planning and development in the region and resources needed. The most recent contracts for 2007-2013: Contrats de Projets Etats-Regions (CPER) focus on three priorities: local competitiveness and attractiveness, the environmental dimension of sustainable development including natural risks and social and territorial cohesion (DIACT 2006).

In Germany, the national spatial planning principles are translated by the 16 federal states or lander into regional development plans, or Landesentwicklungsplan/programm(LEP/LEPpro. Lander level



Regional development plans are legally binding on all lower planning bodies. The Lander or state level regional plans cover issues such as the desired settlement structure, open space and its protection, and infrastructure: transport installations, public utilities and waste disposal. The Lander have established a variety of arrangements for spatial planning at sub-lander level. For example, Bavaria has 18 planning regions, whereas Hesse has only three and regional plans are produced by these sub-state level bodies.

In Poland too, regional governments have an important role in spatial planning. Legislation requires two different processes and documents: regional strategies and regional plans. The plan for spatial development of a region should cover: spatial development and settlement, infrastructure, natural and cultural environments, balancing regional and local requirements and agreed social objectives and directions of development.

The three Belgian autonomous regions have their own forms of spatial planning documents. Flanders' Regional Spatial Structure Plan (Regionaal Ruimtelijk Structuurplan Vlaanderen) and Regional Implementation Plans (Regionale Ruimtelijke uitvoeringsplannen). The Structure Plan sets out a vision for the region and aims to create a coherent and coordinated plan for all regional spatial initiatives. The Regional Spatial Implementation Plan sets out procedures for implementing the Structure Plan. Flanders also has provincial level structure plans and destination plans.

In Bulgaria, under the Spatial Planning Act 2001, 28 districts were given responsibility for producing District Development Schemes. These were to cover the general spatial structure of the region, the location and future development of human settlements and infrastructure of national and regional importance and measures to protect the environment and for the prevention and mitigation of environmental damage and public health impacts (Bulgarian National Centre for Regional Development, undated). However, the Regional Development Act 2004 instituted 6 large planning and statistical regions in line with EU policy. Boundaries to these regions were changed slightly under a new Regional Development Act in 2008. It is not clear what progress has been made on regional spatial planning within the districts or the 6 regions.

In Spain, where spatial planning is the responsibility of the 17 regions (Autonomous Communities), each region has its own detailed planning legislation. Regions produce regional plans (planeamiento territorial) that are legally binding in a plan-led system. The respective regional government's legislation and plans at regional and lower levels classify all land as one of three categories:

- Urban land (suelo urbano)
- Developable land (suelo urbanizable)
- Land unsuitable for development (suelo no-urbanizable)

The definition of the third category is complex and contentious and has been subject to recent legislative change. Some land falls into this category because it has special environmental, cultural, heritage, or landscape value that demands special protection. It is not clear whether flood and coastal erosion risk play any part in the designation of land as unsuitable for development (Burns 2000, 2010).



LOCAL LEVEL SPATIAL PLANNING

Land and property owner rights

At all levels, spatial planning is a process that involves restrictions and constraints on property and land owners' rights. However, it is at the local level that this is most apparent because local policies plans and planning constraints may apply to specific sites and affect specific owners of property and land. Underlying the arrangement in different countries are different conceptions of property rights. In EU countries current land and property rights are established by law reflecting different conceptions of property rights. In most EU countries there are long established systems for registering and documenting land ownership. In some countries, for example Bulgaria, property rights have undergone recent changes following the break-up of the Soviet Union and legal processes for the restitution of land to former owners.

Land and property owner rights, depending on the law of a country, usually include the following: the right to occupy, use and enjoy property, to transfer, inherit and sell, to develop, change or improve, to cultivate and produce, to restrict access to others and to access services. Land and property ownership may also involve obligations, for example, the obligation not to harm others (Payne, 2004). Spatial planning most commonly may constrain the right to develop and change land and property through new or extended building or adaptation to buildings. It may also affect change of the use of land or property. The extent to which spatial planning impacts on property rights will depend on the specific provisions of the planning system.

In England, when the current planning system was instituted in 1947, it was recognised that planning took away property rights from owners and it was felt that these rights should only be restricted in limited circumstances. From this it followed that the specific circumstances in which planning permission should be required were defined. In other countries, broad zoning arrangement and associated regulations specify what development or use may take place within zones in development plans or regulations. In a third arrangement certain categories of land and property may be declared free from planning regulation, for example rural property.

Local level spatial planning

Key documents consulted for this review (EC 1997) indicate that in all the EU Theseus countries, and indeed in all Europe (EC 1997), local authorities have key responsibility for local development planning and the major responsibility for land use change and building control. This responsibility is under the general supervision of the regional and national authorities and in relation to their plans and policies. However, defining what is 'local' is challenging: the number, size and type of the local authority units which undertake spatial planning at the local level vary greatly across the Theseus countries (Table 5). The geographical areas and populations covered by the local plans and planning activities are diverse and varied within as well as between countries.

In all the EU and Theseus countries, there are two distinct spatial planning processes that take place at local level:

- production of local spatial development plan documents;



- the management and control of development through building permits and planning permissions.

Local development plans

According to EC (1997), most European countries and many of the Theseus countries have two forms of local plan. Firstly, a general or framework plan for guidance on long term goals, future settlement patterns and major infrastructure and a link with regional and national guidance. These plans usually cover the whole local authority area. They are mostly legally binding. Secondly, regulatory plans that may cover the whole or part of the local authority area indicate detailed specific zonings for buildings, land use and infrastructure, and grant the right to build or change land use through permit procedures or more detailed implementation plans. In addition, there are detailed building control instruments of various kinds.

Table 6: Local authorities and local spatial plans in WP case-study areas and other Theseus countries

Local level	Type of authority	Av. pop. estimated	Local spatial plans
Bulgaria	263 Municipalities, 5333 settlements inc. 242 towns	30,000	General development plans of municipalities or towns. Detailed development plans
England	326 local authorities	158,000	Local Development Frameworks - LDF. Supplementary Planning Documents
France	36,778 Communes: Most are grouped for planning purposes		Local urban plans (Plan Local d'Urbanisme – PLU) Territorial Cohesion Plans (Schemas de Coherence Territoriale – SCOT)
Poland	2,489 communes		Local comprehensive planning document Development plans
Spain	8,000 Municipalities	5,300 <i>To be confirmed</i>	Local Development Planning: Local plans(Planeamiento general) municipal) and other detailed local plans e.g. partial, special plans (planeamiento derivado or de desarrollo)
Germany	12,000 Municipalities (Gemeinde)	6,800	Two phase urban land use planning: Preparatory land-use plan (Flaechennutzungsplan) Legally-binding land use plan (Bebauungsplan)
Italy	8,100 Comuni	7,000	General Regulatory Plans (Piano regolatore general) and plans that cover part of the local authority area
Belgium	Flemish Region: 308 Municipalities Walloon Region : 262 municipalities Brussels Capital region: 19 municipalities	17,000	Municipalities in the different regions produce different types of local plan



Figures must be treated as approximate. Data compiled from different sources with various dates.

- (1) National Centre for Regional Development undated
- (2) Office of National Statistics 2010
- (3) DIACT and DGCID 2006
- (4) Lendzion and Lokucijewski undated

In most cases local level plans have to conform to higher level plans and national policy and guidance. However the mechanisms and efficiency with which this conformity is enforced vary. Planning also varies in the extent to which there is public engagement in the planning process. Planning legislation in England ensures that a substantial programme of consultation takes place. In other countries consultation opportunities appear to be more limited.

In addition to the formal local development plans required by law and undertaken within administrative boundaries, local planning authorities and others may group together to develop other forms of spatial planning and plans. These informal groups are not tied to administrative boundaries or formal procedures at sub-regional, local or neighbourhood level. The spatial planning for the Thames Gateway Growth area in England has been cited as an example of this new 'soft' planning approach operating across administrative boundaries with a focus on coordination, integration and inclusion (Allmendinger and Haughton 2009). Other examples of this 'soft' planning approach may exist in the Theseus countries.

Development management

Development management and control is a process that imposes restrictions and constraints on what property and land owners can do in terms of development and use of their land. In some countries this is largely achieved through regulatory plans and zoning in development plans.

The Compendium (EC 1997) found a high degree of similarity in the way the then Member States (i.e. excluding Bulgaria and Poland) regulated building and land use change through a system of building permits. It also noted some similarity in what is subject to control: main building permits in most cases cover new construction, extension or demolition of buildings, building regulation, change of use or subdivision of land or buildings. There are differences particularly in terms of the extent to which minor building works and extensions are regulated. In Spain, for example, control can be exercised over very detailed matters (EC 1997). In all countries there are some general exceptions from planning control and these tend to be for agriculture and forestry (EC 1997). For example, in Bulgaria, within rural areas outside the boundaries of human settlements, it is permissible in certain circumstances to build agricultural buildings, industrial and warehouse structures and other infrastructure (Bulgarian National Centre for Regional Development, undated)

There is a range of other building permits that may be required in relation to building and change of use in the different EU countries. In Belgium, France, Germany and Spain, it has been possible to apply for a preliminary permit to establish the principle of the conformity of a proposed development to the plan in advance of applying for a building permit. In England it is possible to apply for outline planning permission to determine whether development is acceptable in principle.



Most applications for building permits are determined at local level by local politicians. Under what is called the 'plan led system', applications are examined for conformity to the local regulatory development plan, where such plans are binding and where a plan exists (EC 1997).

There are variations in who may appeal or challenge a planning application, to whom the appeal is made and on what grounds the decision may be challenged in different EU countries. Commonly appeals are made to the courts or to a higher level authority, although this may vary depending on whether appeals are made on substantive grounds relating to policy or facts (this could be on the extent of flood or erosion), legal or procedural grounds (EC 1997).

FCERM PLANS, DATA, MAPPING AND MODELLING

If spatial planning is to address FCERM, good information on flooding and coastal erosion risks are essential as well as mechanisms whereby this information is made available to spatial planning authorities.

Following a preliminary assessment to be completed by 2011, the Floods Directive (EC 2007) has made it a requirement for all EU countries with areas assessed as having significant flood risks to provide flood hazard maps and flood risk maps. The maps must show the potential adverse consequences associated with different flood scenarios, including information on potential environmental pollution and an assessment of activities that have the effect of increasing flood risk. Maps are seen as necessary for information, for priority setting and for decision making. This includes spatial planning decisions, although spatial planning is not explicitly mentioned in the Directive.

The Directive also requires Member States to provide appropriate flood risk management plans by December 2015 with a view to avoiding and reducing the adverse impacts of floods. This requirement is based on the recognition that the causes and consequences of flood events vary across the countries and regions of the Community. Flood risk management plans should ensure relevant coordination within river basin districts, and promote the achievement of environmental objectives laid down in Community legislation. They should focus on prevention, protection and preparedness. With a view to giving rivers more space, they should also consider, where possible, the maintenance and/or restoration of floodplains, as well as measures to prevent and reduce damage to human health, the environment, cultural heritage and economic activity. The elements of flood risk management plans should be periodically reviewed and if necessary updated, taking into account the likely impacts of climate change on the occurrence of floods. Member States are asked to encourage active involvement of interested parties in the production, review and updating of the flood risk management plan and to make assessments, maps and plans available to the public.

Member states are required to show on maps the flood extent, depth or water level and where appropriate the velocity and relevant water flow for three scenarios.

- floods with a low probability, or extreme event scenarios;
- floods with a medium probability (likely return period ≥ 100 years);



- floods with a high probability, where appropriate.

Thus the Directive will ensure that comparable assessments of flood risk, maps and management plans are available by 2015 in all the Member States. Some of the Member States have already gone some way towards meeting the requirements of the Flood Directive with their pre-existing mapping. There is currently no EC Directive covering erosion risks that would standardise the provision of information on these risks.

In England, there has been a long tradition of providing flood maps to local planning authorities. However it only became possible to have a detailed and prescriptive policies on development and flood risk, when modelling techniques improved in the 1990s and it became possible to develop nationally consistent flood modelling and mapping to guide spatial planning. The EA provides flood risk maps to local planning authorities showing the extent of river, coastal and tidal areas with a given probability of flooding. These maps are updated when new information becomes available, usually on a three monthly basis. Local authorities in England are required to provide flood risk assessments and these do cover issues such as the depth of flooding, velocities and flow paths. Mapping of forms of flooding other than tidal, coastal and river flooding, such as urban flooding, is still under development in England.

ROLES OF THE PUBLIC AND THE PRIVATE SECTORS

A key factor in spatial planning is the nature of the roles of the public and private sectors in planning and development. Countries vary in the extent to which development is plan led or market lead. England and Spain are thought to be unusual in the extent to which development is market led with a much lower level of direct public involvement in the implementation of new development. In these cases public planning is undertaken primarily to promote and regulate the actions of private developers (EC 1997).

In England land is allocated for development and for different land uses in the development plan. However whether or not development is realised as planned will often depend on a private developer coming forward with proposals, or on a partnership arrangement between the local authority, developers and other stakeholders. Furthermore, developers may bring proposals for development outside the areas allocated for development in the plan.

In many other EU countries, the relationship between public planning and implementation is much closer, with the public authorities having extensive powers to realise development (EC 1997). A proactive policy-driven land assembly and land supply processes in the Netherlands, Germany and France, contrasts with the more passive and reactive approach in England (Oxley et al. 2009).

THE MATURITY AND COMPLETENESS OF THE SPATIAL PLANNING SYSTEM

In conclusion, it is useful to consider criteria for judging the maturity or completeness of spatial planning systems. A number of factors have been identified as indicative of maturity in spatial planning systems by the European Commission (EC 1997). These are important matters that need to be explored in the case studies.



Public acceptance and enforcement

The degree of public acceptance of the need for planning and regulation, and linked to that, the degree of compliance and the effectiveness of enforcement mechanisms are important considerations. In the absence of survey data on the public views, it is difficult to assess the degree of public acceptance except in terms of behaviour: i.e. do members of the public comply with spatial planning law and regulation; although compliance will also reflect the perceived efficiency of existing enforcement arrangements. In England, planning proposals and decisions are often controversial at local and national level but this is perhaps inevitable since planning is a process that seeks to find a balance between often conflicting interests. Planning procedures, and in particular planning application processes, are often criticised as bureaucratic, cumbersome and slow and there has in recent years been a constant search to make planning processes quicker and simpler (Killian Pretty Review 2008).

All the Theseus countries have procedures that enable enforcement action to be taken against unauthorised building works and land uses. However, the amount of unauthorised development that occurs varies between countries. Spain has been identified as having a particular problem in this respect (EC 1997). The liberalisation of the planning system in Spain also had an important role in the expansion of house building from 1996 to 2007 (Oxley et al. 2009). Some countries pursue enforcement more effectively than others. Most countries have the power to order complete or partial demolition or reversal of a change of use. In some countries e.g. Germany financial penalties may be imposed as well (EC 1997). In England it is possible for planning permission to be granted retrospectively.

The provision of up to date policy instruments and plans

Not all local authorities have development plans in place and some of the plans available are not up to date. According to the Compendium, there were some countries such as Germany, the Netherlands and Italy where a binding regulatory plan has to be in place before development could take place outside of an already built up area (EC 1997).

In England, the development plan process for producing Local Development Frameworks (LDF) was established in the Planning and Compensation Act of 2004, but there are still some local authorities that have not successfully adopted the key document (the core strategy) and many still have other LDF documents to produce. In England, there is evidence that managing development, when local plans and policies are out of date and do not reflect national policy, can cause difficulties (Tunstall et al. 2009).

In Germany, municipalities operating without up to date plans have in the past been reported as problematic for the spatial planning process, although this situation might have changed in recent times (Greiving and Turowski undated). In Bulgaria, it has also been reported that financial constraints hamper the production and updating of municipal Master Plans. Furthermore Bulgaria's Spatial Planning Act 2001 does not contain an explicit requirement and deadline for updating plans (National Centre for Regional Development, undated). It is possible that both these issues have been addressed in recent years in Bulgaria.



The degree of vertical integration and co-operation between levels of administration

Most spatial planning systems are hierarchical with lower level plans required to be consistent with higher level plans. However systems may vary in how successful they are in achieving this vertical integration. In Germany there is a collaborative mechanism in spatial planning. The planning strategies from the lower level have to be taken into account when devising plans and principles at the higher level, especially in planning infrastructure. The lower level plans are obliged to reflect the guidelines and principles of the higher level (Oxley et al. 2009). In the case of Poland, Lenzion and Lokucijewski (undated) report that plans are made and controlled independently by the respective regional or local self governments. Although the intention is that lower level plans should be compliant with higher level plans, the criteria for compliance are not clearly defined and dependent upon the relationships between authorities (COMMIN undated).

The existence of transparent and productive mechanisms for consultation and engagement

The Aarhus Convention on access to information, public participation in decision-making and access to justice (UNECE 1998) gives everyone the right to have access to information on environmental matters, to participate in environmental decision-making and to access justice. The provisions of the Convention have been embodied in two EC Directives, Directive 2003/4/EC on public access to information, and 2003/35/EC on public participation in Environmental decision-making. The Convention and Directives clearly apply to spatial planning in Europe.

The extent to which these objectives are realised in spatial planning the different EU countries is likely to vary in a number of ways:

- in the legal requirements;
- in the mechanisms used to inform and for consultation and engagement;
- in how wide and inclusive the processes are in terms of the stakeholders and members of the public reached;

In the duration and timing: from one-off events to continuous involvement.

The following gives some indication of the legal requirements and differences in consultation processes in some Theseus countries. Public consultation and engagement is a field in which there has been significant development over recent years and the information for some countries presented here may not reflect current practice.

In England, planning law and guidance make clear provision for informing and consulting stakeholders and the public. The guidance (PPS 12) places strong emphasis on public consultation and engagement throughout the plan-making process. Local authorities are required to produce a 'Statement of Community Involvement' outlining their strategy for engaging the public in the preparation of each of their DPDs and also to report on how they have carried out their strategy.

Planning documents, applications and decisions are available to the public on the internet and in printed form. While formal processes of consultation on documents and via public meetings and exhibitions are used, more deliberative and participatory methods such as workshops and visioning



exercises are also employed in developing plans. There is substantial stakeholder and community involvement in the development of the non-statutory Sustainable Community Strategies which feed into local development plans in local authority areas.

Information provision and consultation methods associated with spatial planning in Poland have been criticised as formal and limited although some innovative planners have organised discussion events (Lendzion and Lokucijewski , undated).

In Bulgaria, draft regional development schemes are subject to public debate prior to their submission to an Expert Panel. The authorities developing the plan decide on the stakeholders to involve, the procedures and the organisation of the debate. A similar process is undertaken for Master Plans for Municipalities and towns. Every citizen has the right to participate in the public debate and to express his or her views on the proposals. Detailed plans are not subject to this process but interested parties within a given area have to be notified and there are requirements for official and press announcements of the detailed plans (National Centre for Regional Development, undated).

In Germany, as required by the Federal Building Code, local planning is reported to involve intensive public participation in two phases. The first phase covers early involvement of the public, public agencies and neighbouring municipalities. The second formal phase occurs when a draft plan is put on display and any member of the public is entitled to inspect the plan and make suggestions. The municipality is obliged to examine carefully any suggestions made because the treatment of public responses is regulated in detail by the Federal Building Code (Greiving and Turowski undated).

NATURE OF THE MITIGATION OPTION THAT IS PROPOSED

The mitigation option proposed: To ensure that an assessment of FCERM risk is included in spatial planning at a strategic and a local scale in order to reduce current risk and to restrict the build-up of potential damage from flood and coastal erosion into the future.

As the earlier discussion revealed despite some moves towards integrating FCERM into spatial planning across Europe this is far from being effectively achieved. The following section, which ground tests this option, explores the extent to which planning practitioners in the case study locations are aware of FCERM, and to what extent they are able to integrate it into planning practice. This is an important consideration as it cannot be assumed that practice is at the same stage as policy, indeed a gap is common, especially in a time of rapid change. The ground testing examines efforts at integration and explores the factors inhibiting or enabling such integration. Section 4 provides some guidelines based on these findings, and suggests ways in which FCERM may be more effectively integrated in to the spatial planning process.

GROUND TESTING OF LAND USE PLANNING

METHOD USED FOR GROUND TESTING

In order to ground test the mitigation option a number of interviews were carried out with a range of key informants who have differing forms of involvement in the planning process. The approach



used to gather information was in-depth, semi-structured interviews. The aims were exploratory, rather than definitive. Information on ideas, tendencies, experiences and viewpoints were desired rather than facts and figures. In this type of qualitative research method the results are to some extent led by interviewees, their knowledge and what they are willing or able to discuss. Therefore some questions were covered in more depth than others.

Five countries were involved in this project and each chose a case study location. These were Bordeaux in France, Devon in the UK, The Hel Peninsula in Poland, Santander in Spain and Varna in Bulgaria. The details of the sampling in the research were determined locally by THESEUS researchers active in the relevant study site, in consultation with FHRC. Discussions with Work Package colleagues at the May 2011 Gdansk meeting concluded that we should seek interviews with:

- Key informants to arrange initial interviews with: planners from both local and strategic levels (the latter depending on the case-study area)
- Environment Agency (or equivalent strategic regulator with responsibility for flood and coastal erosion risk management)
- Key developers
- Local councillors
- Community groups and possibly land owner representatives

Given the complexity of spatial planning arrangements, snowballing was used as a technique for identifying the range of interviewees to be included in the survey. During the interview the participant was asked to suggest the names of additional people or groups with a stake in the key issue whom they felt should also be interviewed. The aim was a sample size of 10-12 interviews for each study area.

All interviews were conducted using a survey guide. This ensures all the desired topic areas are discussed and that there is consistency (as far as is practicable) between the interviewers. The structure of the interview, as well as the proposed interview questions were derived from the proceeding literature review of spatial planning and the various conceptual frameworks identified elsewhere. The survey guide was designed to collect data via interviews to help meet the aims of WT4.2. These aims are to:

- 1) To investigate the role that innovative methods of using spatial planning and controlled urbanisation could play in restricting the impact that hazards bring at the coast
- 2) To examine the potential for innovative governance arrangements to facilitate the innovative methods of using spatial planning and controlled urbanisation

The primary research question focuses on how can we build more flexibility into decision-making processes to facilitate an increased capacity for strategic and spatial planning to adapt to both planned and surprise change. The proposal focuses in detail on the planning systems, gathering basic pertinent information on methods of appraisal and governance processes as these relate to the delivery of spatial planning.



The interviews were designed to guide the interviewees in a recognisable path through the range of interview questions. They were organised around following broad structure:

- 1) Exploring the international, national and regional context of the role of spatial planning in managing flood and coastal erosion risk
- 2) Understanding spatial planning and opportunities for innovation at the local scale
 - a) Local development plans
 - b) Property rights and planning permissions
 - c) Public consultation and engagement
- 3) Flood and coastal erosion information and maps
- 4) Maturity and evaluation of the planning system

Slightly different versions of the interview guide were produced for regional planners, local planners and non-planners. There was some variation in how these guides were used in order to adapt to local specificities.

An initial analysis was carried out by work package colleagues with the results of this analysis being written in English. This reduced the need for translation and minimised errors that may occur during this process. A template was provided to ensure a consistent approach between analysts. These templates were then sent to Middlesex University for cross case study analysis.

Like all research this type of ground testing has a number of limitations. Working across countries without a common language brings its own set of difficulties. As work package colleagues kindly collected and provisionally analysed data collected in their own countries the final analyst and report writer is reliant on understanding others work and their translations. In any translation process it is inevitable there is some shift in meanings, however discussion and verification of meanings have hopefully minimised these problems. The ways in which information has been analysed and summarised also means that it has not always been possible to distinguish individual interviewees' views to the same extent within each set of provisional analysis. The results/discussions are based on understanding interviewees' knowledge and perceptions, which are necessarily partial and from a particular viewpoint. This is also one of the strengths of this type of research, as it allows access to a range of perspectives.

RESULTS OBTAINED FROM THE GROUND TESTING

One of the key findings to emerge from this research is the variation between the different case study areas. Spatial planning and FCERM are at very different stages of development in the five countries and the extent of integration between the two is also very varied. The diverse political and cultural contexts were also an important factor in influencing the role that spatial planning was seen to currently play in improving resilience and the potential it has for the future. The following discussions are ordered around the four key themes which shaped both the literature review and the survey guide. However, the sequence has been adapted to facilitate the discussion and so varies from earlier sections.

Within each of these broad themes there are a number of subsections which reflect ideas which have emerged from the analysis. These subsections consider first the idea or concept which has



emerged as important and then looks at how this is articulated in particular locations. In this type of research the findings are driven to a large extent by interviewees concerns. Therefore the balance between, or weight given to, the various sections may vary considerably and may differ from that set out in the literature or the interviews. In some locations they were facing severe difficulties within the planning system, this led interviewees to focus to a large extent on their current problems and so discussions on wider issues relating to the integration of FCERM were very limited.

As expected many of the discussions are focused at the local/regional level. To a large extent the interviewees raise current difficulties or concerns regarding the spatial planning process in relation to FCERM, or show an absence of awareness of important issues. However, there are some positive examples which suggest that planning processes may play a role in the future. There is also optimism amongst some interviewees that FCERM and EU involvement in particular may offer not only improved resilience but also a way to solve current difficulties within the planning system.

Following the discussions based around the four broad themes is a set of guidelines.

The international, national and regional context

These questions focus on the interactions and inter-relations between spatial planning and FCERM at broad scales. They include the influence of EU directives, policies and treaties of relevance to spatial planning as well as the influence of the European Spatial Development Perspective. They seek to gain perspectives on the coordination of planning and how this coordination might foster integration with FCERM objectives. Also important is identifying the different scope of broad agencies, the distribution of power and flexibility at broad scales.

Implementing EU regulations: both problem and solution

As identified earlier although there is as yet no Europe wide spatial planning law there has been a growing interest in spatial development planning within the EU and a number of directives, treaties and policies which are influential in relation to spatial planning at the coast. The extent to which these have been integrated with spatial planning in the case study locations was extremely varied. This was a reflection of the very varied physical, political, social and cultural backgrounds of these countries as well as the differing planning systems that exist. A lack of resources to implement yet more changes, in what has been for some a continually changing policy environment, was a key issue. However the more optimistic of the interviewees felt that the EU regulations offered the potential to not only promote resilience (although the term resilience may not have been used) but also to overcome some of the difficulties they experienced within the current planning system.

Having sufficient resources to implement EU changes is a particular problem in Santander, Spain where the planning system appears to be in crisis. There have been many normative and procedural changes taking place between 2001 and 2006. The regional level plan was approved in 2001, in 2004 littoral use planning affected more than 40 municipalities, and then in 2006 the state approved a new law which was transposed to the European one. The system has not been able to cope with these changes so that currently there is not a coherent set of legislation. Current planning legislation at the municipal level has led to a position where people are forced to work with older or several contradictory pieces of outdated legislation. The situation is described by interviewees as incomplete, confused and unworkable. Those people working for the public sector are said to be



close to desperation. In contrast the gaps and inconsistencies within the system were being exploited by private companies to increase profits in a way that was felt to be at the expense of resilience (discussed further in following sections).

Although conforming to EU regulations had added to the burden of change they were also seen by some to offer a potential solution to the current problems. It was thought that if the European frameworks could be applied effectively this could produce a workable integrated system, and close the current 'loopholes' being exploited by private companies. It would also provide greater environmental protection and make the system more resilient as resiliency is better integrated into these frameworks. However, incorporating this legislation will be extremely difficult as municipalities struggle to catch up with previous changes. A lack of political will, the inertia of a slow and cumbersome administration, and uncertainty about the procedures to follow were understood to be the main reasons for this inability to produce a workable system which meets current legislative requirements. How this was to be overcome was not clear.

Varna, in Bulgaria also had a number of problems with its planning system. However, these were of a different nature and arose to a large extent from problems inherited from its historical political context. There was a clear post-soviet influence which impacted at many levels. During the soviet era, when there was almost no private property, informal largely unregulated relationships between individuals' were significant. Business was carried out, agreements made and money distributed through personal arrangements. One outcome of this was the construction of many illegal buildings in the coastal protection zone. These illegal buildings remain and more are still being built. This reliance on personal relationships persists into the post-soviet era. 'Grey' economics and politics dominate, these operate largely outside the formal system and so regulation is very difficult. For this reason more optimistic interviewees, see the EU as playing a positive role and believe that EU interaction should be extended.

The problems of compatibility between scales

Some interviewees didn't feel that there was a good fit between the EU legislation and their current legislation, although opinions differed on how and why, and where the blame lay. Lack of consistency and cooperation between the various scales of government, planning related regulation and FCERM is a problem within countries, as well as between national and European levels. There appears to be conflicts between different scales, in all locations, but this is expressed in different ways in the various locations, at least in part because their spatial planning regulations operate at different scales and with different sets of regulations, historical and political contexts etc.

In Bordeaux, France one interviewee talked of the tension between EU regulations and the needs of local people. In applying EU regulations he felt that the needs of people were not sufficiently considered and that instead there was too much emphasis in standardisation across Europe. Bordeaux also reported tensions between the communes and the government (local v national) with some processes not adequately crossing scales. "There is a consultation process but it is only focused at the mayor's scale. The consultation process does not integrate the citizens, the hunters, chamber of commerce, businesses and farmers". There is also tension between different policies which have different aims – "Contradictory policies are in the Gironde department; on one hand we



have the flood risk and on the other hand we are encouraging new people to inhabit in the department". The mayors also illustrate some of the tension between different policies – “Mayors should not use the city growing as an electoral promise”. Trying to implement policies across a wide range of scales, meeting the needs of diverse groups in a fair way, was problematic. Some of the tensions created are discussed further in sections below.

How flood and coastal erosion risk management is being perceived within the planning system

In the UK where the EU regulations appear to be more firmly established (although by no means fully integrated) some interviewees were able to provide more detail regarding which aspects of FCERM were effectively integrated or not into spatial planning. The survey question didn't explicitly address the point of whether planning systems recognise and know about coastal flooding and erosion, as the question focuses on if/how FCERM is actually integrated as a process into spatial planning. The interviewee responses highlighted the difference between these two points, that planners might be aware of, for example, Integrated Coastal Zone Management (ICZM) but because of certain constraints they might not be able to integrate this within planning practice. The constraints were mostly considered by planners to belong to ICZM rather than to the planning system's ability to absorb or integrate ICZM ideas. There was a unanimous agreement that ICZM and spatial planning do not have effective links. There is a very strong feeling that ICZM isn't practice-orientated enough to allow it to be usefully integrated in spatial planning; that the broad principles of ICZM are too general have not been translated in a manner that can be used by planning system.

When asked to reflect on the success of links between FCERM and spatial planning, the response was mixed, and indicated that a substantive proportion of the interviewees believe that the linkage is not functioning adequately. Two key reasons were given by different interviewees to support this view: one was that relationships between the two processes were reactive; the second reason was lack of long-term visioning for adaption to future environmental changes and this long-term vision with considered an essential element of FCERM. Although, the interviewees question the success of linkages between FCERM and spatial planning, there is evidence to suggest that FCERM is considered relevant to the spatial planning process. For example FCERM is used as a criterion in preparation of Local Development Plans.

There was a strongly emergent view on the necessity and usefulness of spatial planning at sub-regional or regional scales for FCERM. A key thread running through this discussion was the need for 'beyond local' planning is a response to the reality of the natural environment; that is, the regional and sub-regional spatial nature of coastal processes. Although a local planner also made the point that the sub-regional scale makes sense, as councils find themselves with similar interest and problems. He suggests that regional management simply emerges as a necessity even if it is not facilitated by legislation.

These issues were not covered in any detail in the other countries. However, in the Hel Peninsula, they noted that while only a few of the interviewees knew about ICZM as a measure for coastal coordination in Poland, most of them saw the urgent need for systematic cooperation of different sectors.



The maturity and evaluation of spatial planning systems

This section focuses mainly on the acceptance and enforcement aspects of the maturity of spatial planning systems. Discussions elsewhere highlight the problems caused by systems which lack cohesion, effective links and cooperation between levels. Mechanisms for consultation and engagement are discussed in the following section which explores spatial planning at the regional/local level.

Attitude to regulation of planning

The public acceptance of the need for planning and the related issue of the level of effective enforcement again showed significant variation between the locations. This might be largely expected given the very different political and cultural contexts. Whilst a review of literature relating to cultural variations in accepting regulation and reinforcement might be valuable it is not possible to consider these broader issues here. The discussion focuses on those issues explored by the research, which is the extent of acceptance of spatial planning regulation in the FCERM context and attitudes to its enforcement. Attitudes varied from what was described as “fairly high acceptance of the need for spatial planning” in Devon, England (although this is not to say certain decisions weren’t contested) to widespread resentment and problems of non-compliance in Bordeaux, France. In some locations the way in which FCERM has been applied has exacerbated or created problems, leading to a resentment and rejection of the planning laws and a believed rise in illegal buildings. The varying attitudes and some of the underlying factors are discussed below. This issue is also linked to that of community engagement, for it is generally claimed that early and effective community engagement will lead to a higher acceptance of planning decisions. The question of community engagement is an important one; whilst some linkages are highlighted here it is discussed in more detail in sections below).

In Bordeaux in those areas subject to the PPRI regulations (Predictable Flooding Risk Prevention Plans), that is those areas at most risk of flood, residents cannot build or extend their old buildings. This has to be strictly and inflexibly applied, a situation which has led to considerable resentment amongst the residents. Residents find it unacceptable that they cannot build on their own land “People do not understand how they could not build on the ground they bought” (Interview 2). This lack of acceptance has led to problems of people building illegally, which then means that cannot get insurance, and so are likely to be less resilient. This problem is exacerbated because not only do these people have building restrictions, they also receive flood water in order to protect more urban areas. As one interviewee explains “we assist in a double punishment of some communities. They can’t build and extend their communities and at the same time they receive flood waters to protect the more urbanized areas” (Interview 2). This has implications for community engagement activities. Successful dialogue and agreement is much less likely in a situation where residents are angry at what they see as unfair treatment and unreasonable restrictions. The application of FCERM in this location and the tension it has created between urban and rural locations was a key topic which dominated interviews. The processes and implications are considered further in sections below.

In Santander, Spain because of the many changes taking place between 2001 and 2006, current planning legislation at the municipal level is incomplete, confused and unworkable. There are many rules and regulations in force, some of which are contradictory and following one may lead to



breaking another. Additionally, as legislation is constantly changing, at each stage new requirements may emerge which leads to further uncertainty. All of which makes it very difficult if not almost impossible to comply with the planning regulations. This has led to a situation where the community has internalised that it is better not to plan. An independent interviewee from an international firm described planning as a trap and argued that “if you don’t plan you are better equipped for the future”. In this situation non-compliance with the regulations may be seen as a sensible strategy for coping with the many uncertainties thrown up by a system that is not working.

The view within the Devon interview group was that the need for spatial planning is largely accepted by local communities. Although, one interviewee suggests that given the complexity of planning, and the public’s limited exposure to the planning process the level of awareness is fairly low. He implies therefore that the need for planning is not fully appreciated. Two ideas emerged from the discussion on public acceptance of the need for spatial planning. The first is the view held by interviewees that stakeholders value planning as a means of delivering a stable future, for creating and ensuring that their vision for the area protected. This would seem to resonate with the desire to maintain status quo, which could be considered one aspect of resilience building. The second idea relates to the attractiveness of spatial planning as means of formalising decision-making on how a space is created and maintained. The point is made that the public value spatial planning for its contribution to regulating behaviour: although, the level of regulation required might in itself be in question.

Flood and coastal erosion information and maps

Discussions on this aspect were relatively limited, perhaps because for many interviewees FCERM was not yet sufficiently integrated to be at the stage where they were making use of the available data. However, a number of participants in Devon did highlight the need for accurate information and maps on which to base decisions. For example a regional planner stressed the need to be able to access up to date information and to have good evidence to support decision making and strategies that are developed. She also recognised that this led to a reliance on “technical advice and expertise” beyond the planning team (Interview 8). Another interviewee in Devon discussed how erosion risk mapping was less developed than flood risk mapping which posed a problem when trying to develop policy (Interview 5). Interviewee 7 when discussing coastal erosion risk mapping stated that “I wish we’d started this 20 or 30 years ago, this mapping process, we’d have got more confidence in the data ...”. This illustrates not only the need for accurate information but also the requirement to those using it to have confidence in its quality. A local planner (interview 9) discussed issues that arose when the information on which they were basing their decisions was changed or updated. He pointed out how a recent revaluation of flood data by the EA in Exmouth led to changes in their decision making and which location was the ‘favoured site’ for a development. Some of the issues that arose when trying to understand, interpret and communicate risk data are considered in the later section on ‘Uncertainty’.

Spatial planning in the regional/local level

This theme is comprised of a series of sub themes and as expected this is the section with the greatest detail as this is the level at which innovation is more likely to emerge. This is also the key



scale for understanding resilience building processes such as community participation. Questions focused on interactions between FCERM, resilience building and spatial planning.

Conflict/Tension between groups

Conflict or tension between particular sub groups is not unexpected in a complex issue such as spatial planning which must balance competing demands at a whole range of scales. However, in two of the locations the planning system itself, or failures within the system, had come to create or exacerbate tensions. In Bordeaux, France the FCERM strategy has led to a division between urban and rural areas and an increasing rejection by some rural residents of the legitimacy of the planning process. Difficulties within the planning system in Santander, Spain have led to a situation where private companies are able to exploit gaps and inconsistencies in the system for economic gain, often at the expense of the public sphere. This was thought likely to lead to reduced resilience as the public good loses out to private profit.

The French example of Bordeaux is particularly interesting as it illustrates potential dangers arising from unsuccessful integration between the FCERM and the planning system. (Although it should be noted that coastal erosion risk seems not to be integrated in to FCERM). The overall strategy to reduce exposure to risk is to concentrate growth in certain urban locations considered to be at lower risk (for example Bordeaux city) and to freeze growth at other locations considered to be at most risk. Furthermore, to ensure more protection for the areas considered to be at lower risk, natural flood storage areas are placed in the areas considered to be at higher risk of flood. Through PPRI (Predictable Flooding Risk Prevention Plans) areas most at risk of flooding are allowed almost no development and obtaining permission for what little is allowed is seen as a slow, cumbersome and inflexible process. Rural residents resent what they see as an unfair process where they are penalised for the protection of urban areas. This penalty involves not being able to develop their own land, which as discussed earlier was extremely unpopular and led to a lack of acceptance of the planning regulations, as well as having to accept floodwaters in order to protect urban areas. Inflexible regulations allowed planners no space to take account of local needs or individual circumstances. The process created disparity between areas and led to resentment and conflict.

This strategy, of relying largely on developing areas which are seen as safer whilst sacrificing areas that are seen as high risk, was felt to be too narrow in focus and overly restrictive. It could be argued that adherence to this simple spatial solution inhibits the creation of more innovative solutions to flood risk and prevents the promotion of new forms of resilience. It may even had the potential to increase risk, by increasing population and development in locations currently considered safe, but which may be at risk in the future. These problems may be compounded because areas designated as 'safe' are unlikely to plan for possible risks and so give little consideration to warning systems, evacuation plans etc. which could increase their resilience. It may also lead to the loss of flood knowledge or collective flood memory in some locations as risk awareness and knowledge held by the local population is displaced and dispersed through pressures to relocate to urban areas.

This conflict also plays out on a spatial scale leading to tensions between the local and the regional levels. At the local level, the mayors who are the elected local authority have to satisfy the local population needs of a growing city through economic growth but they are also obliged by the core



regional power to implement the PPRI regulations. Yet they see regional PPRI regulations as constraining this growth in an unfair way as it limits growth only in certain rural locations. They are then not disposed to become involved with FCERM planning. As can be seen in more detail in further sections these tensions between urban and rural, local and regional do not promote dialogue and community engagement which is a key aim of EU policies and seen as a key factor in the promotion of community resilience.

The concept of resilience

Across the locations many of the interviewees had not come across the term resilience. Even where the term was recognised understanding was often very limited. It seems that the idea of resilience has yet to make much impact amongst planning practitioners. In Santander it was not incorporated into the system and resilience was described as not being on the agenda and there were no documents found which used this term. In the Hel Peninsula only two respondents had heard of the term but could not discuss it any detail. Similarly in Bordeaux only three out of the eight interviewees knew the term. In Devon, although interviewees were not asked explicitly about resilience only one interviewee from the Environment Agency (EA) used the term, suggesting that it is not widely used in spatial planning. The EA employee is likely to know the term through EA work, such as flooding, where the term is widely used. Given that the term resilience is used widely in the hazards or disaster literature and widely incorporated into emergency/disaster policies at the international (UN) and national levels it is perhaps surprising that it has made so little impact on spatial planning. In such a situation, where a complex, multi-faceted concept such as this is almost unknown, it is likely that at best there will be a simple 'laypersons' understanding applied.

In Bordeaux a narrow view of resilience had been adopted, reducing this complex multifaceted concept to one of resistance. This has led to a narrow focus on specific areas, such as Bordeaux the city and a policy of encouraging movement to the areas considered safe. There is then no consideration how the 'at risk' areas might be made more resilient as the strategy is largely one of abandonment. Neither is resilience, in the wider sense, considered in the urban areas as these have been designated as 'safe'. This policy has social consequences for the dwindling populations in the rural areas, not only a loss of communal links but also a loss of knowledge in coping with floods, both factors which may reduce resilience. There is also an economic loss, as the severe building restrictions impose an economic cost. The focus would appear to be on reducing vulnerability rather than promoting resilience, yet resilience is much more than an absence of vulnerability. The strategies used here suggest a rather narrow or simplistic understanding of the concept of resilience (which as the large and increasing literature illustrates is a complex multi-faceted concept). Some of the current difficulties could perhaps have been avoided if a wider understanding were incorporated, which recognised for example the social and economic aspects.

Community engagement/stakeholder engagement

The move to greater community or stakeholder engagement which is impacting on FCERM can be seen across a variety of EU policies over a number of years. Indeed a range of policies at international and national levels have stressed citizens' rights to be involved in environmental decision making and more recently in flood risk management e.g. the Aarhus Convention (UNECE 1998); the UN 1992 Conference on Environment and Development (UNCED) and the global action



plan Agenda 21; the EU Water Framework Directive (2000/60/EC); the 2005 Hyogo Agreement; the Floods Directive (2007/60/EC Art10) and the Flood and Water Management Act 2010 (for England and Wales)). Community engagement became an essential part of Flood Risk Management (FRM) policy in the UK. In the recent incorporation of FRM into the National Flood and Coastal Erosion Risk Management Strategy (Defra/EA 2011) the need to re-engage communities in the risks they face and the choices that affect them has again been stressed. Similarly spatial planning in EU countries should be conducted to the Aarhus Convention principles of 'good governance', making openness, participation, accountability, effectiveness and coherence a necessary requirement for decision making. This requires much more than the provision of information or formal consultation processes. Despite this community engagement is not effectively used across all the case study locations. Some interviewees suggest it is still little more than a consultation exercise and it may be seen as unnecessarily slowing the system

The two terms discussed here, community engagement and stakeholder engagement, would appear to be used in different ways by interviewees. The terms may refer to engagement with 'the public' or residents who will be affected by planning regulations or it may refer to engagement with 'stakeholders' who hold some kind of position or power (either formal or informal). There seems to be some suggestion that community engagement is associated with 'ordinary' residents whilst stakeholders are those with a particular view to represent but this is by means fixed and they may be being used interchangeably. Further research might usefully try and explore the differences and similarities between the two types of engagement and how the terms are used.

Interviewees in Devon were to varying degrees familiar with and used a variety of engagement processes and these are discussed in some detail shortly. Within the other locations there was less experience of community engagement and it was often seen in negative terms, as the processes were not felt to work effectively. For example interviewees in Bordeaux undertook some form of community engagement but they found this difficult due to the anger within rural communities at not being allowed to build or extend their properties and having to accept flood water so that designated urban areas could be protected. Interviewee 7 also suggested that the only consultation that does take place is essentially a sham where the deal is already done. "There is no consultation, except a so-called consultation with the DDTM officials and the disaster and emergency services. We meet with them but the decisions are made". A situation that is known to lead to disillusionment of those consulted and is far short of the ideals of genuine engagement. Varna in Bulgaria shared similar problems, although arising from a different cause. A lack of trust in the authorities, and scepticism of the benefits of taking part had led to reluctance on the behalf of citizens to engage in such processes.

Some interviewees in Bordeaux felt that the consultation process was not wide enough. As the process focused on the mayoral scale it was said not to adequately integrate citizens, hunters, chambers of commerce, businesses or farmers. Another difficulty experienced in Bordeaux was the rapid turnover of certain key stakeholders. "The government officials, as stakeholder in regard of the flood risk, are turned over all the time. As soon as they begin knowing the area they are moved somewhere else or they have advancement" (Interview 5). Despite the current difficulties experienced in carrying out community engagement, a number of interviewees felt that community



engagement when carried out effectively could play a useful role. In Bordeaux for example it was believed that more community engagement could lead to a wider range of possible solutions being discussed and so more account being made of social and economic factors which are currently inadequately considered. It was also argued that a wider involvement of stakeholders would prevent solutions from being imposed from above.

The current difficulties in Santander, Spain where a lack of current coherent legislation makes the planning process incredibly fraught and slow made it very difficult to effectively engage stakeholders. Interviewees believed that public participation has some value but current regulations made it too complex and therefore too slow. There are a number of stakeholders who must be involved in the process of creating new planning tools. These were felt to be too numerous and a lack of effective coordination further slowed down the process of creating an up to date land use plan for the municipality. A recent example serves to highlight some of the issues encountered.

Earlier this year (2012) the Santander Plan was approved by the town hall after ten years. However, when the document was sent for final register and approval by the regional authorities they decided to consult airways authorities which had produced their specific document but hadn't submitted it in time. New and unexpected modifications then had to be introduced, fortunately these were minor and no public exhibition was needed and everything was solved within a month. If another exhibition had been required this could have taken another six months, something that has occurred at least four times in the last four years. Given the current problems in attempting to produce workable up to date legislation it is perhaps not surprising that stakeholder engagement is not given a high priority. It would seem that in some locations community engagement has yet to make much impact, is poorly understood, and there are few people with the relevant knowledge or skills. There certainly seems to be little that could be considered innovative. However in Devon in the UK there was a wider experience of using community engagement and therefore a more detailed analysis was possible.

Three emerging ideas were identified from the discussion of methods of stakeholder engagement in Devon. The first relates to the role of spatial planners within the planning process and there is a view that a planning team comprised of more than professional planners, leads to a more mature and open debate and higher levels of trust. A second idea which might be identified is the challenge of creating and sustaining engagement with local communities which is appropriate to the long-term nature of the risks of FCERM. Two issues are touched on here by individual interviewees: the need to broaden the generational base of the members of the public engaged and the need to increase awareness of longer-term risks. It was thought that improving the first issue might facilitate improvements in the second. The third and related idea is the problem of increasing local communities' sense of ownership of the planning process; addressing the challenge of helping communities to buy into those planning processes which are beyond the very local spatial scale and the very immediate temporal scale. There seems to be no real professional or scale-focus driver among the interviewees in terms of these opinions. One interviewee raises a point about the important of ensuring quick turnaround and feedback to stakeholders during an engagement process.



The interviewees agree that although deliberation might occur at plan development stage, conflicts can and often do resurface at the implementation stage. Three perspectives are offered on this by different interviewees: 1) they are a result of problems in the engagement process; 2) planning processes are constrained to suffer this problem as specific details (often the basis of conflicts) are not often available when plans are deliberated and 3) raising conflicts late might be a tactical response of stakeholders to exert pressure on the decision-making process.

In response to a question about examples of where planning permission processes failed, two ideas can be identified. The first relates to the importance of a good planning framework. This is directly interpreted by one of the interviewees as being a 'strategic framework' and he highlights in his view the mistake of moving away from RSS (Regional Spatial Strategies). The second relates to constraints exerted by the complexity of the planning process; the amounts of bureaucracy, and particularly the levels of information and documents required to be submitted when there are FCERM issues at stake. Two perspectives are given on this second point; one raised by two of the interviewees is that developers and applicants find bureaucracy frustrating due to cost and difficulty of reading and understanding requirements, another individual perspective is that slimming down the process would create a leaner, more efficient system. Both strong comments on this point came from local planners. There were a number of other broad points on challenges raised by individuals: the difficulty faced by planners in managing the process of decision-making when a very well-resourced and 'determined' application is made; the reality of the UK psyche 'being precious about the coast'; and the fact that risk assessment for FCERM requires a broad range of information on very specialist areas to be submitted and that this can mean that the costs are considered by applicants to be prohibitive.

Scenario analysis and envisioning

Given the situation described above where the use of community engagement could be said to be at a relatively early stage of development, and in some locations is functioning very poorly, it is perhaps unsurprising that the use of visioning tools or scenario analysis was very limited and not well understood by the spatial planning community. Only one interviewee in Devon, a non-planner working in regional scales and with Shoreline Management Plans, spoke at any length regarding 'visioning processes'. The remaining interviewees in Devon could see a potential role for scenario analysis, but concerns were raised about having sufficient expertise and resources. In the Hel Peninsula, Poland some interviewees acknowledge the need to approach long term development issues more creatively, but to date scenario analysis and envisioning had not been used in planning in the case study area.

Resistance to change, coastal identities and flood memory

This section covers a number of complex and related ideas. Broadly speaking the presence of flood memory (relatively recent flood experience within the community) is seen to facilitate change whilst an attachment to a particular view of the coast is understood to lead to resistance to change. The coast is understood as a special place, which people may feel particular attachments to and have specific visions of how it should be, although different groups within society may hold different visions. Mobility is generally understood to lead to loss of flood memory and so may be one cause of



a reluctance to accept change or to lead to a collective loss of understanding in how to cope with floods. These issues highlight the importance of what might loosely be called the social aspects of resilience.

Interviewees in Devon were in agreement on the difficulties of obtaining acceptance of change from coastal communities. All the interviewees held the view that individuals, as well as societies, are simply resistant to change. From the discussions, a number of reasons contributing to this resistance were identified: each raised by an individual interviewee. One reason relates to the perception, and perhaps fears of coastal communities, that the essence and nature of the environment (which is highly valued) will be lost, especially in terms of the development of coastal areas. The interviewee who raised this issue associates this view in particular to those who have moved to the coast from large cities, often for the 'lifestyle' it offers. This reluctance to change was also seen as a national characteristic; "as a society we are very precious about our areas of open coast. It's part of the psyche of the UK, we're an island nation" (Interview 3). Another interviewee suggests that the inadequacy of decision-making processes places individuals in a context in which they have 'an impossible decision' to make i.e. lack of forward planning means individuals can invest in property in high risk areas and in this context, resistance is naturally to be expected. A third rationale for resistance to change is the focus on comparatively short-term timescales. The problem of short-term scales was associated by the interviewees to both the process of spatial planning (the spatial planning process working in relatively short timescales) and to individuals and communities living in coastal environments who find it difficult to think in the long term. For this latter issue, the point was made that it is the short-term memory (5-10 years) of individuals and communities that drives much of their expectations on their environment.

Resistance to change may take a number of forms, for example in Devon there was an example of residents' resistance to a local landmark which was understood to play a key role in the creation of the place as somewhere special. The following quote from Interviewee 5 highlights the different priorities of the community and the professional with regards to what is important and the timescales at which they focus. "The [place name] example is a great one, where we had a Victorian promenade, it's there in place, they're all obsessed, it must stay there, this must be there, this is what makes the community. 250 years ago there wasn't a community, it was sand dunes ... it's a problem all over, people are just used to that little bit of 5, 10 year memory, what's in it will drive a lot of their expectations." In the Hel peninsula interviewees felt that the local community was not ready to move beyond their traditional image or identity. This was believed to be due to the fear of a loss of a way of life, which has some resonance with the Devon findings, but also because it may threaten tourism and therefore be economically disadvantageous. There were however some examples of tourism business adaptation strategies such as investment in natural phenomena as visitor attractions and the creation of cycle tracks, which would suggest that some forms of change are possible.

Flood memory, or more usually the loss of flood memory is raised as an important issue in accepting change. Amongst interviewees in Devon it was generally felt that there was insufficient flood memory or that it was being lost or that people were not listening to those older members of society who held such memories. Providing visual evidence of previous events was seen to help persuade



people of the risk; “If you’ve got an old picture of an area under water and you superimpose their house on it, it works” (Interviewee 3 non-planner). In Bordeaux it was feared that the risk culture and local knowledge about floods would be lost as policies transferred risk and displaced the population. One interviewee felt that newer members of a community were not seen to understand flood risk in the same way as those born there; “the new population do not integrate the same risk culture as the persons born in the community” (Interview 6). Generally the presence of flood memory was seen to lead to desired behaviours and flood memory was associated in a straight forward way with recent flood experience.

Uncertainty

This is a theme which comes up in a number of different contexts. Uncertainty is difficult to deal with and generally causes problems where it exists. It is not possible to remove all uncertainty, there is always some uncertainty in risk for example and climate change issues tend to have high uncertainty levels. Views on how this should be put into the public domain varied. Interviewee 7 (a County Council member) in Devon accepts that whilst there is a degree of uncertainty there is sufficient statistical certainty to put data into the public environment. He suggests that the best available information should be used to impact the planning process. He argues the need for a competent professional to explain the issues and the uncertainty in the data to local communities. He does not believe that information should be simplified but rather effort should be expended so that the public can understand this information. In fact he claims that is only “fair to give everyone access to as much information as possible” (Interview 3 non-planner). Interviewee 8 in Devon raised the issue of how data is understood by those within the planning system; she believed that the Regional Planning Groups discussions with experts had enabled them to effectively interpret the data. This makes the important point that who is ‘expert’ is context dependent. Those within the planning system are likely to benefit from expert advice as well as those in the ‘community’.

In contrast some types of uncertainty arose from problems within the planning system. For example in Santander, Spain where the current system lacks coherence and stability there is uncertainty within the system. When submitting a plan it is not possible to know whether there are additional steps because at each stage new contingencies may emerge that will introduce additional procedural steps, so that it is impossible to know when and if the submission is complete. This has led to loopholes which are being exploited by private companies for profit. Those working within the system found it extremely frustrating. It has also led to a loss of faith in the planning system amongst the wider public.

Direct questions related to managing uncertainty and the spatial planning process in Devon led to a relatively substantial discussion, although the responses were quite varied in nature across the interviewees. A number of themes could be identified. The first idea expressed by a number of interviewees is that uncertainty is part of the reality of spatial planning; it is a fact of decision-making that spatial planners are used to and have regard to. It is worth noting however that one interviewee – a local planner - contradicts this statement. He informed the interviewer that up until recently, he’d taken information regarding flooding, flood zones etc. provided by the EA as ‘100% accurate’. It was only a recent revaluation of this information by the EA which had led him to realise



the information's uncertain nature. This reinforces the earlier point made about the value of expert advice to planning teams.

Secondly coastal erosion emerged as important topic when discussing uncertainty and specific references were made in three cases to the National Coastal Erosion Risk Mapping exercise. Interviewees felt that uncertainty has been relatively much higher for coastal erosion than for flooding but that recent monitoring has increased confidence in the available data. A final and third idea concerned the value of short-term planning permissions or 'time-limited developments'. Two interviewees viewed short-term planning permissions as a tool that is working well for modest planning applications. It might be interesting to note that both of these interviewees were non-planners. One of the interviewees' response suggested such short-term planning permissions were proving useful as they are a tool that planners could 'readily get a grip on'. A number of the individual points made by interviewees are interesting. As discussed earlier one interviewee (non-planner) relates uncertainty to the issue of fairness, that is fairness in providing access to information as well as fairness in access to guidance on how the process of how information is calculated. Another interviewee (again non-planner) makes one of the few direct references to resilience in relation to the issue of uncertainty arguing that designing for the extremes is very important to building in resilience.

Conclusions of ground testing

Although there was considerable variation across the case study locations it would appear that FCERM is not yet well linked into spatial planning. Awareness of relevant EU directives, policies etc. was also limited. Even where awareness was higher these were not felt to be well linked to the spatial planning process. Linkages between scales were generally viewed as problematic. The adoption of relevant EU policies was seen by some as a burden, and some locations were already struggling to create up to date and coherent planning systems. In such situations adopting the relevant EU legislation is likely to be difficult. However, some of those interviewed also saw it as a possible solution to some of their current problems, if it could be implemented adequately. Bordeaux provided an example of how integration between FCERM and planning need not necessarily produce positive outcomes. Approaches to integrating FCERM need to be applied carefully, weighing up costs and benefits and considering carefully how it will impact on various groups.

Conflict or tension proved to be an important theme, particularly in Santander and Bordeaux. In the former inconsistencies within the planning system were being exploited by private companies, so that public and private were opposed, with private gain benefitting to the detriment of public good. In the latter rural and urban had come into conflict, through a policy of allowing development only in the urban areas whilst sacrificing the rural ones.

The concept of resilience has yet to make much impact within spatial planning teams; most of the interviewees had not heard of the term or knew very little about it. It was certainly not appreciated as a complex and multi-faceted concept.

The extent to which community engagement was used was again very varied. In some locations it was at best a consultation exercise where 'the public' had no real decision making power. In the UK



example community engagement was more widely used and appeared to involve a genuine engagement. Even here however techniques such as visioning or the use of scenarios were not well known or widely used.

There was some awareness of the importance of the identities of coastal regions as special types of place and a discussion of the important role of flood memory. However, this understanding was relatively limited and generally people were seen as opposing change of any sort, unless perhaps they had recent experience of an event such as flooding. A more nuanced approach, where attempts are made to understand what people wish to preserve and why, may open up some aspects for change or enable planners to allay fears.

Uncertainty caused difficulties in two respects. Understanding and dealing with uncertain data could be difficult for both those within the planning system and the wider public to understand. One solution offered to this was an investment in suitable experts who could effectively explain this type of data. Another problem with uncertainty arose when the lack of coherence and stability within the planning system meant that it was impossible to know when a submission was complete. This was extremely frustrating within the system and had led to a loss of faith in the value of planning by the wider public.

To conclude there was very wide variation found across the case study areas. There is obviously some way to go before FCERM is effectively integrated into the planning system. The majority of interviewees raised problems rather than offered solutions. However, identifying these barriers is the first step to removing them. A number of the interviewees were hopeful that EU legislation could be helpful and that greater integration would lead to positive changes.

LAND USE PLANNING AS A MITIGATION OPTION INCLUDED IN THESEUS' DSS

LAND USE PLANNING AND THE SPRC STRUCTURE

This section considers the source, pathway, receptor; consequences model and how it relates to spatial planning and urbanisation. This section highlights the potential that spatial planning has as a mitigation option rather than providing evidence of how it currently operates. As the ground testing revealed there is considerable effort still needed to incorporate FCERM effectively into spatial plans. Therefore what the following offers is a discussion of what may be achieved when some of the highlighted barriers can be removed.

Spatial planning is primarily concerned with the idea of exploring and making changes with the nature of the pathway, receptor and the consequences rather than with the source. Urbanisation and spatial planning do not affect the source, except perhaps marginally in the creation of urban 'heat islands' that might exacerbate storminess and hence flooding. There is some potential to influence the pathway through the creation of 'green areas' which would allow the flow of flood water or by the development of structures which inhibit the flow.

Where spatial planning and urbanisation are likely to have most impact is through changes to the nature of the receptor. It is developments at the coast that alternative mitigation options seek to protect. Spatial planning offers the potential to reduce or prevent growth in areas most at risk and



so reduce potential exposure. It may also be used to change the nature of buildings in a risk area so that they are more able to withstand and recover quickly from floods. This may be through physical measures or through changing use, for example moving key functions to higher floors. There may also be an affect at a communal level as spatial planning could perhaps be used to influence where to locate essential services such as water, gas, electric, transport, hospitals and other emergency services so they are less likely to be interrupted by flooding or similar events. Planning could also be used ensure the provisions and maintenance of suitable evacuation routes. It may also be possible to ensure that large communal buildings, which might for example be used as rescue centers, are suitably sited.

All of the above have the potential to change the nature of the consequences. There is potential for changes that lead to the following:

- Fewer people to be exposed to the risk
- Fewer properties exposed to the risk
- More people to be safely evacuated in the event of an incident
- More essential services to be maintained during an incident
- Quicker restoration of essential services where they have been disrupted
- Quicker recovery times in restoring buildings and infrastructure to their usual use

INCLUDING LAND USE PLANNING WITHIN THESEUS DSS

This work is included in the development led in the course of WP5.

LAND USE PLANNING AS A RESILIENCY ENHANCEMENT LEVER

The following section discusses the ways in which spatial planning may be used as a resiliency lever, drawing on the 2010 paper by Wardekker et al which aims to operationalise a resilience approach. The findings from the ground testing of the option of incorporating FCERM into spatial planning, which were discussed in the previous section, are considered in relation to the suggested resilience principles of 'Homeostasis'; 'Omnivory'; 'High flux'; 'Flatness'; 'Buffering' and 'Redundancy'.

These principles were found to have relevance at two different levels in relation to spatial planning. Firstly they may apply to the desired spatial form of an 'at risk' region, for example open spaces may provide a 'buffer' against a disruptive event and so increase resilience. Discussions of these aspects by interviewees were relatively limited, due to lack of effective integration of FCERM and in some cases the current difficulties within the planning system. However, some examples of what may be achieved through spatial planning are given for each principle (largely from Wardekker et al.'s research with practitioners in Rotterdam).

Secondly the resilience options may apply to the way in which FCERM is incorporated into the spatial planning system (e.g. through governance structures) and the ways in which spatial planners engage with 'at risk' communities to secure spatial planning changes. These tend to relate to social rather than physical features. For example poorly incorporated FCERM principles were found to lead to social conflict, whereas the 'homeostasis principle' suggests that social cohesion will increase resilience. It is this social aspect that has proved most fruitful in the ground testing and therefore



these aspects are discussed in greater detail. The remainder of this section takes each resilience principle in turn, briefly outlines what it entails, and then discusses it in relation to both of the levels discussed above.

HOMEOSTASIS

This “involves incorporating feedback loops that stabilise the system to external perturbations” (Wardekker et al 2010:992). It may also relate to the removal of feedback loops which lead to instability.

Considering spatial form the road system could be designed to enhance the removal of water from the area in case of flooding. Flexible structures and infrastructure would provide a stabilising feedback as well. Flexible flood defences (e.g. small scale ‘flood beams’ and large scale flexible storm surge barriers) could be closed when necessary, while not preventing access at other times. Critical facilities, such as the crisis management centre, could be made mobile. As yet FCERM doesn’t appear to be sufficiently incorporated into the planning process for these to have been seriously considered within the various planning systems.

These feedback loops also apply to social systems. For example Wardekker et al discuss how unclear responsibilities may inhibit effective feedback loops or how social cohesion improves feedback loops and can produce more effective collective effort in the face of a threat. This aspect of homeostasis has a bearing on a number of the topics discussed earlier.

In the section considering issues of conflict or tension between groups two examples were discussed where the planning system had led to a conflict. In Bordeaux the strategy of concentrating growth in particular urban locations whilst restricting growth in rural ones led to a tension between those residing in urban and rural areas. Such tensions clearly inhibit social cohesion and therefore the potential that collective responses may have for increasing resilience. It was also feared that the movement of population from rural to urban areas, and the dispersal of previously cohesive communities, along with the dispersal of their collective flood knowledge or flood memory, would lead to a loss of resilience amongst the population. In Santander the problems within the planning system had led to a situation where the public and private spheres were opposed. This was believed to lead to a loss of resilience as public good lost out to private gain.

The issue of community and stakeholder engagement proved to be an important one in the ground testing. It is clearly seen as a key strategy not only in FCERM but also much wider and there is considerable pressure from international levels downwards for its more extensive use. Effective engagement is also likely to be an important factor in securing spatial planning changes which can enhance resilience. Genuine participatory engagement relies in part on effective feedback loops, so that all those involved are informed and can feedback information into the system. In this case the emphasis is not necessarily on a return to previous conditions but effective change to ensure future resilience. In some instances the routes or methods to provide feedback were too slow and cumbersome.

For example in Santander the large number of stakeholders and a lack of effective coordination were found to slow even further an already cumbersome process. It is clearly important to ensure that



effective feedback loops are in place. Simply demanding more community engagement has not been sufficient. Poorly executed engagement, where participant views are ignored, or are slow to be heard tended to lead to cynicism about the value of the process on both sides. In Bordeaux it was recognised that the wider input that effective stakeholder engagement can bring should lead to a wider input of views (more effective feedback loops) and therefore a broader understanding of resilience. It was hoped that this would encourage a more effective range of measures and therefore enhanced resilience (social and economic as well as physical).

Many of the interviewees believed that local people were simply resistant to change. This may be seen as positive in that it indicates residents' commitment to a location and a level of social cohesion which facilitates the ability to respond collectively to threats. However, it may have a negative impact where spatial planning changes intended to increase resilience are being resisted. In this situation the local population's feedback loops would appear to be successful in stabilising the system. Yet what is required is a change in the system. This would suggest some modification is required to the system of feedback, perhaps the input of new information to persuade participants' of the future threat and the benefits of change. This may relate to 'high flux' in the form of having high quality information available to people in a format they find acceptable (it may also involve omnivory – having information available in different forms). Maybe the feedback loops could be widened to incorporate the planners and others views more effectively.

OMNIVORY

This is where there are several different ways of fulfilling one's needs, so that if one becomes unavailable another may be used. This provides a diversification of resources and means. It is similar to redundancy (discussed shortly) but it entails having multiple *different* approaches that may be used alongside each other, rather than multiple copies of a single approach. In terms of spatial form this may be achieved by planning which allows for existing functions to be relocated to other spaces/buildings so that multiple locations can fulfil the function. Or to have flexible spaces which may be used for different functions.

Omnivory may also offer a solution to some of the problems of uncertainty. Uncertainty was a theme that arose in a number of contexts. Generally uncertainty was seen to cause problems. One example was the difficulty found in understanding and conveying uncertain information, such as that related to risk and climate change. Omnivory may be one solution in that the information could be provided in a range of formats, so that hopefully it will speak effectively to a wide range of people. During the ground testing the use of experts to explain and communicate uncertainty was suggested both within planning teams and to advise the public. This suggests that omnivorous planning teams may be more effective rather than those based on narrow specialisms. Such experts are also likely to be able to provide information in suitable formats for both those within and outside of the planning team.

HIGH FLUX

High flux allows for rapid responses to threats and changes. This could for example be achieved through shortening the planning horizon for buildings, and urban planning in general. For instance, one could plan for houses to be replaced after 30 years rather than 50; thus ground level can be



elevated/modified more quickly. This can be combined with a ‘cradle-to-cradle’ approach and the use of modular elements in buildings; building a “rebuildable city”. If elements of constructions could be reused or deconstructed and later rebuilt, the area could be modified relatively quickly, and at lower costs, to accommodate changing conditions. The planning process could include easy-to-modify land-uses in areas where future changes may be needed.

High flux does not only apply to changes in the built environment it is also about the flow of high quality information. FCERM was found to be very poorly integrated into the various national planning systems. There was relatively little knowledge of the various EU regulations and how they would apply to spatial planning. This would suggest a lack of information flow. Similarly the lack of awareness of the term resilience and understanding of what it means amongst the interviewees involved in spatial planning suggests poor information flow as does the lack of knowledge of good practice in terms of community engagement. Further research is needed however to see where the blockages occur and how these may be overcome.

Something is preventing the knowledge that exists at the theoretical level in spatial planning and in aspects of FCERM from EU to national level from effectively reaching spatial planning practitioners. However, when considering human systems the issue is more complex than the simple provision of information. For example the information may be provided but ignored, not understood, forgotten or rejected. There may be many reasons preventing new ideas or information being incorporated. In Santander for example, where the planning system appears to be in crisis, it is not surprising that additional information or burdens that are not seen as core functions receive little attention. Lack of information could also lead to examples of spatial planning regulations being avoided. In Varna the reliance on personal relationships, and therefore a lack of transparency, or information flow, had led to illegal buildings in the coastal protection zone and therefore a loss of resilience.

FLATNESS

This relates to the prevention of overly hierarchical or top heavy systems as these may limit the system’s ability to react quickly and flexibly, especially at the local level. It is argued that this would “reduce the flexibility, slow the response to disturbances and compromise the adequacy of responses” (Wardekker et al 2010:993). It is difficult to see how this may relate to spatial form but it does have some relevance for the more social aspects.

Flatness is a complex issue in this context. Within spatial planning a clear hierarchy is in place, and as discussed earlier, planning is influenced at a range of levels from EU to sub national. It is difficult to see how the system could operate without such hierarchies but it is also clear from interviewees that relationships between the levels are complex and links are often not effective (that is there is a lack of high flux). There is also some tension between the levels. For example in Gironde it was felt that there was too much emphasis on standardisation across Europe and not enough consideration of the needs of local people.

Top heavy hierarchies were shown to cause problems in some instances. For example a lack of genuine, participatory engagement, where power and responsibility is shared downwards with local people and stakeholders inhibited the development of community engagement. This was found especially in Bordeaux and Santander. In both cases it led to a distrust or disengagement with the



planning process. This makes it more difficult to achieve acceptance of planning changes which could ensure future resilience.

BUFFERING

This involves the ability of the system to absorb disturbances, at least to some extent. So for example certain non-essential low lying areas could be planned to serve as temporary water retention areas. The concept of 'water squares' is for example already being used in Rotterdam's water policy plans. In addition to buffering capacity against disrupting events, one could buffer against disrupting trends by leaving plenty of open spaces (parks, squares, etc.). These could change function relatively rapidly if the future situation would demand this, thus increasing the flexibility of the area's urban planning. Alternatively building can be built above a certain level or ground level assigned a less essential function such as parking.

Buffers were being used in Bordeaux, and certain rural locations were being allowed to flood in order to protect particular urban areas. However, this was not a solution that was socially accepted, which demonstrates the need to consider solutions in relation to one another and to look at social as well as physical impacts. Implementing one solution may cause a different problem and physical solutions which are not socially acceptable will have limited benefits at best.

REDUNDANCY

Redundancy is where there are multiple instances of something available, so that when one fails another may be used. For example there may be multiple routes in and out of an area, or multiple means to supply essential services such as energy and water. There could be multiple crisis-centres in different locations, and multiple access levels to buildings. This is an area where spatial planning has the potential to play a role, ensuring that such redundancies exist and that they are suitably located. Although it must be remembered that there is a cost to building such redundancies, and the benefits and impacts of various solutions must be weighed.

In terms of implementing spatial changes redundancy could be considered in relation to community or stakeholder engagement. For example rather than relying on a single contact person within the community/organisation or within the spatial planning team several persons could be trained to take on this role. In this way if one contact moves on or is temporarily unavailable a route to communication is still available. A rapid turnover of staff in stakeholder organisations was mentioned as a problem by several interviewees during the ground testing and redundancy is one means by which the problems this causes could be ameliorated.

SYNTHESIS : GUIDELINES FOR IMPLEMENTATION

Incorporate a more complex understanding and use of the concept of resilience into working practice.

Currently, amongst interviewees, the concept of resilience was almost unheard of and certainly not well understood. There is a need to ensure that the planning system 'on the ground' uses a more complex, multi-faceted approach to resilience. They would need to consider the impacts of actions on the various forms or types of resilience. It may be that no



solution addresses them all, it may be a question of weighing up options, but at least they would be making decisions based on a fuller understanding of the consequences.

The concept of resilience is being used at the theoretical level in planning and in relevant areas such as flood/disaster related research. The issue is how to ensure it is being used by planning practitioners. In the UK for example resilience and community resilience are being incorporated into 'emergency management' as can be clearly seen in the Cabinet Office's approach. It is also being used by the EA in relation to non-coastal flooding. It is likely that there are similar examples in other countries. Perhaps existing knowledge and experience in other sectors can be harnessed. How this is to be achieved needs further consideration.

Spatial planning should learn from and make use of the existing knowledge and expertise that already exists on community engagement and visioning processes.

Community engagement is a key strand of much EU thinking, not only for planning and FCERM but much more widely. There therefore exists a wide range of expertise in this area that could be usefully harnessed. This would avoid costly mistakes, build on existing skills and knowledge, and is potentially a relatively inexpensive way to meet a key requirement.

In particular efforts must be taken to ensure that engagement is a genuinely participatory process. Token forms of engagement, which do not move beyond simple consultation, may lead to cynicism, loss of confidence in the planning system, avoidance of planning regulation and conflict.

Planning teams should be comprised of more than professional spatial planners

This offers one possible solution to implementing the first two suggestions. There is also an example from the interviews which illustrates how resilience building could be substantially strengthened by widening the professional basis of planning teams. The ground testing also highlighted the usefulness to the planning process of having non-planners within the spatial planning team. Interesting and useful comments relevant to resilience building and spatial planning were made by the non-planners interviewed also suggesting external views could be helpful. This has the potential to address a number of problems faced. Teams could for example include expertise on conveying complex and uncertain information (e.g. future flood risk), expertise on participatory community engagement or experts in 'resilience'.

More focused and comprehensive training and capacity building needs to be developed for planners to improve their understanding about the nature of hazards and the role of land-use planning in reducing hazard risks, and to ensure that hazards are 'mainstreamed' into their daily work (Glavovic, Saunders and Becker, 2010).

This may not be an especially innovative point but it has been raised as important by interviewees and addressing this factor could make significant contributions to a more innovative interface between spatial planning and FCERM. The evidence from the Devon interviews strongly links the need for capacity building to the concept of leadership for innovation. This could also to some extent address the point above about resilience, as this could be built into the training.



Use special coastal zone designations to create momentum for resilience building

This guideline relates to the importance of coastal zone designations as a signal in the spatial planning process of the uniqueness of coastal areas. The fact that ICZM does not have effective links to spatial planning was a clear message to emerge from the interviews. Creating a special designation(s) might be one practical means of facilitating more focus on coastal issues. There is some evidence from Devon that that such a designation can create momentum to work with local communities for new, innovative ideas.

‘Climate Proofing’ spatial development would strengthen links between FCERM and spatial planning.

As an interviewee in Devon highlights it is problematic that spatial planning processes rarely take into account the extreme event. Along with a number of interviewees across different locations they stress the tension between spatial planning with its growth and development focus and FCERM. Birkmann (2007) argues that Environmental Impact Assessments (EIA) used in spatial planning focuses primarily on the project-environmental impact chain and do not focus on the consequences of environmental change for the project. However, to do this would require an improved evidence base.

Create ways for planners to incorporate a more nuanced understanding of place identity, collective memory and how these relate to resistance to change. This should be linked to community engagement processes and visioning.

Collective memory (shared accumulated experience and history) can be an important constraint to building resilience. This is directly related to the practical work of spatial planning e.g. landscapes locked into particularly identity; the social memory of communities, networks and key actors creating and maintaining identities of the area. The spatial planning process could significantly contribute to resilience building by creating new ways of exploring memory and linking this with visioning processes – making links between ‘backwards’ and ‘forwards’ thinking as one interviewee in Devon suggested.

Conversely collective memory may also enhance resilience and its loss can be a problem. A better understanding of the processes involved could enable the spatial planning process to build on and enhance existing resilience. There is a need to move beyond the view that people don’t like change. A more nuanced approach to understanding attachment to particular places might reveal which aspects are most valued and reveal those where change can be made. Existing literature on this topic could be drawn on to find ways of making this accessible to planning teams. Alternatively external experts could be used.

Consider further how flexibility and variation may be incorporated within the planning system

Many interviewees raised the need for flexibility. This related to a number of issues raised. Firstly in Bordeaux, France the rigid inflexibility of the FCERM policy was seen as one of the main reasons for the tensions created and why people were prepared to build illegally. Secondly, if community engagement is to be taken seriously and people genuinely involved in the decision making process then some variation in outcomes is to be expected. Thirdly if



there are to be innovative solutions this would suggest going outside of the normal procedures. Finally if the longer term and extreme events are to be considered this is likely to require changes to the current system

The TE2100 Flood Risk Management Plan is an interesting example of a plan that is designed to be flexible enough to cope with various climate change scenarios. Led by the Environment Agency, the Thames Estuary 2100 project (TE2100) was established in 2002 with the aim of developing a long-term tidal flood risk management plan for London and the Thames estuary. Public consultation was used and comments received were fed into the final draft. The plan sets out our recommendations for managing flood risk across the estuary through to the end of the century. It sets out the strategic direction for managing flood risk across the estuary, and contains recommendations on what actions we and others will need to take in the short term (next 25 years), medium term (the following 15 years) and long term (to the end of the century). The plan is based on current guidance on climate change, but is adaptable to changes in predictions for sea-level rise and climate change over the century. Whilst this may not be directly relevant it illustrates that it is possible to plan flexibly for a variety of scenarios in way that takes local views into account.

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BUSINESS DISRUPTION AND RECOVERING: BUSINESS CONTINUITY PLANNING AS A MITIGATION OPTION (DENNIS PARKER, EDMUND PENNING-ROWSELL AND LORAIN McFADDEN)

GENERAL CONTEXT

The objectives of this chapter are:

- 1) to evaluate the feasibility of employing Business Disruption and Recovery (BDR) Planning as an innovative tool for managing coastal flooding risks, and
- 2) to present guidelines for business enterprises and related institutions which enable them to enhance their ability to recover from the potential impacts of coastal hazards in the future.

From the DOW the aim of the WT4.3 is to “investigate the role that innovative methods of managing business operations could play in reducing the impact that hazards such as flooding bring at the coast and in estuaries. The aim is to investigate how far these methods might minimise the need for (or the design standards of) the kinds of major coastal and estuarine defence structures that otherwise would be needed in the future with climate-change induced sea level rise”.

The paper has three principal parts:

- a) The 6 following sections which define BDR Planning and explore the concept mainly through a review of the literature;
- b) The four middle sections which present an analysis and discussion of ground testing field surveys in five study sites; and
- c) The last section which presents the ground-tested Guidelines.

BDR PLANNING DEFINED

BDR Planning involves designing or redesigning a business operation so that it is resilient (or more resilient) to the shock of a flood. BDR Planning is about making explicit contingency plans to minimise the human, physical and consequential disruption and loss which a flood can have upon businesses. It involves making organisational plans designed to anticipate, prevent and reduce the impact of a flood on a business and to enhance the process of business recovery so that disruption and loss is minimised.

In this case our focus is specifically upon flooding and coastal erosion but in many cases generic (i.e. all hazards) BDR planning is likely to have beneficial impacts upon flood disruption and loss potential.

The BDR Planning process

BDR Planning involves a number of key steps commencing with an assessment of flood and related coastal risks and ending with a learning and adjustment feedback process (Figure 9).

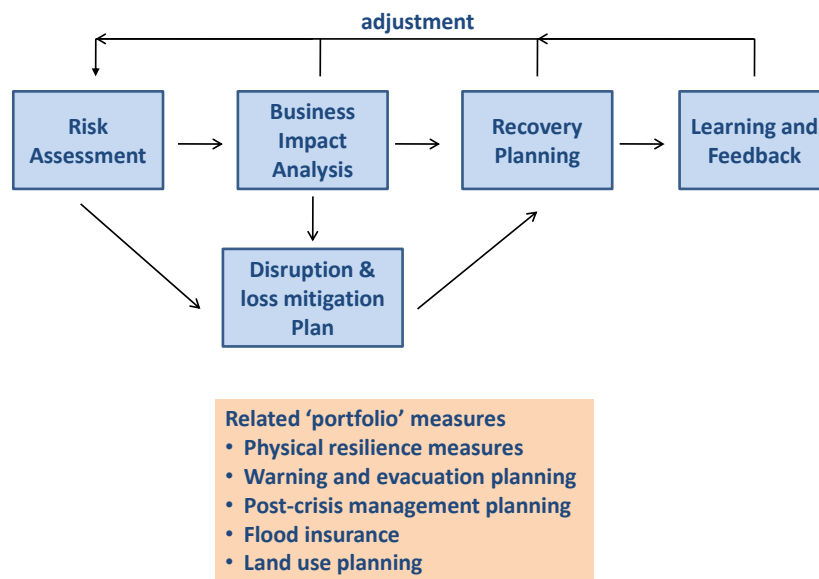


Figure 9: The BDR planning process

BDR Planning within a Portfolio of Coastal Risk Management Measures

BDR Planning can be intimately related to other innovative coastal risk management tools and may be profitably designed alongside them in a structured coastal risk management portfolio (Figure 9). The other tools which BDR Planning often sits most closely alongside are:

- physical resilience and resistance measures (which may be building or property specific or designed for a risk zone containing more than one property) (an example, is the flood proofing of a building by retrofitting it with flood gates and other devices to flood prevent water penetration), and
- flood warning and evacuation.

However, measures such as land use planning and post-crisis management, may also be integrated with BDR planning in various ways to mitigate the consequences of floods.

Related Concepts and Terms

BDR Planning, or aspects of it, is related to a number of similar concepts for which different terms are sometimes or even commonly used. BDR Planning is very similar to Business Continuity



Planning (BCP) which is the umbrella term which appears to be most used, for example in the UK, for a set of methods and techniques as well as for a promotional organization – the Business Continuity Institute. Like many others in this field, Snedaker (2007) includes disaster recovery (DR) planning in BCP and conceptualises BCP as comprising a number of steps: (i) risk analysis, (ii) business impact analysis, (iii) mitigation strategy development, (iv) business continuity plan development, (v) training and testing and (vi) business continuity of disaster recovery plan maintenance. But Business Continuity Management (BCM) or Business Continuity and Resilience Planning (BCRP) are also terms sometimes used. The abbreviation BCP is not especially new and comprises a well-developed cluster of standards and processes. However, evidence (see below) indicates that the application of BCP throughout Europe is likely to be uneven and, so for example, might exclude the recovery planning aspect of BDR Planning.

‘Crisis planning’, ‘crisis management’, ‘flood incident management’, ‘contingency planning’, ‘continuous functioning planning’, ‘emergency planning’, ‘crisis feedback planning’ are also terms that may be used by businesses and/or flood risk management and other related agencies (e.g. Trade Associations). In this paper we use ‘crisis planning’ and ‘crisis management’ as broader concepts than BDR Planning which is interpreted as a sub-set of crisis planning or crisis management.

BDR PLANNING – EVOLUTION AND INNOVATION

The **modern origins of BDR Planning** may be traced to Y2K preparations and the 9/11 (2001) terrorist attack which gave a major stimulus to develop a ‘resilience movement’ aimed at increasing capacities (institutional, governmental, societal, economic, business, individual) to absorb and adapt to hazardous events of all kinds. During the 2000-10 decade climate change concerns, the growing number of natural and na-tech disasters and a politically and economically less stable world, all added considerable impetus to BCP. Many businesses in Europe experienced some degree of disruption when the Icelandic volcanic ash spread across Europe disrupting business travel and freight movements and all businesses can be expected to have fire detection, alert and response plans in place if they have nothing else. In the light of the 2011 Japanese earthquake and tsunami, and following the Icelandic Ash Cloud events, businesses are now beginning to learn that a stable world can no longer be assumed and that planning for an unstable world is beginning to be very important.

The number of institutions (e.g. British Business Continuity Institute, an acknowledged leader in BCM and its certification) promoting BCP has grown rapidly; BCP is now a key part of Business School curricula and a range of detailed BCP standards are enshrined in ISO standards (e.g. ISO 17799 and ISO/IEC 27001 on information security) which have UK national counterparts (e.g. BS 25999 on Supply Chains and BS7799 on Information Security). Generally, however, although take-up of BCP has been growing it remains lower than is ideally desirable and sometimes untested by real-world events.

BC (i.e. Business Continuity) and DR (i.e. Disaster Recovery) planning has become routine in many medium to large businesses: the take-up challenge lies in small businesses where take-up is lower.

Innovation appears to come mainly in (a) the form of business impact analysis (here there are



branded processes and software) where there is scope for innovative modeling including scenario analyses, (b) within the particular BCP strategies developed by individual businesses faced with particular circumstances and where creativity comes into play, (c) in testing and evaluating the effectiveness of BC plans (including the application of lessons learned from real disruptive events); and (d) in ways of interfacing or integrating firms' BC strategies with those of related companies (e.g. supply chain companies).

NATURE OF THE MITIGATION OPTION THAT IS PROPOSED

OVERVIEW OF THE CURRENT GENERIC KNOWLEDGE AND LITERATURE BASE

A number of sub-disciplines contribute to BDR Planning knowledge including business analysis, business management, IT management, impact analysis, forensic accounting, litigation economics, forensic economics, crisis management, disaster management and insurance. Litigation economics is a particularly large field in the USA and is associated with the allegations that business corporations frequently make about their economic losses being caused by other business entities. There are a number of journals which both represent and reflect these fields including the Journals of: Contingencies and Crisis Management; Business Continuity and Emergency Planning; Forensic Economics; Legal Economics; and the Disaster Recovery Journal. Not surprisingly there is now a substantial BDR Planning literature which may be categorised in a variety of ways including that adopted for this study in Table 7. Because of the size of the North American business sector, much of the literature originates in the USA. Also the vast majority of BDR Planning knowledge is derived from business disruption other than from flooding (which is the 6th most common cause of disruption) and other coastal risks, although the most significant stimulus to BC and DR planning is natural disasters and extreme weather events closely followed by power outages (some of which may be caused by extreme natural events) (Figure 10). However, **importantly**, most of the existing knowledge is **generic** and is likely therefore to be generally applicable to flooding and other coastal risks in Europe.

HOW TO GO ABOUT BDR PLANNING

There is now a vast array of volumes and websites which are more or less step-by-step guides on how to go about BDR Planning. These either focus on BCP and BCM or closely related subjects including 'incident response', 'emergency planning' or 'disaster recovery' for businesses and often provide tips and/or 'reveal' secrets (e.g. Snedaker, 2007; Barnes, 2001; Hiles, 2011, Wallace and Webber, 2010; Osborne, 2007; Syed and Syed, 2003, Shultz and Shumway, 2002; Fulmer, 2005; Erickson 2006). These

Table 7: A typology of BCP and BDR planning literature and knowledge

Type or sub-area
How to go about BC/DR planning
<ul style="list-style-type: none"> - BCP process - Step by step guides



<p>Business impact analysis (BIA) for business continuity and recovery</p> <ul style="list-style-type: none"> - BIA process - How to undertake a BIA
<p>Business interruption losses</p> <ul style="list-style-type: none"> - Litigation/forensic economics - Flood loss estimation
<p>Studies of business damages and consequential losses and recovery</p> <ul style="list-style-type: none"> - Supply chain risk simulations - Input-output models - Post event industry surveys - Insurance studies
<p>Statistical surveys of BCP and DR planning take-up</p>
<p>Conceptual studies</p> <ul style="list-style-type: none"> - Flooding disruption - Resilience (also see C7)
<p>Further lessons from the ENSURE project</p>

volumes explain the BCP process in great detail and explain how to go about BC/DR planning. They often include guidance on risk analyses focusing upon threats such as electricity failures, natural disasters, manufactured risks, supplier risks, pandemics, viruses and hacking. Among other things they emphasise the importance of protecting and making accessible during a disruptive or damaging event items such as vendor and supplier lists, asset inventories, software asset lists, and identities and contact details of trained first responders. They also set out how to undertake BIAs and how to create recovery plans and how to maintain contact with virtual workers using VPNs. They explain uninterruptable power supplies, surge protection, the need to identify critical telephone circuits and to have a telecommunications mitigation plan. Some texts focus specifically on advice for small businesses (e.g. Childs, 2008). There are also texts which focus on crisis management in particular industrial sectors such as the food and

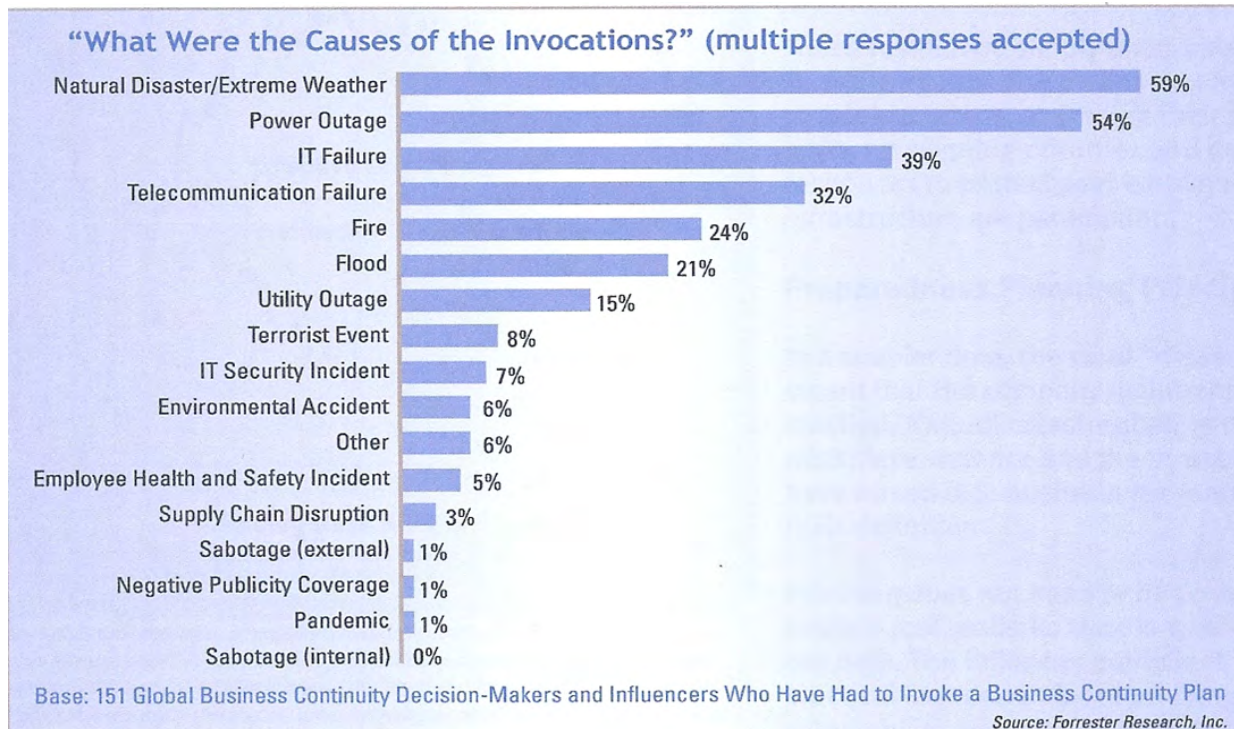


Figure 10: Causes of the introduction of BDR planning (Chase 2009)

drinks industry (Doeg, 2005) or the tourism industry (Glaesser, 2006). There are ebooks (e.g. http://ebookey.org/The-Project-Surgeon-A-Troubleshooter-s-Guide-to-Business-Crisis-Management_974596.html) and websites providing DIY advice on one or more aspects of BDR planning include:

<http://www.thebci.org/>

<http://www.londonprepared.gov.uk/businesscontinuity/>

http://www.direct.gov.uk/en/HomeAndCommunity/InYourHome/Dealingwithemergencies/Preparingforemergencies/DG_175927

<http://www.continuitycentral.com/feature0501.htm>

http://sbinformation.about.com/od/disastermanagement/Disaster_Recovery_Planning_and_Management_for_Small_Business.htm

<http://www.businesscontinuityadvice.com/>

Business Impact Analysis (BIA)

Most of the texts cited in section 4.1 include chapters on the BIA process. One of the most comprehensive of these is Snedaker (2007) who explains that there are four primary purposes of BIA:



- to understand an organisation's most critical objectives, the priority accorded to each and the timeframe for resumption after unscheduled interruptions of business;
- to inform management decisions about the Maximum Tolerable Outage (MTO) for each function;
- to provide resource information on a range of appropriate recovery strategies; and
- to outline dependencies that exist both internally and externally to achieve critical objectives of the business.

Identifying criticality in business functions is a key to BIA and Snedaker distinguishes between 'mission critical', 'vital', 'important' and 'minor' functions.

BDR Planning modelling and performance evaluation is part of BIA and focuses on a **detailed finding fault approach** to business recovery systems and the consequences of these faults prior to taking remedial action (Caesura, 2005). Some businesses cannot tolerate downtime. Businesses in the banking, financial services (e.g. credit card companies), power, telecommunication and health sectors are often responsible for critical data processes and systems. In some such cases, this criticality and minimum standards of service may be dictated by law so that continuity of compliance during a disaster is very important.

Measurement of business interruption losses

Gaughan (2009) provides a comprehensive discussion of a range of methods used by forensic accounting and forensic economics experts working for lawyers for measuring business interruption losses and related commercial damages. This field is concerned with (a) proving business interruption losses (Cerillo, 1991) and (b) determining or estimating them for litigation purposes (Gerald, 1995). Gaughan presents a methodological framework for measuring lost profits owing to business interruption and, for example, examines techniques of distinguishing between business interruption losses arising from disasters and background changes in revenues arising from economic recession, regional economic processes and international economic trends (Bonanomi et al., 1998). He makes the point that in the worst cases business interruption can lead to bankruptcy and/or companies not continuing to exist.

Another field in which business interruption losses are sometimes estimated is flood loss estimation and flood alleviation benefit assessment (Penning-Rowell et al., 2005; Meyer and Messner, 2005; Messner et al., 2006). Parker et al. (1987) created a formulaic method for estimating the indirect business losses arising from floods and developed a business interruption loss data set for the UK based on over 100 interviews with businesses either affected by flooding or located in flood risk areas.

Studies of Business Damages and Consequential Losses and Recovery

Business interruption studies may be categorised into four groups: a) supply-chain risk simulations, b) input-output models c) post-event business surveys, and d) insurance studies (Jain and Guin, 2009). The vulnerability of businesses to the disruption of the supply chain network has been demonstrated in many events. For example, the Taiwan earthquake in September of 1999 had an enormously adverse impact on the semiconductor industry. Hurricane Katrina and Hurricane Rita



caused huge disruptions in the energy market when they damaged off-shore platforms and petrochemical processing plants on the Gulf Coast. The impact of hurricane Katrina on the Gulf Coast's petroleum refining industry is examined by Kirgiz et al. (2009). The industry was forced to suspend operations for extended periods of time incurring substantial business interruption losses eventually triggering consequential loss insurance claims. Kirgiz et al. (2009) present a methodology for calculating refinery business interruption losses which takes into account the effects of the disaster on petroleum product prices.

Supply chain risk simulations model the uncertainty and interdependencies between different businesses in the supply chain network. These models assess the vulnerability of the supply chain and associated businesses (Deleris et al., 2004). The focus of supply-chain simulations is the assessment of the performance of a single business or group of businesses, whereas input-output models are used to model the impact of different events on the regional economy in terms of output of different industries, regional income, and employment (Rose and Lim, 2004). The Disaster Research Center in Delaware has undertaken numerous studies on the short and long-term impact of catastrophes on businesses. These studies have identified key variables that influence business disruption and recovery after disasters (Webb et al., 2002).

Business interruption studies in the insurance field examine the challenges in estimating business interruption exposure and losses from claims after an event. Using past financial data, a study by Foster and Trout (1990) describes different forecasting methods used to project business interruption losses for a business. Other studies (e.g. Swiss Re, 2004) describe the evolution of business interruption insurance in the industry. The complexity of business interruption coverage and business interruption claims has been regularly discussed in the insurance literature. Studies by insurance industry suggest a low awareness of business interruption coverage and high optimism among business owners for a speedy recovery after business disruption (Jain and Guin, 2009). Besides other data inputs, both supply-chain simulation and the input-output model approach require the downtime functions for different businesses to estimate the business interruption losses from an event. Business downtime functions relate the hazard intensity or the property damage level (which is a function of hazard intensity) with the business interruption downtime for a type of business.

There are various case studies in which business interruption losses (sometimes called consequential losses) are evaluated (Jain and Guin, 2009). The Northridge earthquake of 1994 had a major disruptive impact on businesses in the Los Angeles area of California and became the focus of research into economic damages. Most of this research neglects business interruption damages or focuses on the overall extent of economic damage. Exceptions which focus on business interruption losses include the research of Boarnet (1996). Boarnet found that of 559 firms in his survey, 35% reported that they had suffered business losses owing to transportation damage while 10% reported business gains as a consequence of the earthquake. The 'redistributive' effect of disasters on businesses (i.e. losses and gains) is a common feature of most disasters. Using methods described above, Parker et al. (1987) estimated such flood loss potential in case studies of manufacturing firms in Barnstaple and in the River Trent catchment in England, and also in the city of Lincoln. Brisbane's inundated businesses are estimated to have lost an average of more than \$800,000 as a result of the



2011 floods. A Queensland Chamber of Commerce and Industry survey of almost 200 businesses revealed an average loss of \$834,992 for businesses that had to stop trading as a direct result of flood damage or power loss. However, the median average loss was closer to \$60,000, with the mean average swayed by losses incurred by heavy engineering and industrial firms (<http://www.brisbanetimes.com.au/business/flood-losses-batter-brisbane-businesses-20110203-1aff9.html#ixzz1K2Xtlm3a>).

Statistical surveys of BDR Planning take-up

Many websites report the results of surveys on BDR Planning take up. A leader in the field - the Business Continuity Institute - reports a wide variety of statistics relating to BDR Planning take-up (<http://www.continuitycentral.com/news05623.html>). For example, the following are reported in April 2011:

- A new international survey of over 600 organizations by the Business Continuity Institute reveals that the vast majority of companies are failing to include business continuity considerations when making major strategic decisions.
- Acronis has launched its 'Global Disaster Recovery Index', a barometer which measures IT managers' confidence in their backup and recovery operations. The survey of over 3,000 small and medium-sized businesses conducted by the Ponemon Institute revealed that Attitudes towards data backup and recovery differ widely around the world. Companies in Germany, The Netherlands and Switzerland they have the highest confidence that they can recover quickly in the event of system downtime: they are more than 50% more confident than the average. Businesses in the UK, Australia and the US all scored poorly on their confidence in their ability to avoid downtime in the event of a serious incident (27% / 44% / 38%). French and Italian businesses are the most likely to admit that they do not have an offsite backup and disaster recovery strategy (41% / 45%) and are the least likely to be able to recover quickly from downtime. They spend the lowest percentage of overall IT budget of all countries surveyed at 5% and 4% respectively.
- Janco Associates has just completed a review of 253 disaster recovery and business continuity plan activations and classified the shortcomings of those plans. The most common issue, occurring in 62% of all recovery plans were errors in the plans. This often was due to the plan not being kept up to date (47%), the unavailability or inaccurate passwords (34%), and failure of the initial restoration process (13%). Additional reasons for failures were: insufficient backup power – 22%; communications not in place – 18%; personnel not adequately trained - 17 percent; system recovery priorities not identified – 14%; recovery processes not sufficiently documented – 13%; and disruption event not identified quickly enough and activation was late – 12%.
- Star, a provider of on-demand computing and communication services to UK businesses, has released the results of a survey of 175 UK small and medium sized enterprises (SMEs). The results show that almost three-quarters (74%) of SMEs surveyed have some sort of formal business continuity plan in place. However, for organizations with fewer than 100 employees, the proportion with no business continuity plans in place rises to 43%, with respondents citing reasons as varied as budget, lack of in-house expertise and resources.



The survey also reveals that more than a third of all respondents (40%) have experienced an incident which required them to invoke all or part of their business continuity procedures. This was due to unforeseen circumstances; from technical problems such as hardware or system failures, internet or network issues, or other factors such as severe weather conditions or a natural disaster.

Conceptual studies

Parker (2007) conceptualises the flooding disruption of businesses directly and indirectly: the latter through linkages between suppliers and customers and through utility outages (Figure 12). Whereas flooding disruption has a negative impact, recovery activities may have an opposite, countervailing, effect on the economy, and because of linkages between businesses, flooding is likely to have both positive and negative economic multiplier effects which play out among businesses within a locality or region (Figure 12). Parker's conceptualisations introduce the **scale issue** which is recognised as a fundamental concept when dealing with a location or territory (or a business within its business environment) and this has implications for BIA, business disruption and resilience. At least two scales must be considered: regional and local. The first permits the recognition of systemic links among businesses, business sectors and economies. Larger (i.e. lower resolution) scales may reveal vulnerability or resilience patterns and processes that are not recognizable locally and they may also reveal different forms of vulnerability or resilience as larger scales are not the simple sum of a number of "small scales".

Wardekker *et al.*'s (2009) resilience characteristics (i.e. homeostatis, omnivory, high flux, flatness, buffering, redundancy, other) are different characteristics or pathways to resilience which may be profitably applied to BDR thinking (see further for an application of these characteristics to BDR Planning).

The literature on vulnerability and resilience is large, heavily laced with conceptual development and discussion and it is related to the literature on uncertainty. It is well beyond the scope of this paper to review and assess the implications of this literature. A useful starting point is the substantial discussion of vulnerability and resilience theory concepts in relation to natural and na-tech hazards developed by the ENSURE research project (Galderisi *et al.*, 2010). This draws on a large range of literature notably including that of Holling (1973, 2001), Handmer and Dovers (1996) and Berkes (2007). For example, this research evaluates concepts which are similar to, or which could be a part of, resilience such as memory, learning capacity, transformability, diversity, spatial scale interaction, creativity and feedback, all of which have relevance and applicability to BDR Planning. In another example from Galderisi *et al.* (2010) resilience is viewed as more than recovery and as a creative opportunity (Figure 13) aimed at achieving a higher level of functioning. Resilience is sometimes defined as the ability to return to a stable steady-state following a perturbation but in disaster recovery it is important that recovery is creative and uses the opportunity to avoid returning to the status quo and to move to a less vulnerable state. The **implications** for WT4.3 fieldwork include lines of questioning on:

- mechanisms for learning and storing learning (i.e. memory) from all experiences of all disruptive events;

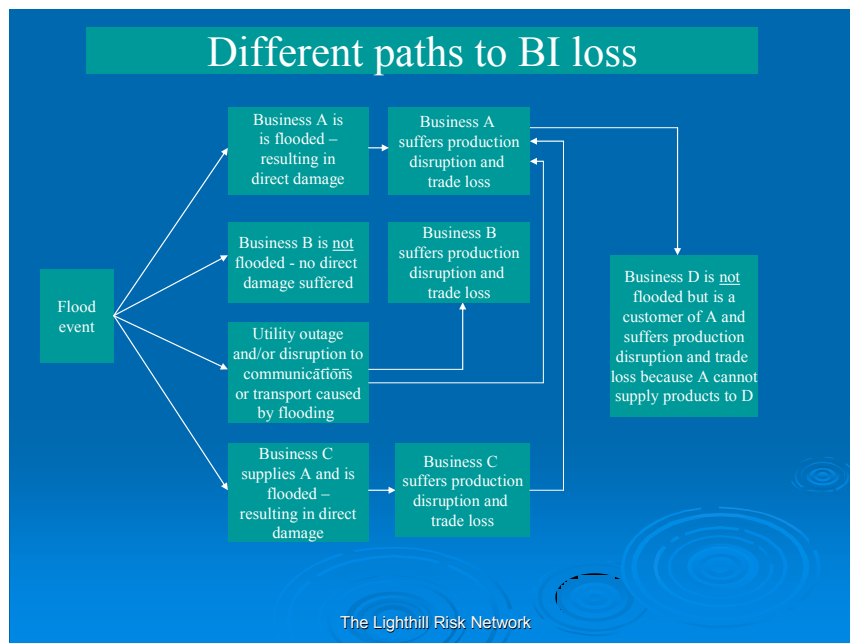


Figure 11: Business disruption linkages (Parker 2007)

- how disruptive events may be or have been capitalised upon to transform the resilience of businesses;
- using diversity (e.g. of supply chain sources; data storage sites) to enhance resilience;
- examining business linkages across scale (see below);
- the extent to which BDR Planning is used in creative mode;

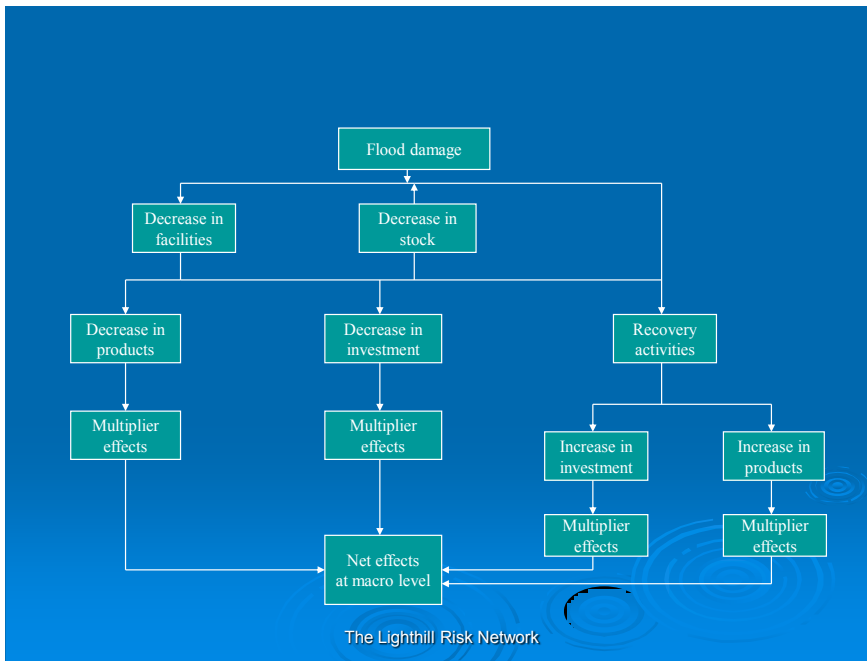


Figure 12: The countervailing effects of floods on business

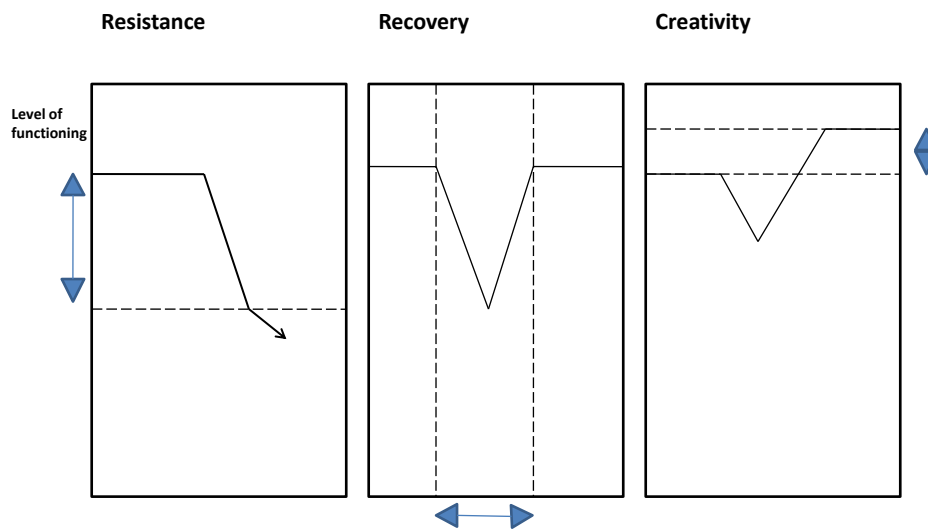


Figure 13: Properties of resilience adapted from Adger (2000) and Maguire and Hagan (2007) in Galderisi et al. (2010)

- the role of feedback mechanisms during emergencies; and
- the extent to which businesses perceive and act upon opportunities to be creative and to move to a more resilient position using BDR Planning and/or following a disaster.



PUBLIC/PRIVATE FLOOD IMPACTS AND RECOVERY PROCESSES

Business Impact Analysis (BIA), which is a key component of BDR Planning, requires a searching analysis of the impacts of flooding and other coastal processes on a business entity and its relationships with other businesses, both in the supply chain (i.e. upstream impacts) and on the customer side (i.e. downstream impacts). In order to undertake a BIA it is routinely necessary to examine the interconnections between businesses and the manner in which flood (or other coastal processes) impacts may propagate through the business community and beyond into society. Impacts on society are something that many businesses wish to avoid or to minimise for reasons of self-interest (e.g. reputation, maintenance of goodwill, maintenance of prosperity and growth potential etc.) and/or corporate social responsibility (CSR). An analysis of business recovery processes, which is part of a business's BDR plan, would require analysis of such interconnections in a business recovery mode.

The analysis of private flood impacts and social recovery processes opens up a complicated set of potential business relationships (Table 8). Initially businesses may be categorised as (a) private and (b) public businesses. Recovery processes can also be considered to operate in the private and public sector with inter-connections between both (examples of interconnections are shown in red in Table 8. In addition, we can distinguish between economic and social impacts and recovery processes (Table 8).

In practice analysing these relationships, especially the ones between the private and public sector and the ones between the business sectors and society (i.e. social impacts), is potentially quite complicated. Division of business entities into private or public only provides a crude distinction between types of business which are encountered in Europe. In reality there are many forms of business enterprise with varying degree of private and public ownership and these forms vary from EU member state to member state. Businesses which have shareholders who may suffer a decline or loss of income as a result of a disaster will have a social impact (i.e. upon the shareholding class). Each of the eight THESEUS study sites will have its own particular set of business types which will determine the particular relationships and interconnections (see Table 8) which will play out in a flood or other coastal disaster. The implication is that, in order to analyse these interconnections in any detailed manner in any location, and to examine the potential linkages between private/public and economic/social impacts and recovery processes, it is necessary to be aware of the types of businesses present because this affects their connections and disruptive impacts as well as recovery processes.

Implications

An issue arises about how far to take BIA and how far to expand the analysis of recovery planning into the social field. This relates also to how far to go down the route of carefully differentiating business types (as in Table 9 above) in order to understand how disruptive events will impact them and those to whom they relate. Although many may be private enterprises, businesses are fully part of the economy and society and cannot easily be separated from them unless some potential impacts are to be ignored. This is because impacts of floods upon both private and public companies will affect not only the business but also the economy and members of society (the latter may be



employees, families of employees, customers or suppliers). Some of this is clearly illustrated in Table 8 above.

As far as business disruption recovery is concerned, it is clear from the literature that private companies have a variety of interests in helping to ensure that a local economy and community are able to recover as quickly and as fully as possible from a disruptive event. They also have an interest in ensuring that public sector businesses recover effectively especially, but not only, where these are infrastructure providers or customers. Not all will perceive these interests as fully as others and many are likely to be much less engaged, or not at all engaged, in taking measures to help recovery in a wider sense. Smaller businesses are likely to be totally preoccupied with survival recovery, whereas larger businesses are likely to be those who will be able to convert their social responsibilities into social recovery actions. Collective BC/DR planning is quite common among businesses and their supply chain partners because businesses have a strong interest in making sure that their operations are not disrupted by interruption or loss of supply of vital components. They therefore often require business partners to have BDR plans, or if they do not do this they are likely to be satisfied that they have adequate alternative sources of components on tap. Beyond this, currently, it is unlikely that business outside of business groups (which may have a common approach to BDR Planning) will engage in any other form of collective BDR Planning, for example with local chambers of commerce and business development agencies. It is also unlikely that business will be engaged in any form of social recovery planning. However, such planning might be appropriate in coastal communities where the threat to business is significant and where contingency planning is developed innovatively in this manner. Indeed, such a concept of collective BDR Planning might be proposed as an innovative resilience measure for coastal communities.

In locations where the flood prone coastline or estuarial margins are narrow e.g. where land rises rapidly in an inland direction (e.g. parts of south Devon where there are drowned valleys (rias) and coastal slopes are convex in places) the social recovery aspects are likely to be much less significant than in locations where the flood prone coastline or estuarial margins are wide and extensive and where land levels are either below sea level (as in much of The Netherlands) or very close to sea level such that flooding can penetrate a long way inland (e.g. deltas, some large estuaries). Clearly in cases where flooding is extreme and penetrates a long way inland (e.g. New Orleans, Katrina event; Northern Japan, 2011 tsunami event) business recovery is fully part of the social recovery process. In the first case, it is perhaps defensible to consider BDR Planning largely separately from social recovery planning, but in the second case the two are barely distinguishable and would need to be considered in an integrated manner.



Table 8: Examples of potential (a) economic and social impacts of coastal flooding and (b) recovery processes in the public and private sectors

	Economic	Social
<p>Private sector enterprise</p> <p>e.g. a boat building and repair company; private fishing company</p>	<p>Impacts e.g.</p> <p><i>Loss of profit impacted owner's income</i></p> <p><i>Loss of business to a private sector competitor</i></p> <p>Recovery e.g.</p> <p><i>Transfer of business to a free-flood site in order to allow recovery at flooded site to restore profitability of business</i></p>	<p>Impacts e.g.</p> <p><i>Loss of business leading to lay-off of workers</i></p> <p>Recovery e.g.</p> <p><i>Owners may elect to continue to pay staff during 'lay-off' period as a way of maintaining goodwill with staff and to help protect families from adverse impacts</i></p>
<p>Public sector businesses and social enterprises</p> <p>e.g. a port authority (passenger logistics, navigation, cargo handling etc.)</p>	<p>Impacts e.g.</p> <p><i>Loss of business to either public or private sector competitor</i></p> <p><i>Loss of revenue and decrease in profits</i></p> <p>Recovery e.g.</p> <p><i>Injection of revenue by Government holding company to help overcome disruption of business and to aid recovery of profitability</i></p>	<p>Impacts e.g.</p> <p><i>Port activity is disrupted leading to knock-on effects in other port dependent business (potentially both private and public sector), leading to lay-off or workers and rising local unemployment with social welfare implications</i></p> <p>Recovery e.g.</p> <p><i>Government compensation scheme for flood affected public businesses and affected families is activated – Europe's Social Solidarity Fund is the ultimate source of funding</i></p>



GOVERNANCE IMPLICATIONS OF BDR PLANNING

Regulatory bodies and auditors play a significant part in driving uptake of BDR Planning. They now routinely place expectations and requirements on businesses to plan fully for business disruption. Companies are increasingly expected to make a statement in their annual financial accounts to the effect that they have Business Continuity Plans in place. Corporate social responsibility (CSR) is also significant driving force for BDR Planning take-up, stemming from businesses' desires to demonstrate that they are good corporate citizens, that they have a social conscience and that they behave ethically. Shareholders and customers are increasingly looking to do their business with ethically responsible businesses and so a degree of public pressure, or governance, is exerted through these channels and through social accounting again with effects being translated through the market mechanisms.

Many large business corporations will have almost certainly developed their BDR Planning to a level where there is a form of collective BDR Planning among them and their supply chain business partners and possibly also their customer partners. It is now common for both public and private sector businesses to require those bidding successfully for contracts from them to demonstrate that they have in place particular business processes, including BDR Planning. This leads to BDR Planning take-up and represents a form of collective planning. Small businesses are much less likely to have done this so that not only may there not be BDR plans in place, but there are likely to be few collective BDR plans, although pressures should be being increasingly exerted upon them in contract bidding processes. This form of collective planning is, in essence, brought about by market mechanisms i.e. businesses are excluded from the market if they fail to comply with expectations.

Governmental organisations, at local, regional and national levels (e.g. City Councils) are capable of exerting BDR Planning take-up pressures in this way. In so far as governmental institutions may have elected representatives as well as appointed officials on their decision-making bodies, there is a potentially significant role in democratic representation of wider social interests in BDR planning. How far in reality this process works, and whether it works effectively in coastal communities, is currently unknown. These kinds of linkages are likely to be tenuous. At this stage it is also not known whether local business support groups (such as the local chambers of commerce in the UK) are in any way effective at organising a **collective** approach to BDR Planning among businesses in their areas, although they are likely to promote BDR Planning.

At this stage it would appear that the strongest governance pressures for effective BDR Planning probably come from large corporations including multi-national corporations and medium-sized businesses and in the way explained above. The trickle-down of these pressures into small businesses is likely to be very imperfect as evidence indicates that small businesses are the least likely to have adopted BDR Planning.

Notwithstanding the current wider issues surrounding governance in flood and coastal erosion management, governance implications arise from BDR Planning. Firstly, coastal hazard/risk events have adverse spillover effects from the private to public sector and vice versa and the propagation of impacts through supply chains and on the customer side means that there can be many business



stakeholders including ones which are not local. Secondly, an effective BDR Planning process may require inputs from both the private and public sectors which will be, to varying degrees, dependent on each other during the recovery phase. For example, slow recovery by damaged and disrupted public sector businesses (e.g. highways authorities) may well magnify the recovery problems of private businesses who provide services and products to these public sector businesses, or who rely upon the services of public sector businesses. Business disruption can also clearly have social impacts (such as the laying off of labour) which may have implications for local communities thereby potentially greatly extending the range of stakeholders. The picture of the range and type of BDR stakeholders which emerges from this analysis introduces questions about what sort of inclusive decision-making processes are currently in place and be appropriate in future for BDR Planning.

BDR Planning appears to be almost exclusively funded from businesses' internal resources and finding the resources to undertake and maintain effective BDR plans appears to be a real struggle for small businesses in particular yet their disruption can have significant adverse local economic and social impacts. This raises a possible question about whether it makes sense for an element of public resourcing of such BDR planning possibly through some kind of local taxation advantage to encourage BDR Planning take-up in small businesses in at-risk communities. Public resourcing of recovery from flood damage and disruption already exists (e.g. the Bellwin Scheme in the UK, and the EU Solidarity Fund etc.) but the extent to which such funding is preventative rather than reactive is an issue for the future. Currently, this kind of funding appears to be reactive only.

THE IMPLICATIONS OF SCALE OF EXPOSURE TO FLOODING AND OTHER COASTAL RISKS

The scale of exposure to flooding has a bearing on the issues which businesses are likely to face in business disruption and BDR Planning, and in turn this has implications for the scope of the WT4.3 fieldwork. Broadly speaking there are two extremes with positions in between:

- 1) locations where the flood prone coastline or estuarial margins are narrow e.g. where land rises rapidly in an inland direction (e.g. parts of south Devon where there are drowned valleys (rias) and coastal slopes are convex in places);
- 2) locations where the flood prone coastline or estuarial margins are wide and extensive and where land levels are either below sea level (as in much of The Netherlands) or very close to sea level such that flooding can penetrate a long way inland (e.g. deltas, some large estuaries).

Naturally, businesses situated in "2" above may experience potential for much larger and longer duration disruption from flooding than businesses situated in "1" above. This is exemplified by the experience of the business community in New Orleans following the sea surge and flooding which accompanied hurricane Katrina (Richardson *et al.*, 2008; Groen and Polivka, 2008). Katrina was exceptional because it devastated the centre of a major urban area, a vital transportation artery (the Mississippi) was disrupted, and US the energy production industry was affected in a major way.

Six impacts illustrate the exceptional effects on business.

- First, the local energy utility, Entergy Corporation, was severely affected, and the company was forced to file for bankruptcy protection in September 2005. Lower revenue and storm restoration costs were cited as the reasons. Permanent loss of connection was experienced



by businesses because of the devastation in New Orleans. Entergy was refinanced by its parent company.

- Second, because people abandoned homes in large numbers, many of them permanently because they were totally destroyed, local tax revenues dried up, and local municipalities experienced a severe drop in income. This had knock-on effects on their ability to employ people and so many were laid off.
- Third, small and medium size enterprises (SMEs) whose customers were mainly in the disaster area suffered a devastating loss of custom as business dried up. This led many businesses to bankruptcy.
- Fourth, businesses whose employees were mainly from the disaster area lost much of their workforces and suffered major losses.
- Fifth, the Port of New Orleans was closed for about four weeks. Exports piled up at the point of production leading to delayed and lost revenue.
- Lastly, the shrimping industry was lost owing to environmental damage.

GROUND TESTING OF BUSINESS RECOVERY PLANNING

METHOD USED FOR GROUND TESTING

Introduction

In this section, existing 'on the ground' experience with BDR Planning tools is tested within the coastal flood risk zones of five Theseus study sites. The objective of the ground testing is to discover whether or not BDR Planning for coastal risks is being employed, the extent to which the BDR Planning process is being employed (i.e. to what extent are each of the components of BDR Planning being used), what business managers and owners think of BDR Planning in terms of building their businesses' flood resilience, and whether BDR Planning is likely to work or not in the future as an element of coastal risk management and building resilience to coastal risks. This ground testing is also extended to business support agencies in the case of the UK study site since they are considered to be a potentially significant element of governance in the creation of innovative means of developing BDR Planning for coastal risk zones.

A questionnaire survey methodology was applied to five Theseus study sites in order to ground test the different aspects of flood risk and BDR Planning according to the themes and questions set out in a Survey Guide.

The Survey Guide was employed to provide Theseus partners with a common survey platform and background, going into more detail than was necessary for the field survey stage. From this Survey Guide a set of Metaquestions was formulated which provided the principal survey tool.

The semi-structured interview surveys focused upon selected businesses within each of the five study sites. The surveys did not extend to local chambers of commerce/business organizations or to local government organizations although some extra survey work was undertaken in the South Devon (UK) study site which focused upon these organizations as well.



Interviews were undertaken in various ways including by telephone (e.g. the South Devon survey of business support agencies), face-to-face interviews (e.g. the South Devon survey of businesses) and on-line surveys (e.g. the Gdansk surveys).

The Study Sites

The five study sites selected for the surveys are:

- Santander (Spain)
- Gironde Estuary (France)
- Plymouth Sound to the Exe Estuary (South Devon) (UK)
- Gdansk (Poland)
- Varna (Bulgaria)

Each study site has its own unique coastal configuration, flood mitigation measures and mix of businesses but the importance of some particular business sectors within the coastal flood risk zone are similar in most cases. Tourism and fishing industries and port industries (e.g. storage, warehousing, recreational facilities, boat repair businesses, ferry terminals) in particular are present, as well as petro-chemical industries, transportation infrastructure, power stations, other utility installations and naval bases. In each of these study sites dynamic coastal and climatic/meteorological processes are at work presenting erosion and flooding risks which are being exacerbated by sea level rise and anthropogenic change. The Study Sites include locations which range from high exposure and vulnerability to flooding and coastal erosion through to locations which have a comparatively low set of coastal risks. Flood mitigation and resilience measures already exist in each study site. For example, in the Gironde Estuary area dredging operations are regular and there are many kilometres of submersible dykes and levees. In South Devon dredging is also common and natural beach defences have had to be augmented by sea walls in some cases. In some of the principal South Devon towns structural flood defence works are in place or being improved. On the other hand, such measures interrupt the coastal dynamics while soft measures such as artificial nourishment tend to be more sustainable and less controversial as in the Heir Peninsular near Gdansk. Heavy storms have created flood chaos in the past in most study sites or near to them, including serious loss of life. The dependence of businesses inland and away from areas at risk from flooding etc. on these port operations is an important problem in terms of business disruption and recovery and introduces a scale issue to these processes.

Selection of Businesses for Interview

A sampling or selection process was used in each study site to identify the businesses for which ground testing interviews were to be attempted. The details of the sampling process were allowed to vary from site to site because of wide differences in data availability from country to country. The sampling selection processes were as follows:

Santander

- The flood risk area in the centre of Santander and at the southern end of the Bay of Santander was first identified.



- A decision was taken to focus interviews on the most vulnerable businesses within this zone, many of these being either next to or close to the water's edge.
- A decision was also taken to focus upon small businesses in this case.

Gironde estuary

A sample list of businesses, located or operating at the Gironde territory within the coastal flood risk zone, was created using

- Bordeaux municipality data, and,
- the snowball effect based on previous interviews.

The initial sample list contained 14 businesses.

The businesses' data list from Bordeaux municipality was about (6) small and medium businesses and (1) large business :

- 6 businesses located at QUAI Brazza and Quai Queyeries near the Bastide district of Bordeaux city and
- 1 business located at the Quai Chartrons.

The snow ball effect through the spatial planning survey drove further identification of 7 large businesses operating at commune scale (surrounding of Bordeaux city). Those businesses were :

- 1 located at city of Bassens,
- 5 located in Ambès city, and
- 1 located in Libourne and operating in the Gironde territory.

The businesses were then sorted by their types (large, medium and small), their location in relation to the Garonne and Dordogne river banks, their location in Bordeaux city and also at commune scale and their location at a PPRI area.

Among 7 selected businesses near Bordeaux city, data from only 4 interviews data are useable for analysis. Among 7 selected businesses at commune scale, data were secured for the analysis of 5 businesses.

To summarise successful interviews were secured for 9 of the 14 selected businesses. Most of the not-secured interviews were made impossible by the interviewees' disinterest (at Bordeaux city districts) and also by the confidential nature of the data obtained (i.e. for large businesses at the commune scale).

Plymouth sound to exe estuary (south devon)

- A long list of non-residential properties located within the coastal flood risk zone of South Devon was created by reference to the Environment Agency's National Receptor Data Set (a



national database of all flood risk properties in England maintained by the national flood risk management agency).

- These properties were sorted by ground floor size in £/m² (size data is included for each property in the National Receptor Data Set).
- 18 business properties were then selected for potential interview survey using the following criteria:
 - a range of businesses according to size (small to medium to large businesses),
 - a range of business types considered to be reasonably, though not statistically, representative of the total population of businesses, and
 - businesses in each of a small number of coastal towns in South Devon.
- Interviews were successfully secured at 10 of the 18 selected businesses.
- (8 businesses either refused or were made infeasible by the owner/manager e.g. by referring the interviewee to their head office or by failures to make interview appointments or by business crises).

Gdansk

A sample list of businesses, located or operating along the section of Hel Peninsula and which could suffer either from flood or coastal erosion was formulated from the results of previous studies in the project. Also suggestions of members of the research team and interviewees provided a useful starting point for the selection. The potential range of businesses for selection was, however, large as the actual study site is only inhabited by approximately 400 people only in the area of about 2 km². But the Hel Peninsula has a very specific structure of a rapidly transforming coastal economy, and this is reflected in the selection of businesses for interview.

- First it was considered important to include representatives of tourism small businesses such as camp sites, bed and breakfast establishments, small hotels and restaurants, and also traditional fishermen offering sea angling and related leisure services.
- Secondly, some very specific businesses were selected such as a sail boat repair and cruising services and a business promoting eco-tourism and sports. As the power supply and water management infrastructure is critical to the area the agencies operating those facilities were also included.
- In total 10 business and or utilities were selected for survey. However, 3 of them finally declined for different reasons including one which did not approve of the questionnaire content (the case of campsite owner/manager, since the facility contributes to a land conflict situation).

Varna

Interviews selected according to location along the beachfront in Varna.

Location of Interviews

The location of business interview sites as shown on the following maps (Figures 14-18).



Figure 14: Location of successful interview sites in Santander

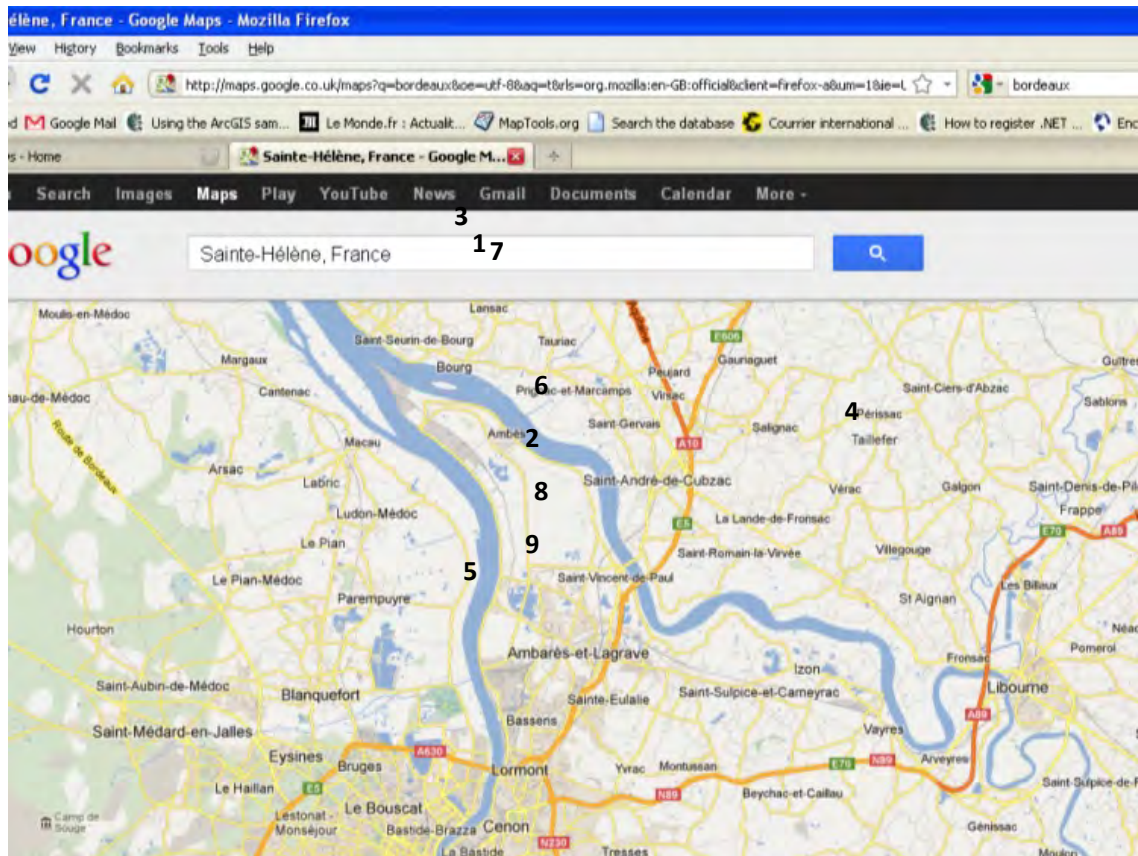


Figure 15: Location of successful interviews in the Gironde



Figure 16: Location of successful interview sites in Plymouth Sound to Exe Estuary (South Devon) (number of interview in each location)



Figure 17: Location of successful interview sites in the Hel Peninsula, Gdansk

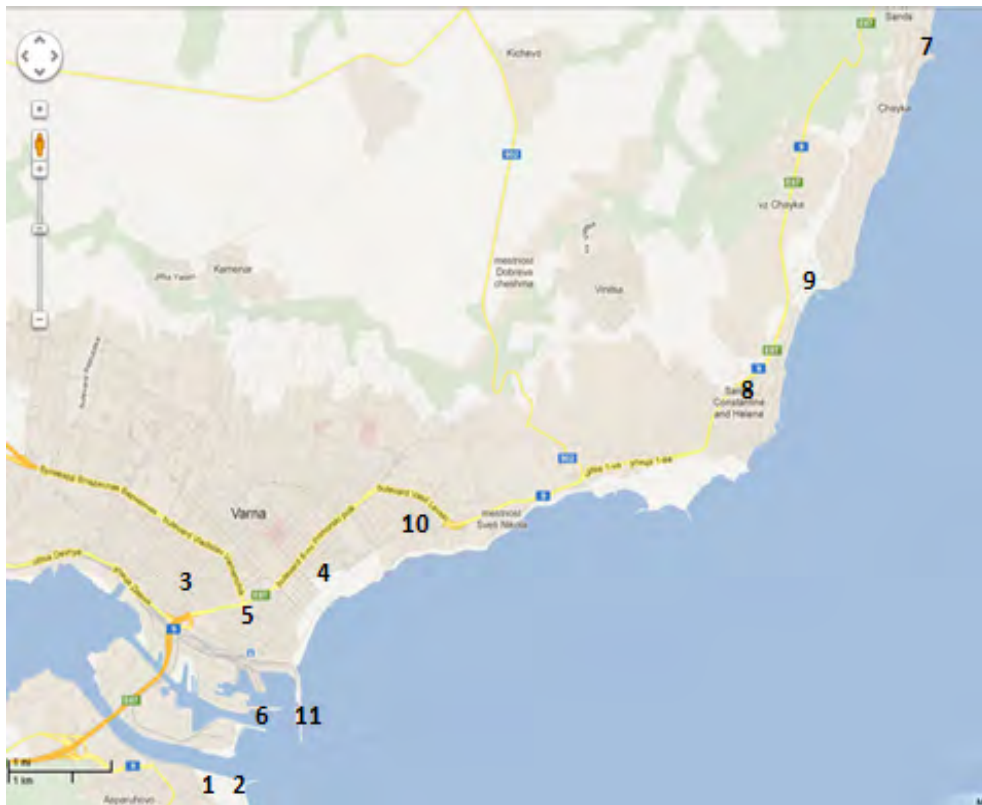


Figure 18: Location of successful interview sites in Varna

Insights Gained from ‘Non-response’

In most of the study sites, non-response or refusal to be interviewed was quite prevalent. It is not always easy to persuade business owners or managers to devote some of their valuable time to answer survey questions at the best of times, whatever the subject of the survey. This suggests that at least in some cases coastal risks and business disruption and recovery was a low priority. In some cases, issues of business confidentiality were prominent and caused potential respondents to refuse an interview or to conclude that the information given was too confidential to use. In other cases, the request for an interview appeared to come at a bad time – perhaps coinciding with a crisis of some kind in the business – and this may have led to a refusal (e.g. a South Devon case).

In some cases, despite explanations from interviewers, potential respondents could not understand the relevance to them of a survey on flood and coastal risk and business disruption and recovery and were simply not interested, refusing on this basis (this occurred in the Gironde, South Devon and Gdansk). Again these cases indicate that contingency planning for coastal risks is considered to be low priority or irrelevant even though the business is located within the coastal flood risk zone. It also suggests a disinterest in business contingency planning in general.

In further cases, local business branch managers felt that they had to refer the request to their head office which in many cases was located in a totally different part of the country so that the interview became impracticable (e.g. several South Devon cases). In these cases, another business – a similar



as possible to or an alternative to the one where a refusal was encountered - was substituted until the target number of interviews was completed.

In the case of the South Devon businesses it was often, but not always, the small businesses where the owner or manager felt he could not spare the time or could not understand the relevance of the survey. In other cases in South Devon it was those managers who felt that they must refer to head quarters where a non-response occurred. Generally, professionally-trained managers appeared to be more willing to participate. In the case of Gdansk a particularly low willingness to participate was encountered initially. In Gdansk the initial lack of willingness to participate was partly due to the very small community coming under study and also by a lack of a culture-institutional legal framework within which business disruption and recovery planning might be embedded.

Ground testing Interviews Secured

The number of interviews secured is given in Table 9. The majority of the businesses were private sector companies. The exception was in Varna where three businesses were governmental/local authority organisations.

Examples of businesses where interviews were secured are as follows:

Santander: shipyard, hotel, supermarket, paint business, pharmacies, textile stores, bar-restaurant, shop

Gironde: car dealership, industrial material market and vegetal oil mill factory, black carbon factory, computer hardware sales., chlorate and sodium production, public works (civil engineering), gas storage, dock warehouse

South Devon: construction materials business, hotel, hire company, railway company, medical surgery, cinema, holiday camp, one other business (type and name confidential)

Gdansk: hotel, ecotourism provider, car equipment repair agent, shop, infrastructure provider, energy company, heritage sailing service

Varna: 8 private businesses, beach restaurant, fishing, port (stevedoring services etc.), hotel and spa, sea, sports and tourism (2 yacht clubs, dolphinarium), 2 universities, 2 governmental organisations and 1 local authority

**Table 9: Business interview number in each study site**

Study site	Number of successful interviews	Number of unsuccessful interviews (i.e. non-responses or where data was considered confidential or unavailable)
Santander	10	0
Gironde	9	5
South Devon	10	8
Gdansk	7	3
Varna	11	2
Total	47	18

An Additional UK Parent Company and Support Agency Survey

In the case of the UK only, a second ground testing interview survey was conceived and undertaken in order to gain further insights into business disruption and recovery in the South Devon coastal zone.

This survey was aimed at two types of organisation:

- the parent companies or head offices of those businesses which we interviewed in the Devon coastal zone ; and
- Local and National agencies which support business companies (e.g. Chambers of Commerce), planning authorities and their related organisations (e.g. Resilience Fora) and organisations including the flood risk management agency and business federations which have an interest and might be expected to have an interest in promoting business and business survival in South Devon.

Interview schedules

Two interview schedules (guides) were constructed, one for each of these types of organization (Annex 3). Briefly the parent company interview survey focused upon

- the parent company's assessment of the level of risk presented to the company and its branches including the South Devon branch by coastal flood and erosion risks;



- whether or not a formal assessment of the risk has been undertaken, and whether coastal flooding and sea level rise risks are expected to be assessed at the parent or local level or both;
- whether the parent company has a generic Business Contingency Plan and whether or not it includes coastal flooding and sea level rise risks;
- whether there is a group level business recovery approach and plan, and whether the parent company has flood loss disaster insurance;
- whether the parent company has adopted sea level rise or flood resilience measures; and
- views about the efficacy of business disruption and recovery planning for flood and sea level rise risks.

The second interview schedule was similar but was oriented towards 'support' or 'potential support' agencies. Briefly it included questions on:

- whether or not the agency has a) interests in and b) responsibilities for helping businesses assess coastal risks;
- whether or not the agency did anything to promote business continuity planning in general and specifically for coastal flooding and sea level rise;
- the key drivers for businesses in South Devon to adopt business disruption and recovery planning;
- the main barriers to such planning;
- limitations faced by the agency in encouraging South Devon businesses to assess coastal risks and to adopt business disruption and recovery planning
- whether or not enough was being done to help businesses adapt to these risks in South Devon;
- whether local councils could do more, and if so what;
- their views on the efficacy of business disruption and recovery planning for coastal risks; and
- the respondent's personal assessment of the severity of coastal flooding and sea level rise risks in South Devon.

Selection of Parent Companies and Support Agencies to be Interviewed and Secured Interviews

5 parent companies and 13 'support' agencies were identified for interview. 3 parent companies refused to be interviewed on grounds of confidentiality and also partly because they claimed they could not afford the time. Several of these companies made it very difficult for the interviewer to find a person to interview. This left 2 parent companies where successful interviews were eventually obtained although both underwent interview on condition that their company's names are not revealed in the research (one also made a condition that the type of business could not be identified either). Of the 13 'support' agencies, successful interviews were secured in 10 of them. The 'support' agency interviews were undertaken by telephone appointment and voice recordings of all interviews were taken as well as hard copy interview instruments being completed in each case.



Issues of confidentiality and disinterest of low priority were again clearly reflected in the response of parent companies to the request for interview, whereas in the case of the support agencies this was not the case.

ORGANISATIONS/INDIVIDUALS INTERVIEWED

The following were interviewed:

- Devon and Cornwall Police/Local Resilience Forum member
- Business West, Bristol
- Teignbridge District Council, Emergency Planning Officer
- East Devon County Council, Economy Portfolio Holder
- Federation of Small Businesses, Kingsbridge
- Association of British Insurers, London
- Exeter County Council
- LiCCO Project, Environment Agency, Exeter
- Headquarters of a company whose branch plant manager was interviewed in South Devon business interviews (2 cases)

RESULTS OBTAINED FROM THE GROUND TESTING

The Key Findings Emerging from the Interview Surveys

Section 9.1 covers the results from the business interview surveys in the five study sites with the exception of the additional UK parent company and support agency survey, the results of which are discussed in section 9.2.

It appears that business owners and managers can be divided in a number of ways which has some power to contribute to explanations of key differences in their responses regarding business disruption and recovery in the context of flood and coastal erosion risks. The results discussed below illuminate these divisions and differences.

Flood experience, perception and resilience planning

Perception of the flood and related risks clearly influences businesses' attitude towards business disruption and recovery planning for such risks. In turn, perceptions of flood risk appear to be strongly influenced by flood experience, particularly whether they have any flood experience or not, and also by their personal assessment of the risks. All the businesses interviewed are located in flood risk zones. The incidence of flood experience, adoption of some form of flood resilience or BDR planning (often basic and incomplete) and possessing a full BDR plan is shown in Figure 19.

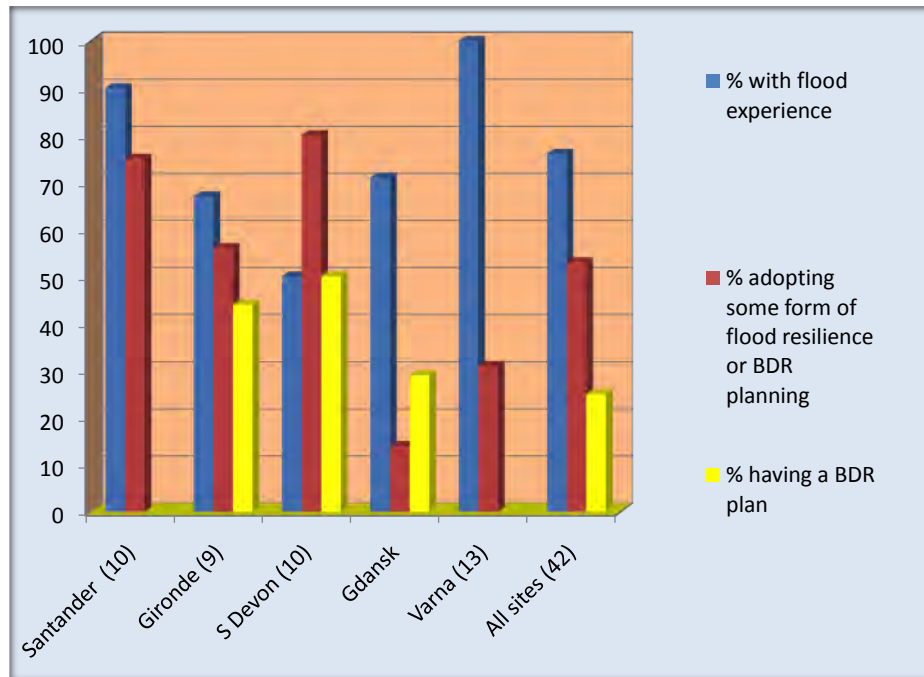


Figure 19: The relationship between flood experience, the adoption of some form of flood resilience and/or BDR planning and actually having a BDR plan

In Santander 9 out of the 10 businesses interviewed had experienced minor disruption from flooding: the remaining business had not. Shopkeepers reported feeling vulnerable to flooding but various flood resilience measures have been taken which already afford some protection from flooding. These measures range from localised hand-made timber flood barriers, moving damageable goods, and providing mutual assistance and alerting actions, to structural measures included in urban reconstruction. The Santander businesses had therefore already engaged to some extent in flood resilience measures although none of them had a business disruption and recovery plan as such – partly because they believe they have already learned to deal with and to adapt to small floods, and partly because they expect the local authorities to organise this for them, especially for larger more extreme floods. In Santander flood resilience is related to flood risk awareness. Flood experience flood risk awareness and increases take-up of flood resilience measures but there are also other factors which reinforce flood resilience (see below).

The Gironde interviews were undertaken in two main types of location: a) in Bordeaux city (6 interviews) and b) in the communities along the Gironde outside of the city (3 interviews). Flooding has a lower likelihood in Bordeaux city compared with the external community areas. Those businesses located in Bordeaux city had no experience of flooding and flood risk was not perceived as a major risk: instead fire risk is seen as the major risk here. In contrast those businesses located in the communities along the Gironde outside of Bordeaux had experienced flooding and here the flood risk is more significant and floods affected the community areas in 1999 and 2009. In these areas perception of flood risk was more developed, flood risk awareness was higher and attitudes towards flood risk were more accommodating of the risk. The higher flood risk and past flood



experience appear to be significant factors here in businesses engaging in business recovery planning but there are also other factors influencing engagement with business recovery planning.

The South Devon interviews revealed that all 10 respondents were well aware of their coastal flood risk and many of these were also aware of their surface water flooding risks as well as fluvial and/or sea flood risks. Perception of flood risks had been influenced in 50% of the South Devon respondents because of the prominence in the local news of a proposed local structural flood mitigation project for Teignmouth where 6 out of the 10 interviews were undertaken. 50% of South Devon respondents had recent flood experience – either minor coastal or tidal/fluvial flooding or local surface water flooding. All 10 businesses engaged in some form of business disruption and recovery planning (often generic), though two of these did not consider flooding even though they are at risk of flooding. In South Devon experience of flooding and activity and news relating to the flood mitigation project for Teignmouth have raised awareness of the flood risk and this has helped stimulate business development and recovery planning in the businesses where successful interviews were obtained. However, although Figure 19 suggest a reasonably high take-up of business disruption and recovery plans (50%), it must be remembered that 8 out of the 18 businesses approached for interview could not be interviewed for one reason or another. In many of these predominantly small businesses, business disruption and recovery planning was largely non-existent and this needs to be taken into account in interpreting Figure 18.

In the Gdansk study site (i.e. the Hel Peninsula) 5 out of 7 respondents mentioned the coastal risk as the most important external source of disruption experienced but their impact was estimated as rather small. However, there is evidence that the fear of coastal events is greater than the severity of events so far experienced. The issue of a potential major sea breach of the Peninsula is discussed in the media from time to time and has been raised on the political agenda especially when Parliament discusses annual budget allocations which determines the resource devoted to artificial nourishment of the beaches which protect the coastline.

In Varna, all 13 businesses had experienced damage from sea storms and flooding. 7 of these companies had also suffered flooding owing to heavy rain, and 2 added local waterspouts as risks to their businesses. 6 of the businesses had made 'preliminary' plans for flood resilience and/or recovery activities whereas 4 companies had not done so because of the costs associated with making such plans. The 3 remaining businesses had not made BDR plans because they believe that the coastal processes do not actually cause very much interruption to their business activities (i.e. they are exposed to flooding but have a low vulnerability to its impacts). Overall, the businesses interviewed in Gdansk believed that BDR planning was inadequate. In Varna, a key reason why businesses do not go further than make 'preliminary' plans for business disruption and recovery is because much of the property (e.g. beaches, coastal structures, roads and infrastructure) is owned by the State. Private businesses do not wish to invest in physical resilience measures because the State offers no repayment for such investment if the property is returned to the State. So this acts as a disincentive to anything more than basic, near-zero business disruption and recovery planning including flood resilience measures.



Business Size

Several of the report templates from the site surveys identify business size as a significant factor in influencing whether or not BDR plans are in place (Figure 20). These include the Gironde and the South Devon templates. In the Gironde the medium and large size companies were mainly the ones with BDR plans and only the large businesses had recovery plans. They were, however, also the only businesses for which emergency plans (covering warning, technical responses and evacuation), are mandatory because these businesses are classified in one way or another as hazardous sites requiring mandatory emergency plans. Business recovery plans are not generally mandatory for classified business sites, but each of the companies involved had also adopted such plans, in effect extending the mandatory emergency plans into full BDR plans.

In South Devon, most of the 8 non-responses (out of 18 firms sampled) were from small businesses none of which appeared to have any interest or knowledge of BDR planning and which felt that the interview was therefore irrelevant to them. Again the medium and large size companies were those with crisis plans of various types and only one small business had such a plan. None of the medium or large sized businesses were classified as hazardous ones requiring mandatory emergency plans.

However, the Varna results do not follow the pattern of the larger firms being more likely to have BDR plans than the smaller ones: the reverse is the case. However, all of the BDR plans in the case of Varna are described as 'preliminary plans' and are probably not as well developed as some cases in other sites.

In the Hei Peninsular all 7 businesses interviewed were of a very small, small or small-medium size and only 1 had a BDR plan for flooding.

However, it does appear from the survey evidence available that, generally, large to medium size businesses with professionally trained management staff are more likely than small businesses to have crisis and/or BDR plans. It is also true that some medium to large size companies located in the flood risk zone have not considered flood risk in their plans (e.g. in South Devon) and that some small businesses have developed crisis and/or BDR plans. These survey findings on business size and BDR plan adoption are broadly in line with other survey findings discussed in Section above.

The principal concerns about impacts of flooding

The principal concerns or worries of businesses regarding the potential consequences for them of flooding are illustrated in Figure 20. These responses are expanded on in more detail in Figures 21 to 25.

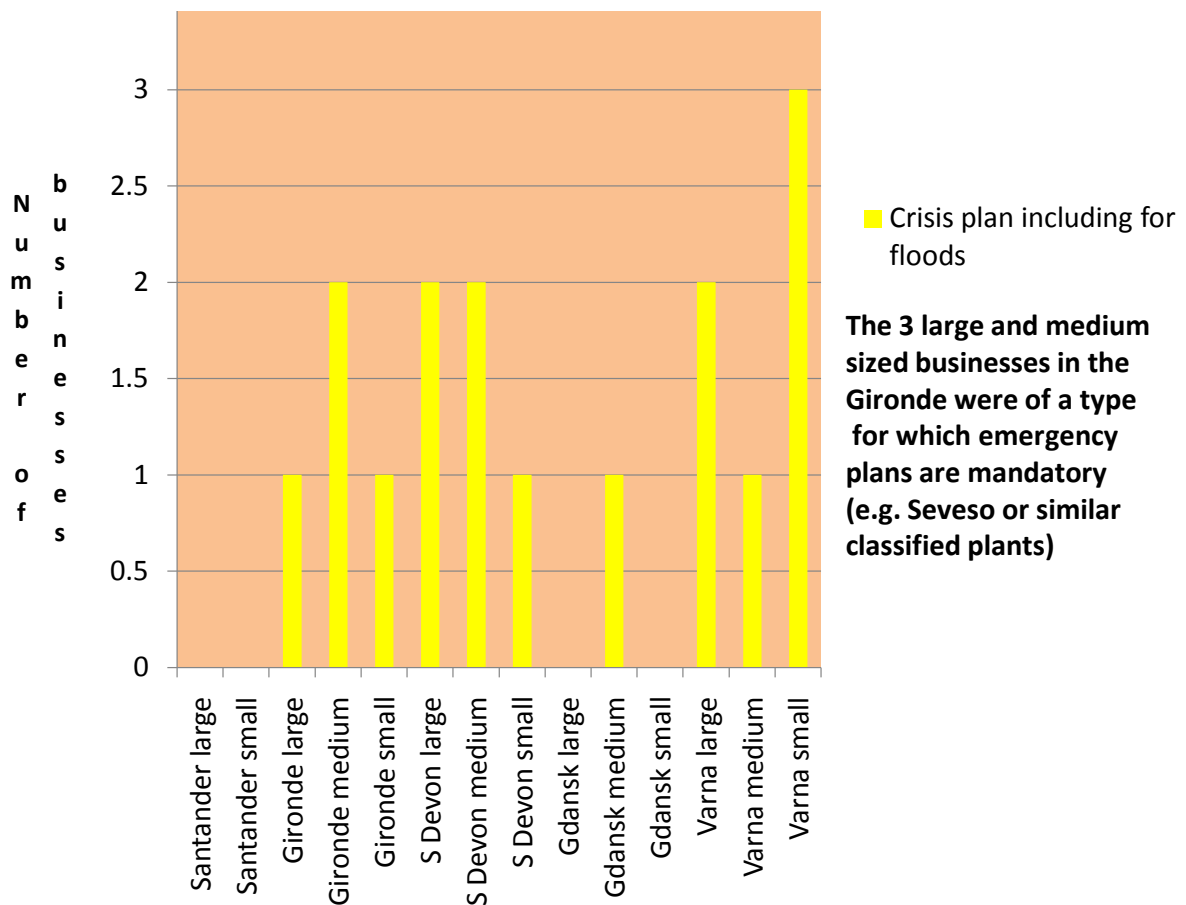


Figure 20: Business size and adoption of crisis plan by the business which includes flood risk

(2) or meaningful (3) (the remaining 2 businesses believed that for them the consequences would be insignificant). The most serious consequences were considered to be for energy and/or water supplies (5 out of 7 businesses believed the consequences would be very serious and the other 2 believed them to be meaningful). After this 6 out of 7 companies believed that consequences for IT systems (data and communications) would be very serious (2) or meaningful (4). 6 out of 7 companies believed that the consequences for customers would be very serious (3) or meaningful (3). Consequences for management and staff were considered to be of a lower order than all those above.

Disruption of transportation networks and the consequences for a) supplies and b) employees getting to work is a principal worry in Gironde, although it is less frequently mentioned in South Devon where it is articulated as a concern about loss of access and/or increased travel distances. Disruption of access and supply chains are two of the three main concerns in Santander. The Gironde flood risk area is broader and extends inland further than in South Devon and Santander and therefore greater extent of transportation links are at risk in the Gironde compared to the other two sites.

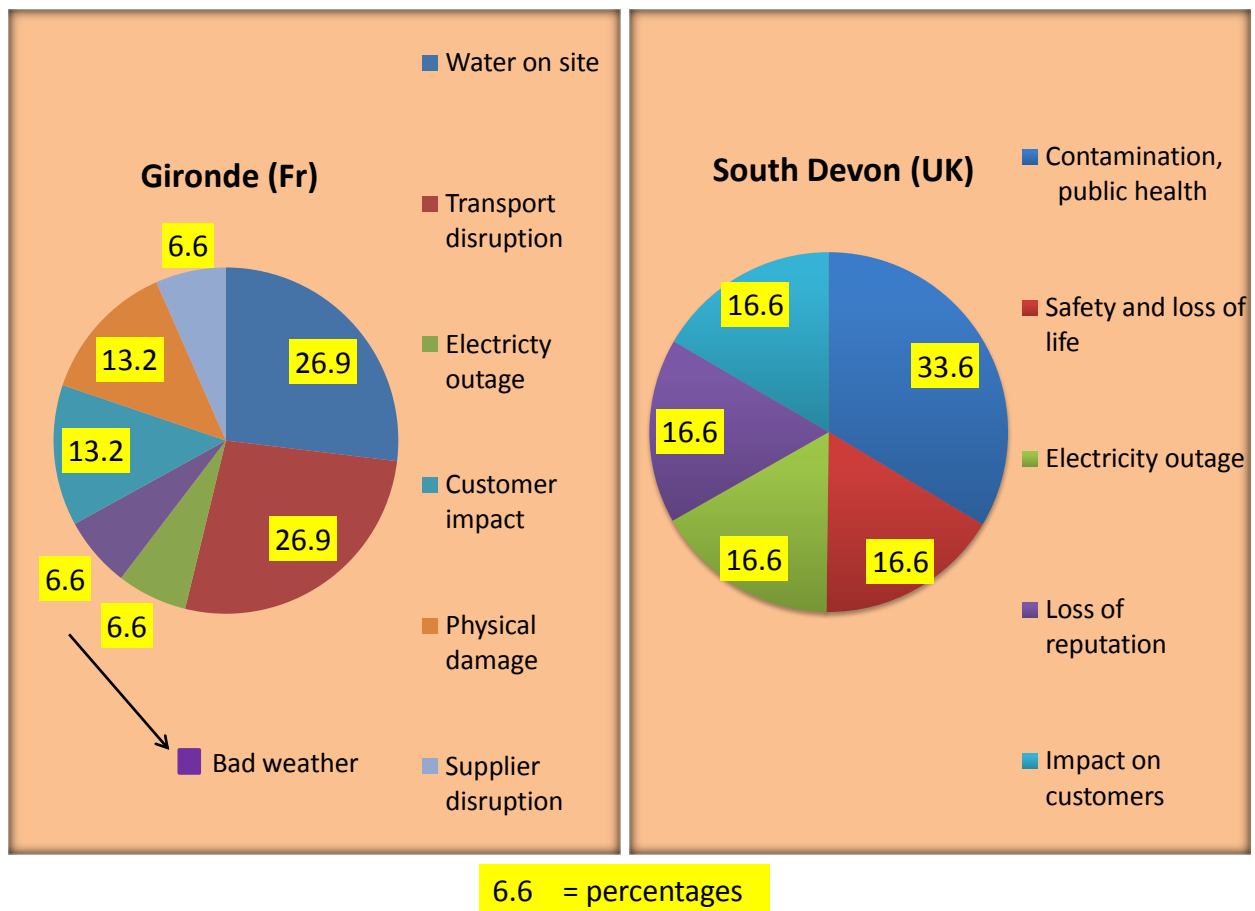


Figure 21: The principal concerns of businesses regarding flood risk and the potential consequences of flooding

The Gironde responses (see Figures 20 and 21) clearly illustrate concerns about flooding affecting transport systems and then affecting customers, suppliers and employees with adverse impacts on the businesses. Here we very clearly see concerns about both backward and forward linkages in the economy the need for BDR planning to address them. These concerns are reflected in South Devon responses where they are articulated as concerns about ‘knock-on’ effects of flooding on suppliers and the effects on customers, and also in Santander. In the case of one company in the Gironde, their business had been disrupted by flooding associated with the tsunami in Japan. Flood disruption at the Japanese partner’s plant in Japan had adversely affected business activity in the Gironde demonstrating the international dimension of business disruption.

Not surprisingly, physical damages to goods and equipment are mentioned as important worries in each of the Gironde, South Devon and Santander. Electricity outages and its adverse impact on production and sales, and also equipment, is also considered important in both the Gironde and South Devon but are not explicitly mentioned in the Santander responses although this problem is almost certainly a risk there. In South Devon the principal concern is articulated as contamination and public health consequences because businesses fear the contamination of their goods and products by floodwater which will render them a total loss on health and safety grounds. These

concerns are not explicitly mentioned in the Gironde and Santander possibly partly reflecting the fact that some of the businesses surveyed there are less at risk on health and safety grounds.

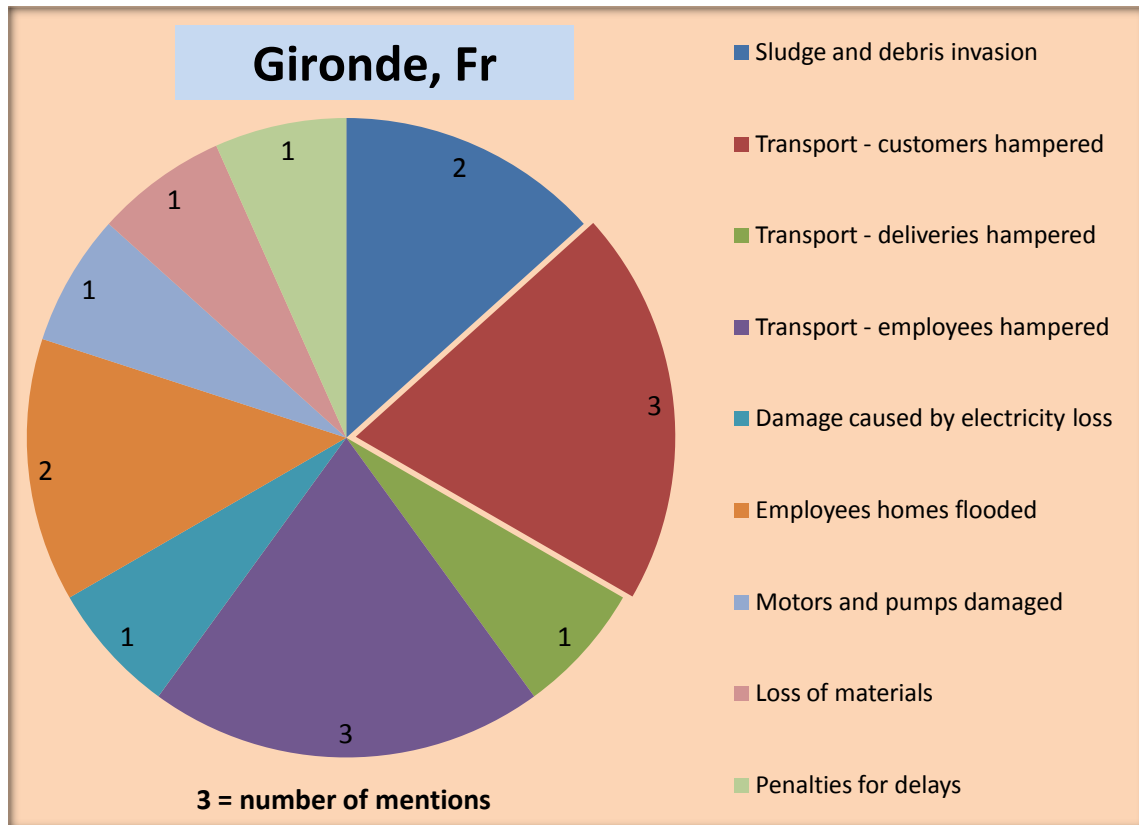


Figure 22: Detailed concerns of Gironde business regarding the consequences of flooding

Other concerns are safety and potential loss of life. It is not known why safety and the danger of loss of life was not raised in the Gironde or the Santander interview responses but these concerns may be wrapped up in the concern about employees contained in the answer about transportation risks in the case of the Gironde responses.

Responses from the interviews in Santander are perhaps a little less informative with regard to these worries probably because the flood risk is perceived to be less severe. In Santander 8 out of 10 respondents were simply concerned about damage to their commodities, and another was concerned more about the hazard to customers (also one non-response to this question). Inferences from the flood disruption inventory which was a product of the Varna interviews indicates that in Varna the main concerns relate to the beach and beach front location of the businesses interviewed. These concerns were damage to fishing vessels, building foundation erosion and physical damage to buildings, infrastructure being buried under sand, lost access and lost inventories. Again the threat to life is not mentioned in these response and nor are backward and forward business linkages which may well be less important in the case of the businesses interviewed than in the other sites.

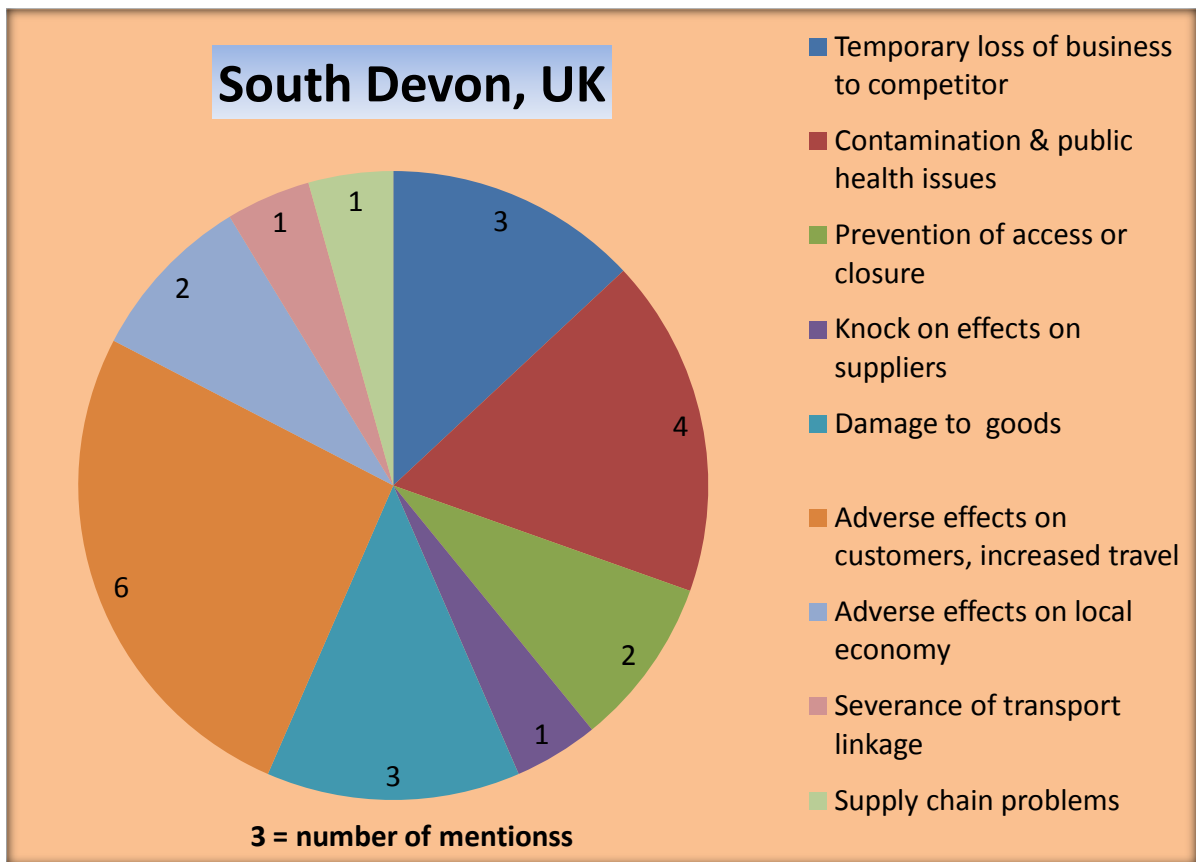


Figure 23: Detailed concerns of South Devon businesses regarding the consequences of flooding

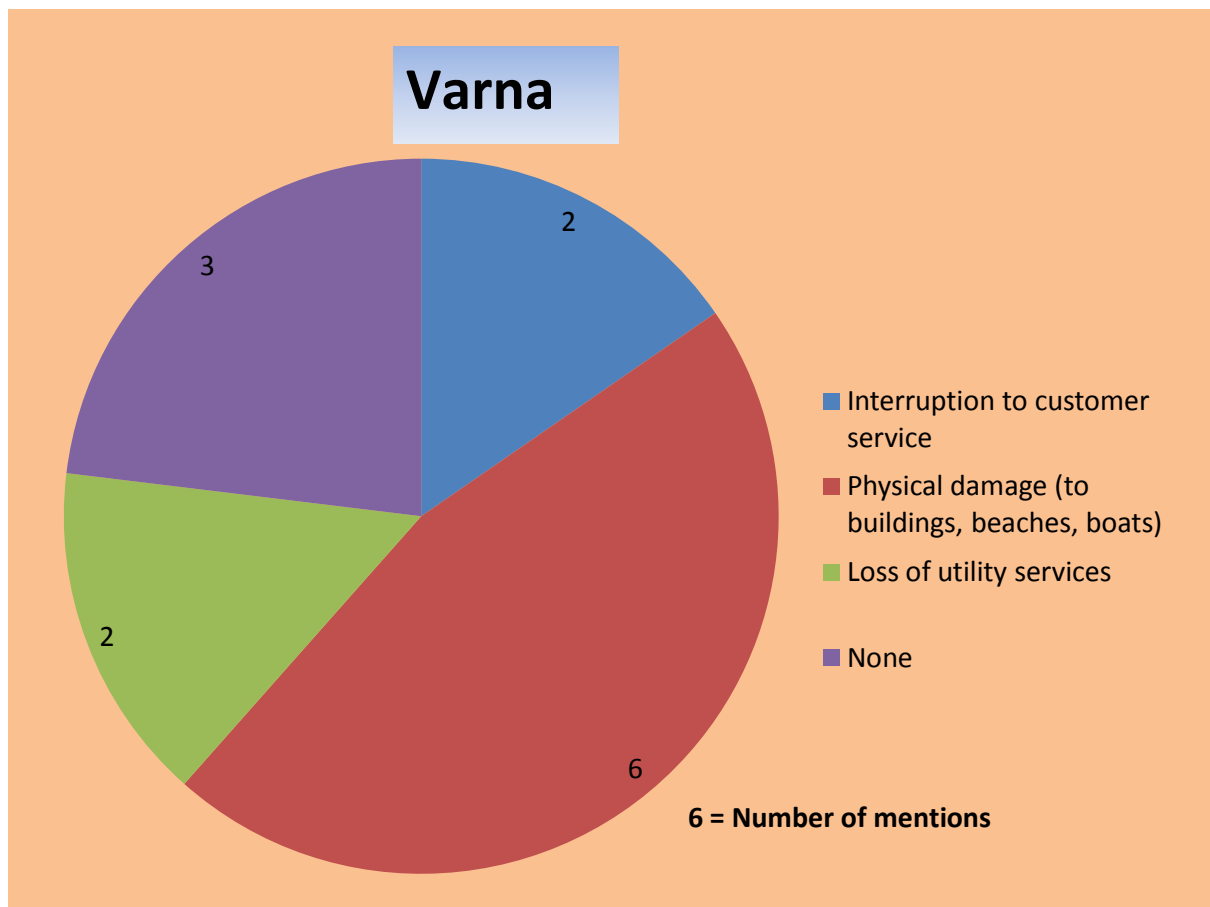


Figure 24: Detailed concerns of Varna businesses regarding the consequences of flooding

The businesses interviewed at Hel Peninsula (Gdansk) mostly fear the breach of infrastructure links to the mainland – electric energy and water supply networks in particular. Transportation and IT disruption is slightly less endangered. In the long term the local economy is very vulnerable to changes in market conditions, especially leakage of tourists and customers of related services. Adverse impacts on Hei Peninsular businesses could be triggered by a coastal event which caused loss of continuity of basic services thereby damaging the image of the area and caused a downgrading in the quality of customer attractions.

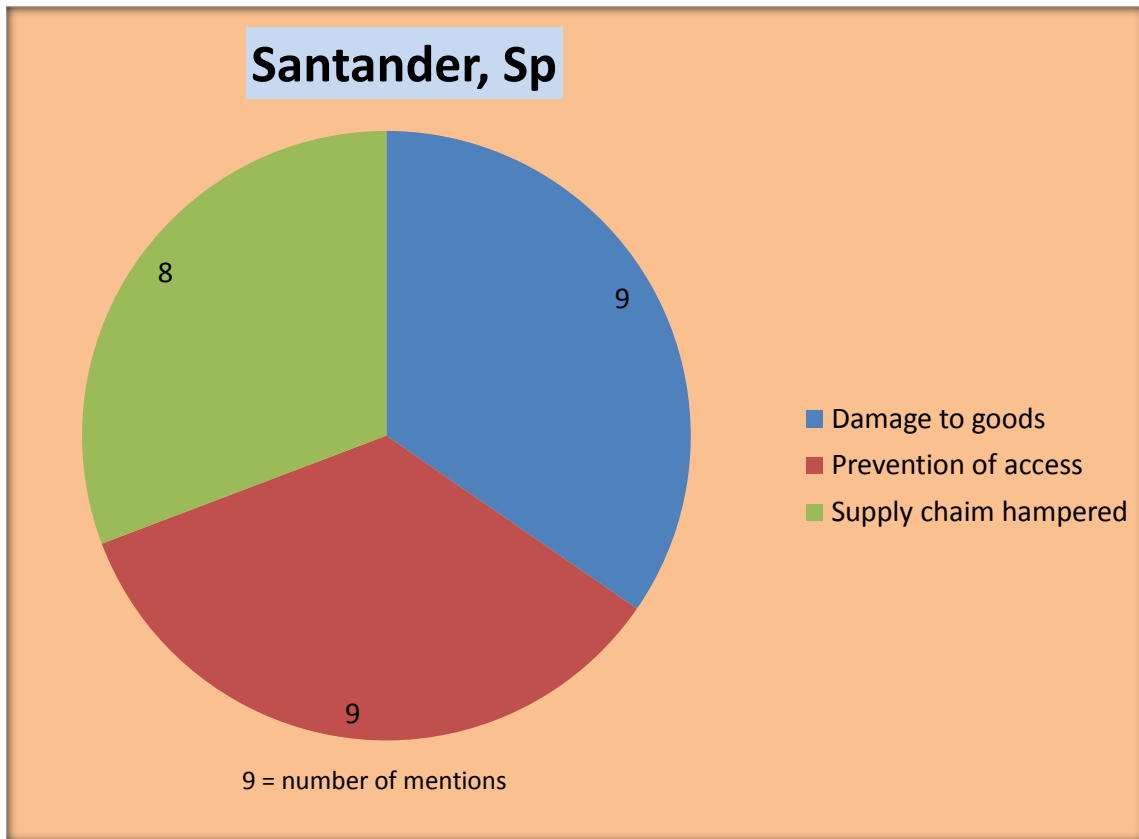


Figure 25: The principal concerns of Santander businesses regarding the consequences of flooding

Frequency of Business Flood Resilience, Contingency and Disruption Planning and Different Types of Plan

Figure 26 summarises the extent of flood crisis planning among businesses in the study sites. It is clear that businesses had many different types of crisis or emergency plan, not all of which extended to the full business disruption and recovery planning described in sections above. Figure 9 described the main components of business disruption and recovery planning as conceptualised above and within the literature. Figures 27 and 28 describe the approaches taken in each of four of the study areas.

In the Gironde, where businesses have crisis plans (here two-thirds of businesses appear to have no such plans which address flood risks), these plans focus on the risk assessment, business impact analysis and warning and evacuation elements, as well as learning and feedback in some cases. The perception of the usefulness of recovery plans, even amongst those businesses that have them, is that they are not particularly useful. One reason that may contribute to this in the Gironde may be that transportation disruption is addressed by the local authorities rather than the companies. In South Devon half of the

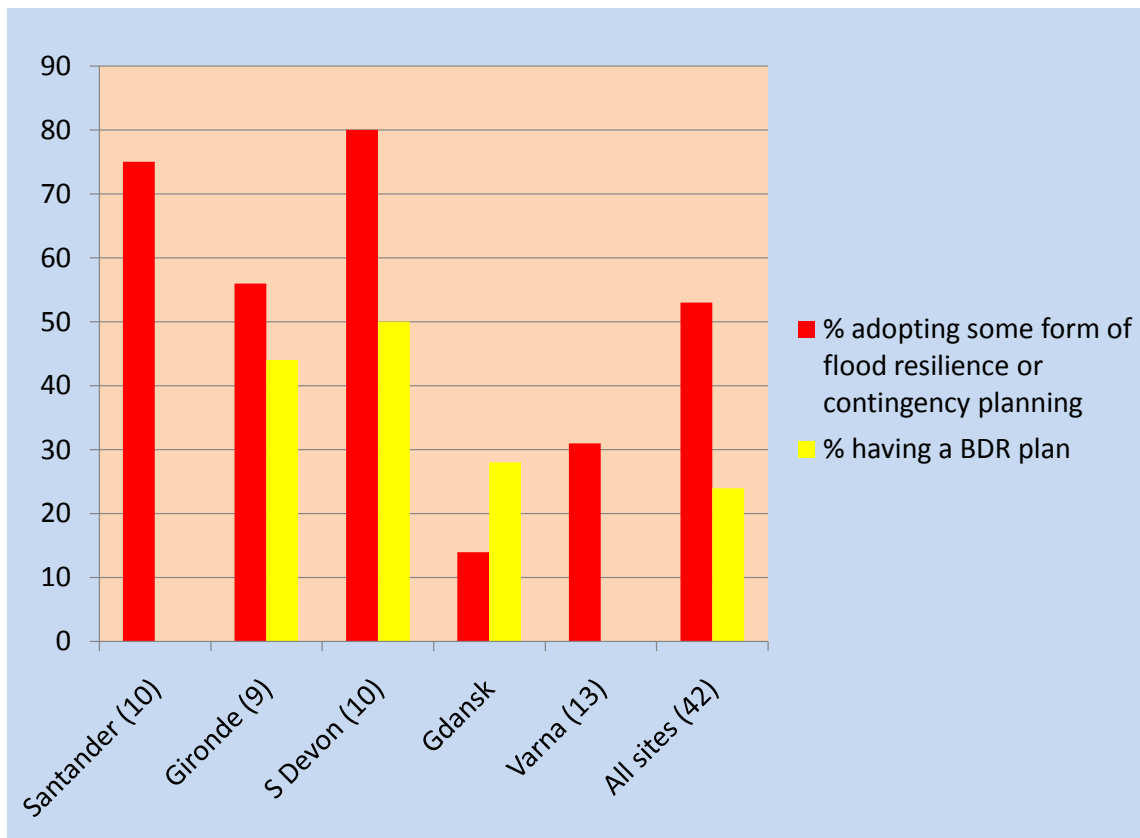


Figure 26: The extent of flood resilience, contingency plans and business disruption planning

businesses interviewed have something approach a full business disruption and recovery plan, although a surprisingly high proportion only appear to have a risk assessment.

In Gdansk only 1 (out of 7 firms) has a full BCDR plan which addresses coastal risk management – it seemed obvious for this company given its direct shoreline location and the nature of activity (gas processing). One other business has a draft of BDR plan which addresses coastal risks developed within a corporate plan. Most of the respondents - in fact representing very small businesses - declared simply they doubt that such plans could have real impact on the crisis management within the firm in case of major natural catastrophe. However, almost all the businesses included in the survey, are - directly or indirectly – addressed in the County Crisis Management Plan, which in case of this particular seaside area is prepared in cooperation with Maritime Administration Office for Gdansk Region.

In Varna, businesses rely upon the State far more than in the other sites for their business disruption and recovery activities, although quite a few also rely upon their own financial planning and State insurance. In Santander, where physical resilience measures and social networking/solidarity are to the fore, reliance is placed on disaster insurance which appears to have undermined and supplanted business disruption and recovery.



In nearly all cases, where crisis planning is undertaken, it is generic with flooding and coastal risks being seen as one of a range of risks facing businesses. Figure 29 illustrates the degree to which such planning is centralised or corporate or localised. In approximately of the cases where a business crisis plan exists, the plan is corporate and is undertaken by the parent company of the local business site.

Insurance

The impact of the availability of business disaster loss insurance on business disruption and recovery planning for flood and coastal risks appears to be complex. In South Devon, 8 of the 10 businesses interviewed had disaster insurance in place including all of those with flood crisis plans of one sort or another (i.e. 5 businesses). The possession of insurance does not therefore appear to lessen the appetite for flood business disruption and recovery plans in South Devon. Insurance data are not

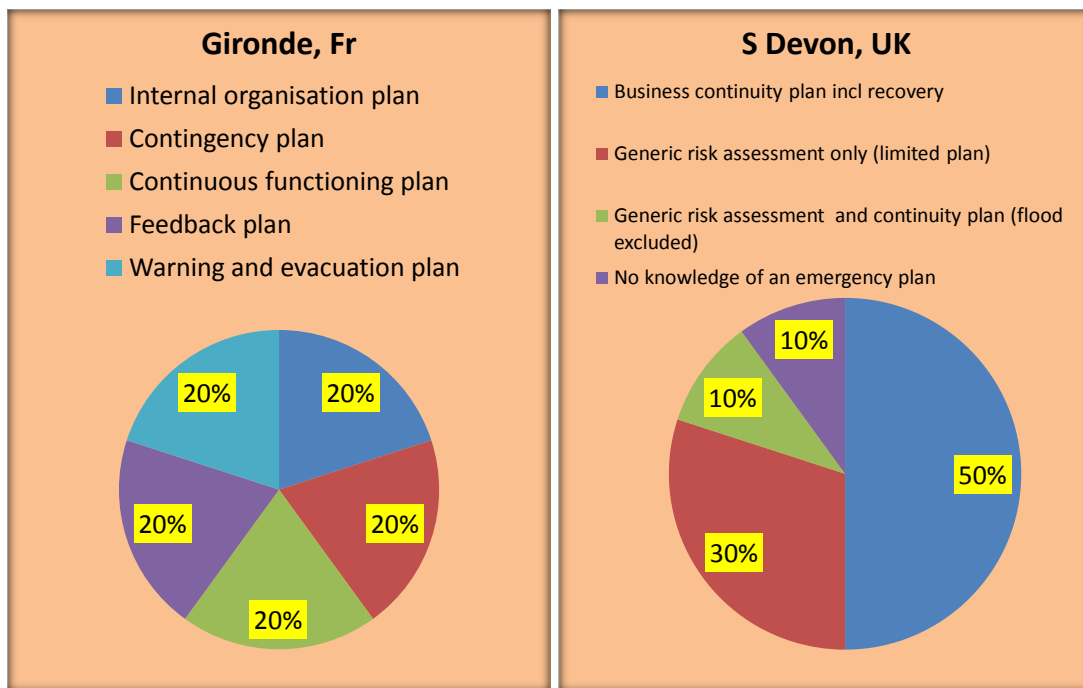


Figure 27: Types of business crisis plan: The Gironde and South Devon

reported in the response template for the Gironde, but the template notes that at least some businesses (as well as, in some cases, their employees) possess disaster insurance and that the compensation for losses that insurance provides may be act as a disincentive to invest in a business disruption and recovery plan, especially the recovery element. In Santander, the presence of an insurance Consortium definitely appears to have a negative effect on flood crisis planning, and again in Varna the insurance afforded by the State appears to have a similar effect although in Varna disaster insurance coverage may be full or partial and conditions for it are strictly laid down.

Insurance as resilience therefore appears to be a double-edged sword: in the UK it appears to be a useful resilience tool added to flood crisis planning, whereas elsewhere it appears to provide a rationale for limiting or for not engaging in any other form of flood crisis planning. Insurance companies appear to miss the opportunity to encourage business disruption and recovery planning by currently not usually giving firms a discount on their insurance premiums for doing so.

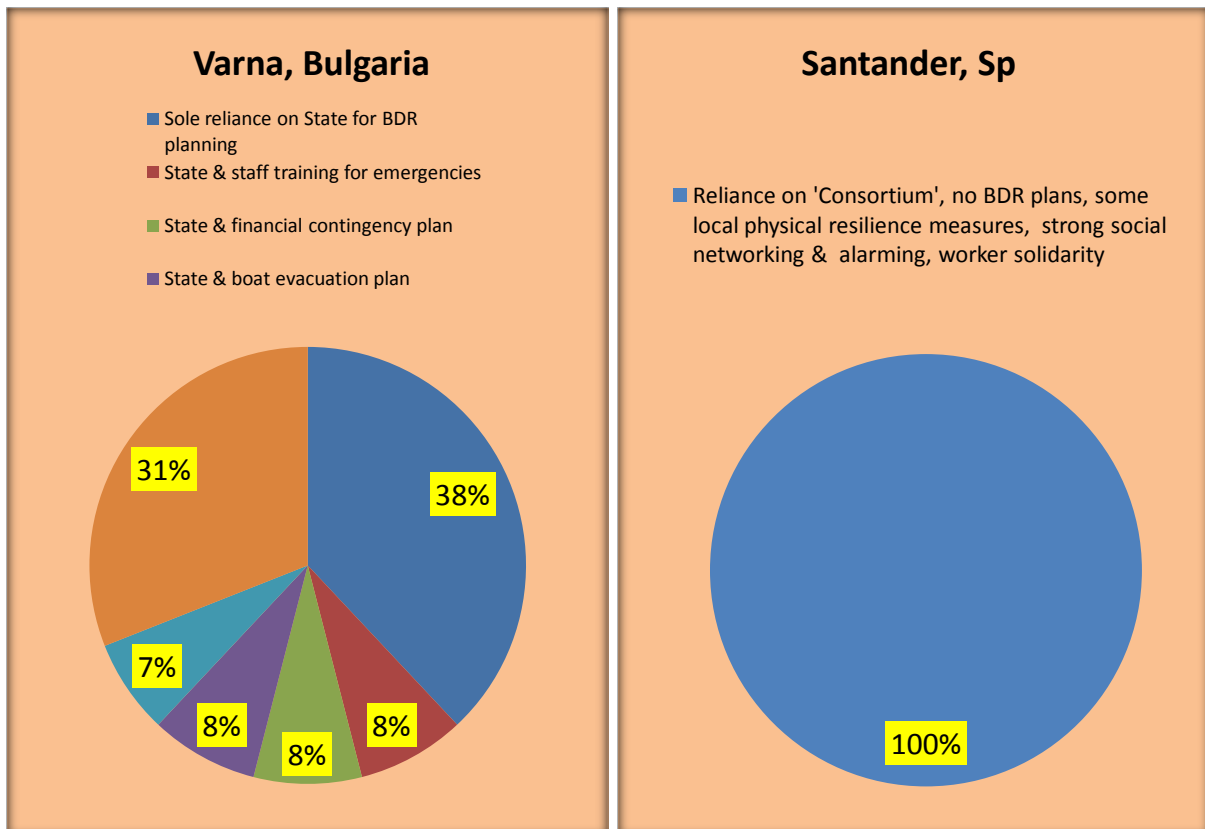


Figure 28: Type of business crisis plan: Varna and Santander

IT Back Up Systems

It is clear from some of the business interviews that a common form of business disruption and recovery planning is IT back up systems. For example, among the South Devon businesses 9 out of 10 had such systems for business recovery, although not all had back up at a different site that is not at risk of flooding. Some businesses in other sites also mentioned these forms of business disruption and recovery planning although, on their own, these plans fall short of a full business disruption and recovery plan.

Electronic data protection and back up for business continuity is currently the area of business continuity planning which the European Union is most involved in regulating because it is imperative



that national and international banking and data management systems do not breakdown and data is unprotected.

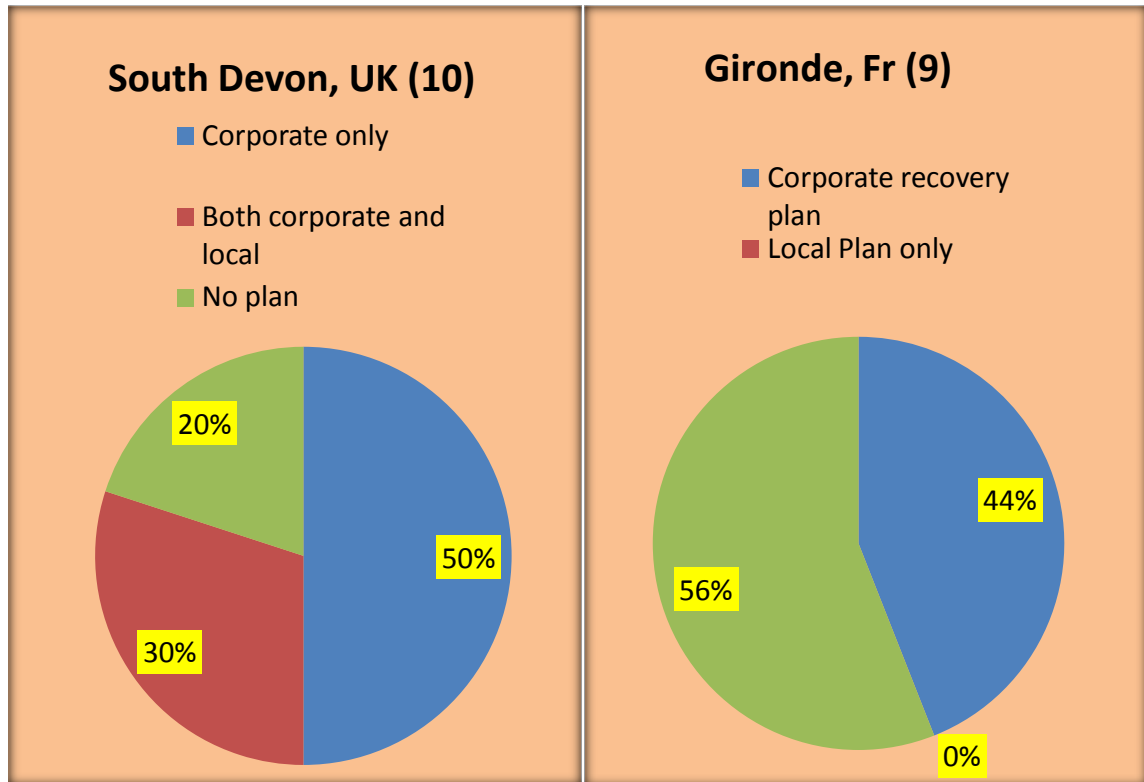


Figure 29: Incidence of centralised and localised flood contingency and BDR planning among business with crisis plans: South Devon and the Gironde

EFFECTIVENESS OF FLOOD BUSINESS DISRUPTION AND RECOVERY PLANNING

The business survey data produced remarkably little to indicate the perceived effectiveness of business disruption and recovery planning for floods and coastal risks, and more generally for other risks. It is clear that this is partly to do with the infrequency of flooding and flood experience, and partly because respondents do not appear to have thought about this much. In the Gironde, most of the businesses with flood crisis plans were businesses for which they are mandatory and so effectiveness is taken for granted to some extent. In South Devon, most of the businesses with flood crisis plans indicated that they believed them to be useful but they had no measure of effectiveness, although one transportation business believed that they were crucial to their business. Clearly, insurance is perceived to be either essential or very useful.

The Key Findings from the Support Agency and Parent Company Interviews in South Devon

These business surveys involved 10 'support agencies' (i.e. those who might potentially provide support or encouragement for businesses in engaging in business disruption and recovery planning)



and 2 parent company HQs (i.e. the Head Offices of the local branches of businesses interviewed in the South Devon coastal zone). The response for a request for an interview from parent company HQs was disappointing (2 out of 5 agreed to be interviewed). Reasons for refusal appeared to be a) the contacts could not see the importance of devoting their time to such an interview b) reluctance to provide information considered as confidential. One of the 2 parent companies which agreed to an interview only did so on the understanding that the identity of their business and the type of business would not be divulged (see 10.7 and 10.9 above).

Support Agency Findings

Table 10 reveals the support agency respondents' assessment of a) the flood risk and b) the sea level rise risk in South Devon. The flood risk is rated as Very High or High by 8 out of 10 respondents. The sea level rise risk is rated as Very High by 4 out of 10 respondents but Medium to Very Low by 6 out of 10 respondents. At least for some respondents the data show that the risks associated with sea level rise are less severe than those currently presented by flood risk, probably because sea level rise risk is perceived by some to be more remote and further ahead in time. Even so this risk rating (Table 10) indicates that support agencies appreciate the severity of flood and sea level rise risks and this is the basis on which their support for business disruption and recovery planning is presumably based.

Few of the support agencies have a formal responsibility for helping businesses to assess flood risks and to adapting to them. Only 3 out of 7 say that they have a responsibility for this in terms of coastal flood risk and only two of these for sea level rise risk (Table 11). However, a higher number of support agencies take action to support or encourage businesses to undertake generic business disruption and recovery planning and specifically for flood and sea level rise risks (Table 12).

Respondents were asked about their views about the soundness of business disruption and recovery planning as a means of addressing flood and sea level rise/coast erosion risks (Figure 30). Over three-quarters viewed this type of planning as sound.

They were also asked about their views about large-scale structural flood defences as a solution to coastal flood and erosion risks in comparison to business disruption and recovery planning (Table 13). 4 out of 10 viewed large-scale structural defences as the best solution but only 2 of these thought that such defences were better than business disruption and recovery planning (i.e. the two solutions are rated as the same by two agencies). Nearly all respondents viewed the two approaches as complementary, but only 1 out of 10 believed that business disruption and recovery was the best solution on its own.

The main drivers in the adoption or non-adoption of business disruption planning in South Devon, according to support agency respondents are given in Table 14. These are the unprompted, spontaneous



Table 10: BDR support agencies in South Devon: Respondent's personal assessment of flood and sea level rise risk

Risk rating	Flood risk	Sea level rise risk
	Number of respondents	Number of respondents
Very high	4	4
High	4	
Medium	1	4
Low	1	1
Very low		1

responses. These findings reinforce the findings from the business surveys above in that they indicate that flooding experience and assessment of flood risk as high are often important pre-conditions for business disruption and recovery planning to be adopted. The perceived costs of such planning are also clearly perceived as a reason for non-adoption. When prompted other reasons for adoption of business disruption and recovery planning were generated (Figure 31). Business survival, legal requirements, and the requirements of shareholders were important as was the survival of the local economy.

Perceived cost and fear of the time and resources necessary to undertake business disruption and recovery planning emerge clearly as the main barriers to such planning according to support agency respondents according to their unprompted, spontaneous responses (Table 15). Lack of know-how and skills is a further reason and shortness of time horizon in comparison to the annual average risk of flooding is also quoted. It is interesting that one respondent observed that insurance companies do not give an premium discounts to firms who demonstrate that they have a business disruption plan which will reduce their losses in times of flood disaster, implying that to do so would probably increase take-up of such planning.



Table 11: Number of South Devon support agencies with formal responsibilities for helping businesses to assess flood risk and adapting to flood and sea level rise risk

Whether or not responsibility is present	Coastal flood risk	Sea level rise risk
Responsibility is present	3	2
No responsibility is present	7	8

Table 12: Number of South Devon support agencies taking action to promote business disruption and recovery planning

Action to promote BDR	In general (i.e. generic BDR)	Specifically for coastal flood risk	Specifically for sea level rise risk
Taking action	6	4	4
Not taking any action	4	6	6

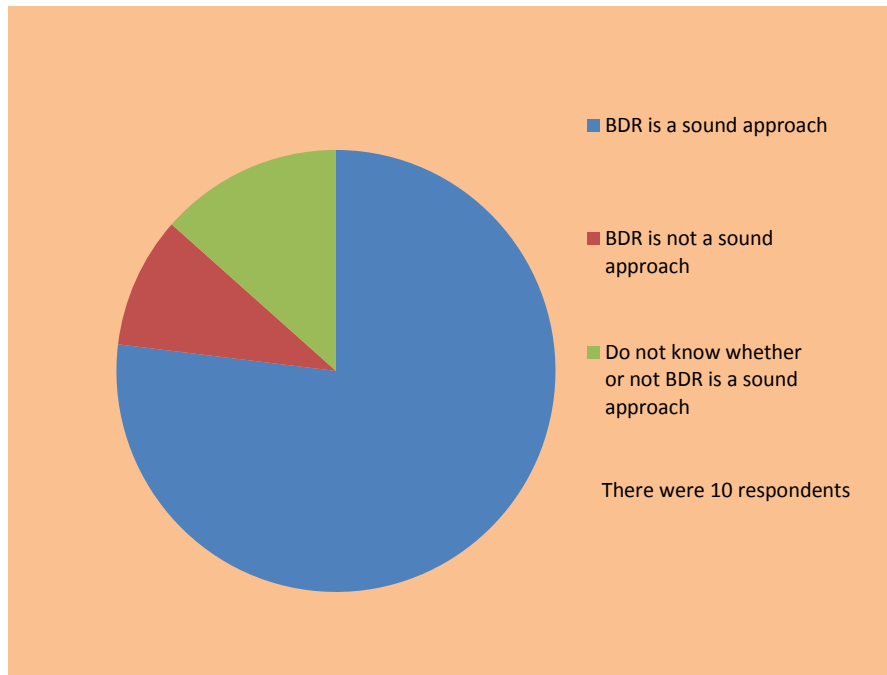


Figure 30: Views among South Devon support agency respondents about whether BDR planning is a sound means of addressing coastal flood and erosion risk

Table 13: Views among South Devon support agency respondents about large scale structural flood defences as a solution to coastal flood and erosion risk

View about structural defences	Yes	No	Unsure
They are the best solution	4	6	0
They are a solution which is better than BDR	2	8	0
They are a solution in which BDR is complementary	9	0	1
They are a good solution on their own	1	9	0



Table 14: The key drivers in the adoption or non-adoption of BDR among business in South Devon according to support agency respondents: spontaneous responses only

Being affected by flooding or know someone who has been flooded
Businesses will only respond to the immediate risk of flooding
The shrinking economy means that business people do not have time to devote to BDR planning
Inability to insure a business
Interest driven – if no interest, then no planning
Perceived cost of producing a BDR plan, and related misunderstandings and myths about the costs (BDR plans do not need to be costly)
Lack of or availability of BDR planning software for small businesses
Awareness of flood risk, flood risk maps help
The costs of BDR planning
If affected by flooding then BDR planning may be adopted, other wise it is not a priority

Table 15: The main barriers to the take up of BDR planning in South Devon businesses according to support agency respondents (spontaneous responses)

Lack of knowledge and thought – also ‘it won’t happen to me’ syndrome
Fear surrounding paperwork and the perceived work costs
Perceived as an extra task not worth doing, can’t be justified, also businesses do not keep plans up to date
They do not know how to do it
The perceived cost versus perceived risk equation and the perceived level of complexity of BDR planning
SMEs are mainly trying just to make a profit
Unless they are large businesses, they do not expect to be in business for long enough to warrant doing BDR planning
Insurance companies do not give discounts on insurance premiums for companies that undertake BDR planning

Not perceiving an immediate threat or risk and also do not have time or skills for BDR planning

Costs of BDR planning

The agency support system in south devon

Figure 32 provides a simplified overview of the agency support system for business disruption and recovery planning in the South Devon coastal zone. The flood response system, shown separately in Figure 32, provides additional multi-agency support in the event of a flood and is largely statutory (i.e. mandatory). As far as the business disruption and recovery planning is concerned the activities of the Local Resilience Forum (LRF) are important and are also largely statutory and mandatory. The LRF is responsible for bringing together the key crisis planning and management agencies to ensure that coordinated planning for an emergency takes place. Local government agencies and the Environment Agency are front-line flood response agencies within the LRF. However, from the agency support surveys reported above, it is clear that most of the support agencies see their support and encouragement for business disruption and recovery planning as non-mandatory and largely advisory

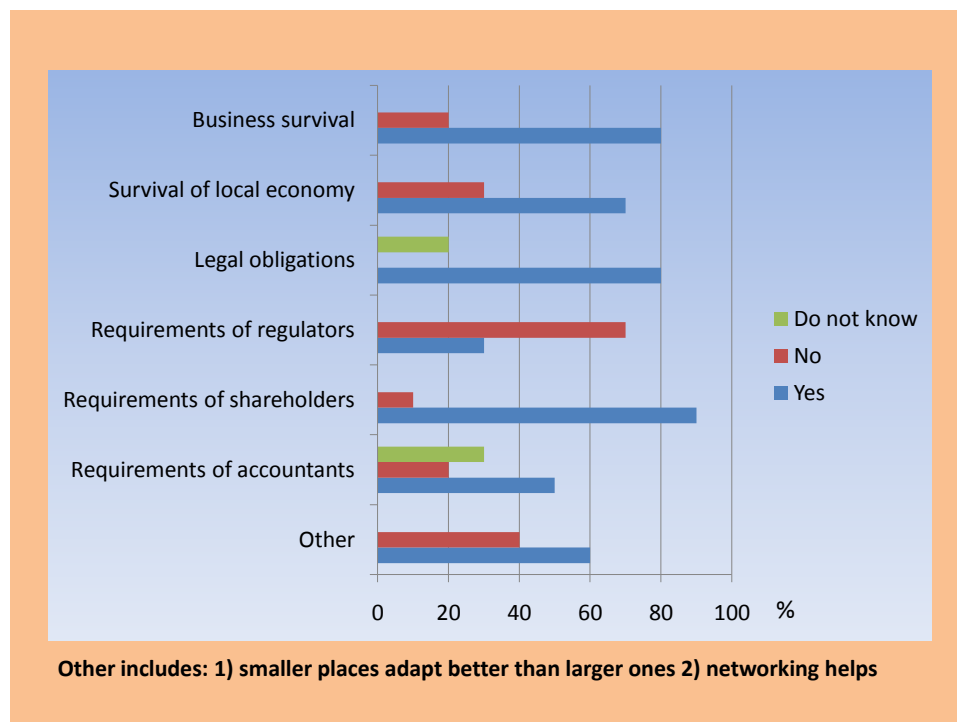


Figure 31: Prompted responses to a question about the key drivers among businesses which adopt business disruption and recovery planning in South Devon

and this appears to limit the extent to which such planning is undertaken. It would, of course, be a large step of questionable desirability for their activities to be mandatory because this could amount to businesses being forced to accept advise and possibly to adopt business disruption and recovery planning.

Parent company interview findings

One of the parent companies had over one hundred business sites in the UK, about 25% of which are in flood risk areas, but no formal assessment of flood risk or sea level rise risk had been undertaken at the corporate level. This company had a generic business continuity plan and expects flood risks to be assessed at the local level which is the case for this company. This company had no group or corporate approach to business recovery which has been shown to be important in some flood disasters (e.g. Hurricane Katrina in New Orleans). The respondent did regard business disruption and recovery planning as a sound approach to coastal flood and sea level rise risks but preferred large-scale structural solutions. In the parent company case, the company had undertaken a risk assessment for flood risks but the respondent was uncertain about whether sea level rise risks had also been assessed. The expectation was for these risks to be assessed at group/corporate level and the company had a generic business continuity plan but for some reason it did not address coastal flooding and sea level rise risks because this was considered to be too finely detailed. This business group did have a robust group/corporate approach to business recovery and the respondent believed that the business

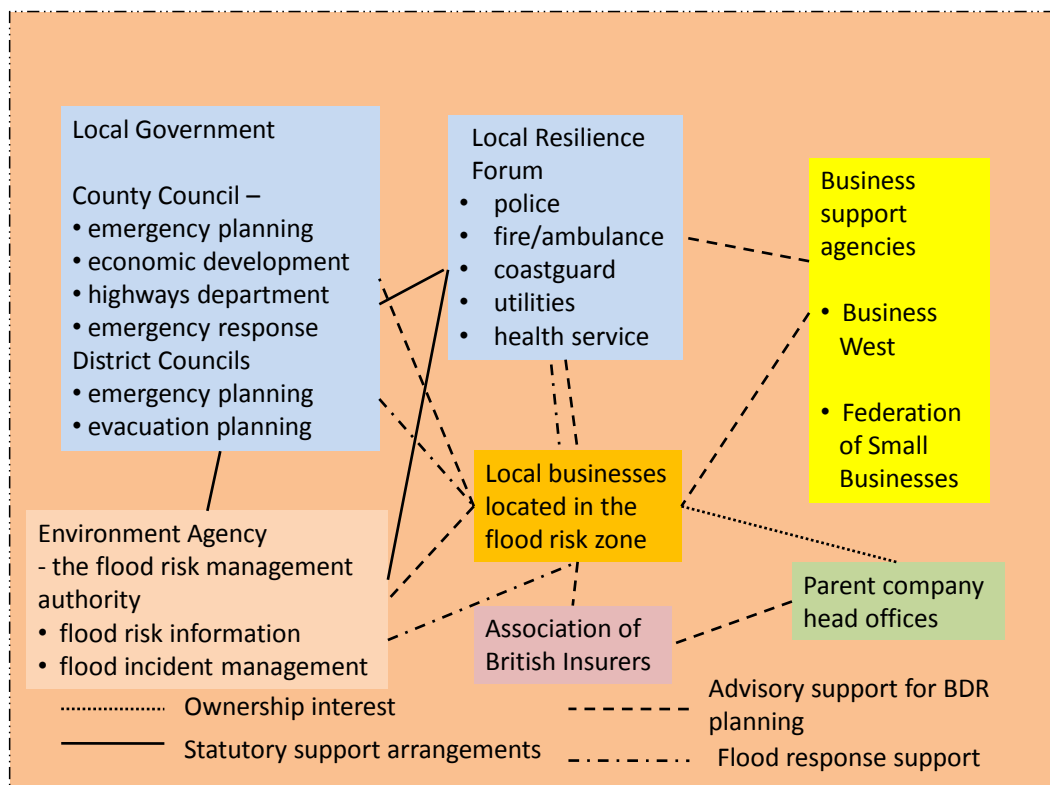


Figure 32: The agency support system for BDR planning in the context of flood and sea level rise risk in South Devon

disruption and recovery planning was a sound approach but that large-scale structural defences are the best solution (and superior to such planning in terms of effectiveness).

Discussion



In this concluding section we discuss the key findings regarding a) business disruption and recovery planning and b) resilience more generally.

THE CURRENT LIMITATIONS OF BUSINESS DISRUPTION AND RECOVERY PLANNING

The main lessons that may be drawn from the cross-site business surveys are set out in Tables 18 and 19 below. Currently, the take up of fully developed business disruption and recovery planning in the coastal flood and sea level rise/erosion risk zone is quite limited apart from where a business site is classified as hazardous and national and international legal obligations to have a plan exist. Limitations are greatest among small businesses where take-up is least. These findings generally mirror the large number of findings about business disruption planning discussed in section 4.

As a strategy for reducing the need for coastal flood and erosion structural defences, business disruption and recovery planning is currently a) limited in its take-up and impact and b) complementary to structural defences rather than a substitute for them. Currently businesses display a very mixed and patchy performance with many displaying a limited sensitivity to coastal flooding risks. Although further research is required, disaster insurance regimes do not appear to encourage business disruption and recovery planning and may even appear in some cases to discourage it.

Recovery planning appears to be the least well developed aspect of business disruption and recovery planning and so, even where businesses have developed flood crisis and mitigation plans, they often exclude the recovery phase.

Figure 33 is an attempt to model the main factors which appear to determine whether or not a business will develop or will possess a business disruption and recovery plan. Many of the pathways through the model currently lead to business disruption and recovery planning not being adopted. When the frequency of large and small businesses is taken into account the model shows that, currently, the majority of businesses will not be inclined to adopt a business disruption and recovery plan. The model does not include any deliberate policy interventions designed to encourage and increase the take up of business disruption and recovery planning, and so there is potential for influencing this positively by adopting effective policies.



Table 16: Lessons from the cross-site business surveys and the additional parent business and support agency in South Devon

<p>Perception of the utility of BDR plans to address flood risk is generally low</p> <p>Transfer of BDR theory into practice is limited, limiting potential resilience</p> <p>Businesses will only think about investing in BDR plans if they are in the high flood risk zone</p> <p>Larger businesses are more likely than smaller ones to adopt crisis planning which includes flood risk</p> <p>For most small businesses, BDR planning is extremely low on the agenda</p>	<p>Businesses do a mental cost-benefit analysis and conclude that the benefit is not worth the cost (possibly by under-estimating flood risk)</p> <p>There is nothing like an experience of a flood to stimulate BDR planning – no flood experience = no BDR planning for floods (generally)</p> <p>Where flood risk assessment and crisis planning exists they are often not subsequently developed into full BDR plans (often recovery is missing)</p>
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Table 17: Lessons from the cross site business surveys and the additional parent business and support agency survey in South Devon

<p>Crisis plans are usually generic and do not always include flood risk even in flood risk areas!</p> <p>Sometimes businesses have crisis plans including for flood risks because such plans are mandatory (e.g. Seveso)</p> <p>Businesses which subscribe to insurance can get compensation too easily without investing in a BDR plan</p> <p>Disaster insurances are often not structured in a way which provides incentives for BDR planning including physical resilience measures</p>	<p>Where the State owns property, businesses are content to let the State pay for damages and so they do little to invest in BDR plans</p> <p>The simplest physical flood/erosion resilience measures are quite common but knowledge about their potential appears limited</p> <p>BDR planning and small scale, property specific flood resilience measures are viewed as 'second best' to large structural defences</p>
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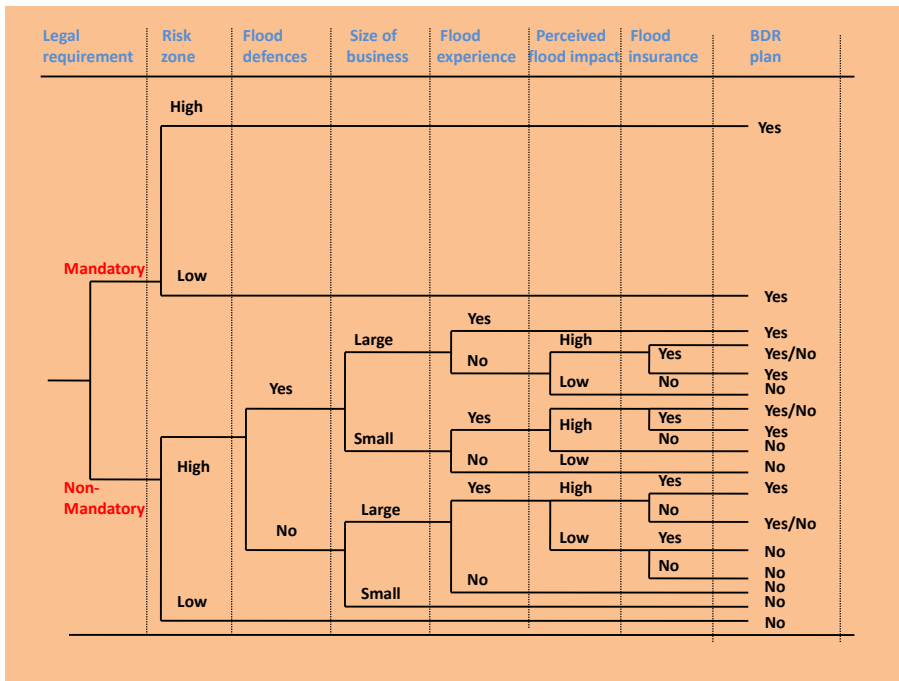


Figure 33: An experimental model of business disruption and recovery planning

RESILIENCE

AWARENESS, CONCERN, ADVOCACY, COMMUNICATION AND RESOURCES

Resilience planning begins with problem recognition and concern: these are necessary pre-requisites for action on business disruption and planning in at risk coastal communities. Awareness of flood risks appears to exist in the high risk zones within coastal flood areas, but the risks appear to be all too easily discounted or dismissed and under-estimated in the lower risk zones. However, awareness and concern does not appear to be enough for business disruption planning as a form of resilience to be adopted in its fullest sense. Instead simple physical resilience measures are sometimes taken together with routine IT back up though often not in a flood risk free location.

Flood risk awareness raising and education is often advocated where flood risks are under-estimated or not perceived and where there is a flood experience ‘deficit’. Awareness raising is very important but there are limits to the extent to which the experience deficit can be made up by educational approaches. Often too much is expected of awareness-raising initiatives.

A number of studies have emphasized the importance of key individuals acting as advocates or policy champions in resilience building (e.g. Olshansky and Kartez, 1998). The viewpoints of key individuals, and their leadership, are important in advancing resilience planning and the adoption of measures such as business disruption and recovery planning. Linked to this, sustained communication of authoritative and well articulated flood and coastal risk information, clearly based on the latest scientific assessment of risks and uncertainty surrounding them, is very important in order to convince business leaders and business owners/managers of the need to act.



It is clear from the results of the business interviews that lack of resources (often time, sometimes staff, sometimes know-how) holds back the adoption of well developed business disruption and recovery planning within businesses, although there are numerous websites providing information, advice and encouragement for such planning. Support agencies may therefore need to be more active in providing practical assistance to businesses as long as they are willing to accept such support, which will not always be the case.

ATTITUDES TOWARDS RESILIENCE

The interviews demonstrated a limited engagement with or understanding of the term of resilience. This is partly due to the use of different lay understandings and sometimes lay terms that refer to part of what the resilience concept means in its fullest articulation.

Often, to a business manager or owner, resilience is interpreted as business survival in a financial sense apparently largely unrelated to the risks posed by disasters including flood and coastal erosion risks. These risks are generally perceived to be much more remote and uncertain risks (i.e. there is uncertainty about whether these risks exist and whether or not they will ever effect the business) than the often all-consuming risks such as losing market share to a competitor, getting paid by customers, being able to pay taxes, receiving deliveries of supplies on time, costs running out of control compared with profits or losing experienced staff.

Resilience is usually comprehended in terms of the resilience of equipment or technologies, particularly IT technologies, and is often also conceived of in terms of physical resilience. Possessing an IT system that is reliable and has back up, making sure that machines and processes do not break down and that staff and suppliers are reliable are examples of ways in which resilience is thought of, though rarely in the terms of 'resilience' itself. Physical resilience measures of a fairly obvious kind, such as flood gates or stacking stocks at high levels, are fairly commonly adopted according to the business survey returns. However, conceiving of resilience as a planned process from risk assessment through to recovery to a less vulnerable state is something that few business managers appear to think about. Indeed, apart from IT back up systems, recovery tends to be the poor relation within business disruption and recovery planning.

Professionally trained managers (who tend to be in the larger businesses) are more in tune with resilience planning in the form of crisis planning in its various forms, but again resilience planning is frequently not conceived of in 'resilience' terms. There appears to be little consideration of engagement in wider community resilience planning for floods and coastal risks although a number of support agency respondent's whose position gives them an overview of coastal communities considered this to be a driver of at least some flood crisis planning undertaken by businesses. The survival of the local economies of seaside towns in the UK is of more general government (local and central) policy concern as well as a concern of local Chambers of Commerce.

RESILIENCE TO COMPLEX HAZARDS

Recognition of the need to be resilient against the increased occurrence of complex hazardous events is key part of being resilient. Most of the crisis planning among businesses appears to be generic i.e. it addresses a range of hazards. In this sense that resilience planning which takes place



in businesses usually seeks to address a variety of hazards but there is little evidence from the business interviews that the potential for coupled events is considered in crisis planning.

COLLECTIVE APPROACHES TO FLOOD AND COASTAL RISK RESILIENCE AND PREFERENCES FOR LARGE-SCALE STRUCTURAL DEFENCE

Although social networking and solidarity emerged as an approach towards reducing vulnerability to flooding in Santander, this kind of collective approach to resilience towards flooding and coastal risks appears to be limited across the study sites. In coastal towns such as Teignmouth in South Devon, where a number of business interviews were successfully undertaken, there are local trade and tourism forums in which local problems can be discussed and collective action can be developed. However, from the interviews it appears that there has been very limited take up of offers by emergency planners to help businesses develop flood resilience plans. The local Chamber of Commerce encourages business continuity planning but again take-up is limited. Instead the main action in Teignmouth is the imminent completion of the tidal structural flood defences for the town which will, for most, completely remove the need for flood resilience plans other than those associated with the local volunteers who are needed to close the flood gates at times when tidal flooding is predicted. This is an illustration case where large-scale structural flood protection resilience has been preferred by businesses and the community rather than business disruption and recovery planning.

EFFECTIVENESS OF BDR RESILIENCE MEASURES AND PERCEIVED COST-BENEFIT TRADE-OFFS

Not enough is known about the effectiveness of BDR resilience measures. Although questions were asked about effectiveness in the business surveys, the results are inconclusive. From the degree of disinterest in these measures among some small businesses and the limited adoption of well developed business disruption and recovery plans, it may be that businesses see this approach to resilience as limited in its effectiveness. There are some strong hints of this within the survey results. Theoretical studies and advocates of business disruption planning may or may not have overstated the benefits of such measures: but it is not possible to draw any conclusions about this from the survey results.

It is clear that in many cases the effectiveness of large-scale physical resilience measures is perceived of as much more effective than BDR resilience measures. However, at least part of this preference may exist because with large-scale structural defence measures the costs are apparently transferred to governmental flood risk management agencies and do not fall directly upon the businesses themselves unless beneficiaries are pursued for contributions (although they may contribute indirectly through general or local taxation). Perceived cost-benefit trade-offs and comparisons are therefore by no means straight-forward and tend to inherently favour the large-scale structural flood defence resilience measures, generating a dampening effect on BDR resilience take-up.

BUSINESS RECOVERY PLANNING AS A MITIGATION OPTION INCLUDED IN THESEUS' DSS

A method for assessing the potential flood loss savings of BDR Planning is set out and explained in Annex 4. This is a generalized, meso-scale method suitable for application in study sites which



comprise a number of at-risk businesses. The method enables the damage savings of property-specific flood resistance measures to be estimated as well as the damage savings likely to be generated by BDR Planning which is often employed in portfolio combination with flood resistance measures. Only the BDR Planning damage savings are attributable to BDR Planning but the savings from flood resistance measures may also need to be taken into account separately.

The method for estimating BDR Planning damage savings comprises three steps:

- 1) establishing generalized depth/duration/direct damage functions for the principal categories of business likely to be found within coastal flood risk zones e.g. tourism/recreational businesses, port industries of different types etc.
- 2) apply direct/indirect damage relationships (e.g. ratios) to these damage functions to generate estimates of indirect business loss potential.
- 3) estimating the indirect damage saving potential of BDR Planning solutions for a range of likely flood warning lead times for floods of different depth and duration, assuming that estimates of potential direct flood damage savings are estimated separately by reference to flood resistance and resilience measures (which are not included here in BDR Planning).

The method requires annual average damage estimates for businesses (without BDR Planning in place). These are derived from loss-probability modeling undertaken elsewhere in the DSS and there is a requirement to split these loss-probability estimates into residential and non-residential estimates. The non-residential loss-probability estimates may be used as a starting point for the application of the above method.

The method is associated with a range of uncertainties associated with averaged damage functions, estimates of indirect loss potential, the range of parameter values by which damage saving potential of BDR Planning may be estimated and potential cross-country data transfer.

BUSINESS RECOVERY PLANNING AND THE SPRC STRUCTURE

The ground testing results reveal that most views of BDR Planning are primarily based upon the idea of exploring and making changes with the nature of the receptor and the consequences rather than with sources or pathways. Governance bodies appear to enter BDR Planning thinking at the consequence end, moving next to receptors and the way in which they might be modified in order to reduce consequences. BDR Planning only seems to lead to thinking about changes in the nature of pathways if it results in ideas about attempts to prevent flooding, for example, by installing flood gates or similar devices to exclude floodwaters but these measures are not considered here to be BDR Planning measures (i.e. they form part of a portfolio of mitigation measures of which BDR Planning and physical resilience measures are two elements). This is not to suggest that businesses ignore the potential of influencing flood pathways by the installation of property or building specific resilience measures because the ground testing revealed that these are sometimes employed. There is no evidence from the ground testing that the businesses interviewed had considered relocating away from a source of flooding.

BDR Planning constitutes a process in which the primary receptor is usually viewed as the business for which an assessment of flood and coastal risk is undertaken. The next step is formulating an



understanding of the likely impacts and consequences of flooding should it occur (i.e. Business Impact Analysis). The final step is to identify ways in which the business may be organized, or redesigned, to withstand the shock of flooding. Here the main emphases are upon trying to make sure that the receptor is resilient by designing in (usually by retrofitting) various ways in which the consequences of flooding can be avoided or minimized. So, for example, a business may choose to locate its IT back-up systems outside of the flood risk zone, or it may develop contingency plans to transfer production to a branch plant outside of the flood risk zone if the primary plant is flooded or it may choose to diversify its component suppliers to minimize the risk of supplier disruption on their business. Most businesses appear to be most keen to avoid adverse consequences for their customers which could lead to loss of reputation or future business. These are examples of spatial transfers but temporal transfers may also be considered, such as having contingency arrangements in place to increase the workforce capacity in order to catch up deferred production immediately after a flood event. Possession of flood insurance allows businesses to reduce the consequences of a flood by spreading the cost of their risks over time.

The theory of BDR Planning also involves other receptors and the minimization of the consequences of the shock of a flood for them. Other receptors include businesses in the supply chain, employees, customers, shareholders and coastal communities. The extent to which these other receptors and arrangements to reduce the impacts upon them are perceived of as important by businesses located in the flood risk zone depends to some extent on the nature of the business (i.e. the extent to which it is dependent upon suppliers) and the extent to which they perceive the wider picture of consequences as revealed, for example, by a sound Business Impact Analysis. There is at least some evidence from the ground testing that some businesses do not appear to be very concerned about the wider impacts on other receptors usually because they have not considered them. In some cases governance bodies in coastal communities understand the risks of business disruption and loss as a threat to the sustainability of their local economies, and they seek to encourage ways of making the business community more resilient.

BUSINESS RECOVERY PLANNING AS A RESILIENCY ENHANCEMENT LEVER

BDR Planning and BDR plans could have a significant impact on leveraging resiliency to flood and coastal risks. They could do so in all of the ways indicated in Table 18 below as well as by being combined with other resiliency measures in a mitigation portfolio.

The resilience measures to which BDR Planning most closely fits are as follows:

- risk communication;
- flood warning and evacuation;
- property or building specific flood resistance measures (both warning dependent and warning independent);
- insurance; and
- post-crisis response.

BDR Plan implementation is most dependent upon risk communication and flood warning.

**Table 18: Potential BDR planning contribution to resilience**

	How BDR Planning could contribute to leveraging resilience
Homeostasis : Incorporation of feedback loops that stabilize the system	<p>Businesses need reliable and accurate information on their flood risk, not only by ‘pull’ methods (e.g. by making flood risk maps and related information on-line) but also by ‘push’ methods in which businesses are sent such information with a specific offer of further advice from an authoritative FRM agency, for example on uncertainties relating to risk data.</p> <p>Information the how to undertake BDR Planning and the principal ways in which such planning could lead to avoidance or reduction of flood losses should be provided in both ‘pull’ and ‘push’ modes by an authoritative FRM agency.</p> <p>Flood warning systems are of critical importance to the implementation of BDR plans since lack of time is one of the principal ‘enemies’ of effective plan implementation. A timely and accurate flood warning, providing sufficient lead time could facilitate plan implementation but better still of severe weather warnings can be integrated with flood warnings to extend warning lead time.</p> <p>Businesses could be encouraged to a) share key aspects of their BDR plans and b) to develop mutual assistance arrangements for flood emergencies so that there is a greater degree of cohesion within the at-risk business community and greater response flexibility. This requires a willingness to share those parts of BDR plans which are not confidential.</p> <p>Businesses could be encouraged to undertake ‘mock’ flood and other emergency exercises in order to identify lessons which can be learned so that BDR plans are improved.</p> <p>Flexible and mobile structures and moveable equipment could provide a stabilizing feedback. Demountable flood defences, mobile control rooms are examples of physical resilience measures that BDR Planning might well identify as feasible and desirable (presenting a portfolio mitigation approach).</p>



Homeostasis : Incorporation of feedback loops that stabilize the system	<p>Lessons learned by businesses which have been flooded could be codified by an authoritative agency (e.g. the FRM agency) and disseminated via appropriately designed local visits or workshops or ‘flood fairs’ (say within a local farmer’s market) to increase businesses’ awareness of these lessons.</p> <p>Businesses should be brought together after a flood event in order to capture experiences about damage and loss avoidance in order that lessons learned are codified and provide a basis for a BDR action plan for businesses to consider taking forward.</p> <p>Businesses could be encouraged to conceive of floods not as one-off, freak events, but as recurring events which occur in clusters over time as well as spaced apart. This could be a message within the FRM information which is provided by an authoritative FRM agency. Examples of such clustered events could be incorporated.</p> <p>Insurers could introduce incentives (such as a premium discount) for those businesses demonstrably providing and maintaining in up-to-date form a BDR Plan designed to reduce direct and consequential flood losses. In practice, currently, such arrangements rarely appear to exist presumably partly because of the additional costs of administration this could involve.</p> <p>Business seeking to make arrangements with suppliers could insist that a condition of a contract with the supplier is that the supplier demonstrates that it has sufficiently well-developed BDR plans in place to counter flood risk even if the supplier is not in a flood risk zone (because the supplier may itself be affected by a flooded supplier). This could be achieved as part of standard contractual conditions in which environmental, health an safety, data protection etc policies could also be insisted upon.</p> <p>A way could be found to facilitate the sharing of experience and knowledge of the business consequences of floods and the ways in which these may be reduced through BDR Planning between a) businesses that have experienced a flood and b) businesses that have no such experience but which are at-risk. Creative initiatives of this kind by local chambers of commerce, local government, cooperatives and trade associations could be encouraged.</p>
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<p style="writing-mode: vertical-rl; transform: rotate(180deg);">Omnivory: Diversifying ways of fulfilling needs: multiple resources and means</p>	<p>Businesses could be encouraged to analyse the critical dependencies in their business model and to consider how these dependencies could be safeguarded in a flood emergency and a flood recovery period. Most businesses rely upon ‘upstream’ material or component suppliers who may either be adversely affected by flooding themselves (even if the business is not flooded) disrupting supplies or who may not be able to get their supplies to the business because of transportation disruption and related access problems. Business also rely upon employees whose homes may be flooded and/or who may not be able to get to work because of similar problems. Finally, businesses are dependent on being able to get their finished goods and products to their ‘downstream’ customers and, because of disruption because of supply chain problems, employee availability and/or access problems and transportation problems, linkages with customers are disrupted leading to loss of sales. In extreme cases (e.g. Katrina, New Orleans) long duration of evacuation of employees and customers may lead to a loss of a key local customer base.</p> <p>Given such an analysis of critical businesses dependencies (which may be undertaken in BDR Planning as a risk analysis and a Business Impact Analysis), businesses could identify ways in which they could diversify their suppliers. They could also consider the concept of reserve labour or ways of continuing to work effectively with a reduced workforce, ways of expediting return to work in the aftermath, and also the possibility of diversifying the customer base.</p> <p>Businesses with branch plants could identify in advance contingency plans for transferring workers, production and/or sales to a flood-free branch plant so that business continuity is ensured. In the Katrina, New Orleans flood disaster a number of well-known large corporations were able to respond almost immediately in this manner because they had made such contingency plans which maximized their recovery rate and minimized their losses.</p> <p>Electricity power outages are among the most frequent consequences of flooding which lead to business disruption. Businesses could try to identify ways of diversifying their dependence on electricity power providers and transmission companies which are considered to be most susceptible to flooding.</p> <p>Diversification of transportation options (i.e. modes and routes) can also reduce business disruption (i.e. by having contingency plans for alternative transportation arrangements for upstream and downstream business linkages).</p>
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<p>High flux: A fast rate of movement allows for quick responses to threats and changes</p>	<p>Early and frequent communication of high quality information, via a multi-media communication system, to business communities in advance of a flood could allow for early alerting of possible problems, early precautions and arrangements to be taken (e.g. key workers to be moved to a state of readiness), and could allow the flood threat to be monitored and progressively responded to by businesses from the development of a severe weather system through to a flood warning in which the uncertainties associated with a flood event could be progressively narrowed down.</p> <p>A combination of the latest ICTs could be employed to disseminate high quality information at regular intervals from the start of a potentially threatening weather event leading to a flood. This could allow warning lead time, and BDR plan implementation times to be maximized and a staged process of readiness evolution and action on the part of businesses. It could also allow for readiness and actions to be de-escalated should the threat lessen.</p> <p>Many of the well-known, high street business brands are already in the business of short cycles of replacement and refitting of shops and stores, simply in order to refresh their marketplace offer and to remain competitive. This is already consistent with BDR Planning which is based on rapid turn-over and which could allow opportunities to redesign buildings, their equipment and fixtures to make them less susceptible to flood damage (e.g. by redesigning floor construction, floor coverings, electrical circuits etc. using flood resilient designs and/or less flood susceptible materials).</p> <p>Business could also be communicating regularly with the supply chain and their customers during the build up to a flood emergency to ensure that contingency arrangements for the continuity of supplies and the flow of products to market as safeguarded in so far as this is feasible.</p>
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<p>Flatness: at hierarchies to prevent them from being too heavy and cumbersome, inflexible and slow</p>	<p>Early warning dissemination systems for businesses could be as direct (i.e. short) and flat as possible. In other words warnings is not disseminated through intermediaries but directly from a single authoritative source (e.g. FRM agency, Met agency) directly to the user (a business owner or manager) or directly to intermediaries if they also need to know.</p> <p>Businesses could ensure that if an internal warning dissemination chain exists, it could also be advantageous for it to be as short as possible (with no or few intermediaries) and is directly received by the appropriate person in the business (which may be the owner, the manger, a key director, or an emergency officer).</p> <p>Similarly BDR Plans could be structured in such a way that their management and implementation suffers as little as possible from the delays of action usually associated with management hierarchies. Decision authority for BDR plan implementation could be at an appropriate level within the firm where the competence and power to take action exists.</p> <p>Large businesses which have many subsidiary or branch plants, some of which are located in coastal flood risk zones, could ensure that the local branches are able to customize group level BDR plans for their local circumstances including the flood risk.</p>
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<p>Buffering: Essential capacities are over-dimensioned so that they have the ability to absorb disturbances to some extent. Critical thresholds are less likely to be reached.</p>	<p>Businesses which are part of a larger business group could take advantage of this ‘group’ arrangement by being able to call upon financial and other assistance, or self-insurance by the group, from group headquarters and other branches. The ground testing provided examples of businesses that, if flooded, could be refitted very rapidly by the parent group with such contingency arrangements in place (for fire as well as flood). It also provided examples of local businesses which could rely upon the self-insurance arrangements made by the large parent group. These buffering arrangements could include all sorts of mutual assistance arrangements including plans to allow production and other aspects of business to be transferred to a flood-free site.</p> <p>Other forms of mutual assistance in times of extremis could be explored between businesses and between the at-risk business community and the rest of the at-risk and not-at-risk community, so that business continuity could be maintained as much as possible and recovery could be as fast and efficient as possible. For example, an at-risk furniture store could make contingency plans with a local flood-free removal company to have furniture removed to a safe place at a pre-designated stage of a flood emergency.</p> <p>Buffering could also mean that an at-risk business could maintain a continuously churning stock of raw materials, components and finished goods/products in a nearby flood-free location. This could allow business continuity and/or return to normal business operations to be maintained more easily than without such an arrangement. JIT (Just-in-time) stock controls could be explicitly adjusted to allow for such contingencies.</p> <p>Buffering could also mean diversifying the supply chain and customer base, as well as transportation systems (see Omnivory above).</p> <p>Insurance against direct flood damage and consequential loss could provide invaluable assistance to businesses threatened by flooding and other coastal risks.</p>
<p>Overlapping functions, or back-</p>	<p>Some aspects of redundancy are similar to, or the same as, aspects of omnivory (i.e. diversification) and buffering mentioned above.</p> <p>At-risk business could have IT (hardware, software and key worker) back up and these could be in flood-free locations not on the first/ground floor.</p>



SYNTHESIS : GUIDELINES FOR IMPLEMENTATION

This section presents ground tested guidelines for innovative coastal risk governance in terms of BDR Planning. Most of the businesses participating in the ground testing surveys were private sector companies. There were also a few state owned or public sector companies, for example in the Varna survey.

The governance environment in which both private and state/public sector businesses sits involves these businesses (their owners, managers and shareholders), flood risk management agencies, local and regional planning bodies, the insurance industry and a variety of business promotion and advisory fora and organisations. The Guidelines apply in some cases to businesses located in flood risk zones and in other cases to the wider governance framework relating to coastal risk zones.

An underlying finding from the research is the variation between the different study sites in terms of resilience and BDR Planning. Engagement in this kind of planning is at very different stages of development in the five countries and the extent to which it is integrated into flood risk management is also variable. Diverse political and cultural contexts lie behind this finding which are the ultimate keys to an understanding of how the guidelines may be most appropriately applied on the ground.

GUIDELINES FOR BUSINESSES

- Businesses located in flood risk zones should prepare generic BDR Plans which include contingency plans for flooding from all sources to which the business is at risk.
- Businesses should subscribe or opt-in to a flood warning service where such subscription or opt-in is necessary to be able to receive timely warnings. If necessary, private alerting services should be explored. There should also be an internal communication system capable of rapidly alerting key workers and all staff of the need to respond in pre-planned ways to a warning of a flood. This communication system should be sufficiently well informed and robust to enable the company to stay in touch with its key workers and labour force during a flood emergency and during the recovery period. Where staff and/or customers may be at risk, this communication system needs to be sufficiently timely and robust to ensure orderly and timely evacuation of premises.
- Rapid decision-making is required when disruption strikes so that adequate arrangements can be made to retain customers – this is a particularly high priority which requires speedy action. For example, businesses should have contingency plans to ensure that customers can obtain essential goods or products (e.g. medicines) during and after a flood emergency. A professional customer communication plan is desirable, which has already identified particularly important or vulnerable customers and ways of communicating with them in extremis, by which the business is able to reassure its customers and keep them informed about recovery progress and/or temporary alternative sources of essential products or goods.
- Businesses should ensure that decision-making processes relating to flood emergencies are as flat and as short and direct as possible, involving as few intermediary decision-makers and



flood warning recipients as possible. Normally a single, senior, competent individual should be charged with taking direct receipt of flood warnings and acting rapidly upon them. This person should have the authority and powers invested in him/her to implement the BDR plan in an emergency including during the recovery period.

- Flexible organizational structures and infrastructure aids response and stabilisation of the business system subject to the shock of a flood.
- Businesses should adopt a BDR Planning process which is proportionate to their resources, their assessed flood risk and likely flood impact. Currently some businesses, especially small businesses which are the most numerous, are put off by the apparent complexity of BDR Planning and its costs in terms of paperwork and time. So a small business located in a flood risk zone where the risk is low, could adopt a simple, inexpensive but effective BDR Planning process whereas a large company located in a high risk zone might well find that a more elaborate BDR Planning process is warranted and desirable.
- Businesses should analyse the critical dependencies and tolerable outage times in their business model and consider how these dependencies can be best safeguarded in a flood emergency and through the recovery period.
- Businesses should seek to diversify their electricity supplies including by securing back up generating capacity. Similarly, diversification for other utility supplies is desirable where these are identified as critical to the maintenance of business continuity.
- Businesses should diversify their supply chain if they are dependent on one or a small number of suppliers for critically important materials or components and/or if one or more supplier is located in a flood risk zone.
- Businesses with branch plants or which are part of a larger business group, should consider developing and maintaining contingency plans which address how the resources of the business group can be best utilized to absorb the shock of a flood which affects just one part of the business. Self-insurance at the group level is one possibility as is the short-term loan of equipment and labour and/or arrangements for temporary transfer of operations to a flood-free site.
- Businesses for which business site access may be interrupted by flooding should explore arrangements for either avoiding or minimizing access interruption. Alternative, temporary routes (or transport modes) may prove feasible and where possible prior agreements should be made, for example, with highway agencies or say, helicopter companies, to prioritise minimization of access disruption should a flood cause serious disruption of this nature.
- Businesses should consider ways in which key workers, and a skeleton labour force, can be maintained during a flood emergency and the recovery period assuming that health and safety considerations allow. For example, this may mean identifying which key workers may have homes which are likely to be affected by flooding preventing them from working, and making contingency plans to temporarily replace these key workers if necessary.
- Businesses should exercise and rehearse their BDR plans for flood and coastal risks in the same way as they would response to a fire alarm and a fire.



- Businesses should seek to make contractual agreements with suppliers in which there is a standard clause which requires suppliers to demonstrate that they have made adequate BDR Plans should they be adversely affected by flooding.
- Businesses should explore the possibility of mutual assistance arrangements with neighbouring companies so that one business could help another (but in different ways) in times of extremis.
- Businesses which are at high risk of frequent flooding should consider ways in which the business may be redesigned to make it more adaptable to flooding and capable of withstanding disruptive impacts. For example, flood proofing techniques could be introduced, the 3D spatial layout of the business could be altered, building services (e.g. electrical circuits) could be repositioned and/or relocated, floor construction materials could be changed from susceptible to less susceptible ones and so on. Inexpensive fixtures and fittings and equipment with a short design life could be introduced to make 'churn' shorter.
- Businesses which are located behind existing structural coastal flood defences should make themselves aware of the design standard of the defences, how that design standard is changing over time, the risks of breaching and overtopping and the consequences of rapid seawater inundation. They should then deploy resources which are proportionate to the residual risks to create an appropriate BDR contingency plan rather than being tempted to place total reliance in the structural defences.
- Wherever possible, critical facilities and equipment should be mobile and/or duplicated (i.e. 'backed up'). Examples include a businesses' crisis management centre and IT (software, hardware and data). Back up facilities should be located outside of the flood risk zone.

GUIDELINES FOR OTHER GOVERNANCE BODIES

- Shareholders should insist that companies located in coastal flood risk zones demonstrate that they have made adequate BDR plans, including through full consideration of the guidelines above.
- Flood risk management agencies should integrate BDR Planning into their strategies, not only for their own business operations but to promote and encourage both private and public sector business to adopt and enhance this form of planning.
- Currently, European countries vary greatly in the extent to which their coastal and flood risk management agencies and strategies fully embrace the concept of resilience including BDR planning and convert this into practice. Where resilience strategies are being prosecuted they sometimes apply only to, or more to, the residential sector.
- Flood risk management agencies should step up their provision of authoritative location-specific flood risk information, and more customized assessments of flood risk, for businesses or for a specific business community.
- A common factor emerging from the business surveys is that often businesses do not feel that predictions of flood risk are sufficiently precise or accurate for them to act upon. They tend to use this as an excuse for not assessing flood risk and adopting appropriate BDR plans. Businesses sometimes refer to different and conflicting flood risk data and predictions which they believe are insufficiently credible to act upon. This may well be because they hear and read different predictions and cannot distinguish the authoritative ones. Flood risk



management agencies could provide businesses with customized risk flood information – specific to their businesses sites – and they could also help provide flood impact information including impact visualisation.

- Flood risk management agencies should seek to dissuade the media and businesses to conceive of floods as one-off, extreme (even freak) events but, instead to comprehend them as recurring events sometimes occurring in consecutive months or years rather than being equally spaced in time, likely to increase in frequency and magnitude in coastal zones. Flood risk management agencies should work with media agencies (local radio and television, local press etc.) to develop stories and media coverage which promotes such a perspective.
- Businesses which have experienced the shock of flooding should be brought together with businesses with no experience of flooding, so that the latter may be helped to learn the lessons relating to BDR Planning. Business fora (such as local Chambers of Commerce, Trade Associations, local authority fora, local economic fora etc.) should take the lead in making arrangements for this to happen.
- Lessons learned by flooded businesses and how these lessons inform resilience leverage should be researched and codified by an authoritative agency (which commissions research) and made available at appropriate venues (e.g. trade fairs, local markets) to raise the awareness of business men and women about the benefits of BDR Planning.
- Increase training for businesses in generic business disruption and recovery planning. Training opportunities of this kind abound in some countries such as England and Wales but may be less well developed say in Eastern European countries. Increasing training is a generalized prescription which is already common but there are likely to be ways of increasing take-up.
- There is a need to somehow ensure that the business community draws upon a more complex, multi-faceted approach to resilience. Businesses need to consider various forms of resilience and how their actions might reduce all forms of vulnerability. Even businesses which adopt BDR Planning in some form or another do not often appear to consider their role in potential community resilience.
- Insurers could introduce incentives (such as a insurance premium discount) for businesses which demonstrate that a) they have an adequate BDR Plan which addresses flood risk and b) that this Plan is kept up to date.

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POST CRISIS MANAGEMENT AS A MITIGATION OPTION (LUCA PIETRANTONI, GIANLUCA PESCAROLI)

GENERAL CONTEXT

THE DISASTER CYCLE

A disaster impacts on the interactions between society, policies and environment. A catastrophe is settled in a dynamic process where actions and responses are activated for facing an adverse event and determine a gain of experience that could be translated in new and different practices. This continuous chain of actions/reactions is defined in literature as “The Disaster Cycle”, and it schematizes different phases that take places in sequence, sometimes occurring simultaneously. Its main goal is to reduce the vulnerability in the future iteration of the cycle by reinforcing short time actions and long-time measures of preparedness and community resilience (Wisner and Adams 2002).

When a disaster strikes it breaks the ordinary development of social system, generating a succession of different interacts in time. The phases of a disaster cycle vary from hours to months and years: they include single dynamics that have proper curves of expansion/contraction and could start before the sudden hit of a catastrophe and last until reconstruction is over. A clear example can be made from flooding experience: humans have elaborated systems of dikes and dams as adaptive measure to avoid coastal waves or river spates during centuries. Together with engineering solutions both formal and informal warning systems have been created, as well as river basin and seaside areas administration policies. A new flooding that exceeds those measures implies a practical response to save lives, to limit damages and to activate a recovery. When the situation acquires a steady state new measures and standard routines will be elaborated to avoid the same failures in future.

Several approaches have been used until now, but they generally maintain the same structure from disaster mitigation to disaster recovery. The different models usually contain a number of phases that could vary from four to six, depending on the complexity grade and the specificity that are intended to face. There could be noted however a main division in two different major temporal lapses: mitigation, preparedness and warning take place before a disaster strike, while response, ongoing relief and recovery take places after the occurrence of the disaster. In the figure 34 this approach and those lapses have been shown underlining how ideally a *smooth transition from recovery to ongoing development* should be found.

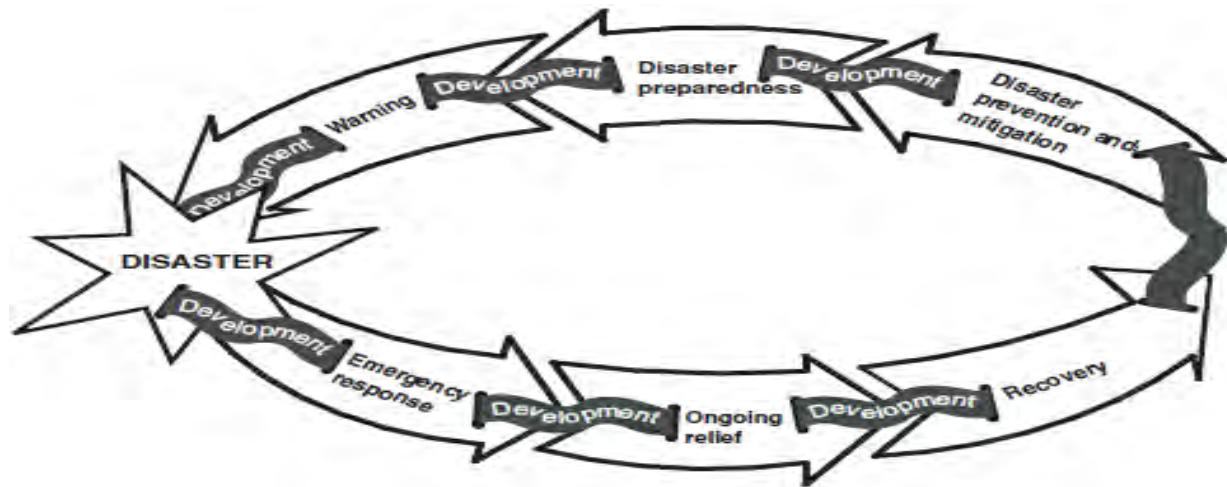


Figure 34: developmental considerations related to all the disaster cycle (Wisner and Adams 2002)

A four phases model will be presented distinguishing in *Hazard Mitigation, Disaster Preparedness, Emergency Response and Disaster Recovery* (Lindell et al. 2007). A general specific duration cannot be identified because every emergency has its own characteristics and requires different actions to be solved. It can be said however that when a community, a local authority, or a local stakeholder decides to manage a possible hazard, a strategy should be developed from considerations about:

- 1) *Hazard Mitigation* intended as the identification of disaster's cause. The goal is to stop the disaster with actions developed before its happening, reducing its likelihood or its impact.
- 2) *Disaster Preparedness* which includes the creation of procedures and planning useful for effective emergency response and disaster recovery. It is based on long-term actions that increase the overall capacity of reaction to disasters.
- 3) *Emergency Response* that starts when the disaster occurs and the emergency managers coordinate the relief efforts to secure lives and provide basic needs. The five main activities include *securing the impact area, evacuating threatened areas, conducting search and rescue operations, providing emergency medical care, sheltering evacuees and victims*. Emergency response is intended to last until the situation is stabilized and risk is returned to normal levels.
- 4) *Disaster Recovery* intended as the process where the community acquires normality back. This phase could be very long, as it includes both rehabilitation and reconstruction activities. The final goal is to restore the quality of life that the community had before the disaster.

The European Union is actually implementing policies related to all the phases of a disaster cycle. Disaster mitigation and preparedness measures include environmental legislation, the diffusion of a "preparedness culture" and strengthening of national civil protection bodies. The capacities of emergency response have been further increased within the mechanism of the European Civil Protection for assuring higher coordination and cooperation among member states. Recovery is finally sustained with Commission's Solidarity Fund as well as with lesson learned sessions organized by the Commission (European Commission 2008). A particular relevance is acquired by flood management because the responsibility of river basins and coastal sides requires a cross-national dimension for geographical reasons. Risk reduction strategies act on all the process. Indeed, the World Health Organization (2002) defined Risk as: *the probability of harmful consequences, or*



expected losses (deaths, injuries, property, livelihood, economic activity disrupted or environment damaged) resulting from interactions between natural or human-induced hazards and vulnerabilities (WHO 2002 p. 7). Risk is modified by the level of local preparedness and could be expressed by the following function (WHO 2007):

Risk is proportional to Hazard x Vulnerability / Level of Preparedness

THE PSYCHOLOGICAL AND SOCIAL DIMENSIONS

A large number of individual aspects is involved in the disaster cycle. According to Tapsell (2011), the responses to flood impacts could be dynamic and overlap over phases. They could condition the evolution of local resilience strategies, as well as the effectiveness of emergency relief efforts at large. The preparation and planning phase could be affected, for example, by the flood experience and the acceptance of living in a risky area, as well as from local flood history. These elements drive choices on invest money or spend time in risk reduction measures as the improvement of buildings and emergency planning. Flooding is said to undermine perceptions of home, individual sense of self and place identity (Tapsell and Tunstall, 2008). People have a strong emotional attachment to their homes, can experience severe distress when they are damaged, and have reported feeling less attached to their homes as a consequence of flooding. Previous flood experience and the impact on people's identity have been shown to be more significant in preparing for flood than simply awareness (Tapsell, 2011). The individual responses and the subjective reactions to flood could be related as well to the characteristics of the property, the measures undertaken in preparedness (as the presence of an insurance), and the assistance provided by relief efforts. Evidently, someone that received adequate information about emergency planning and knows that repair his house in the aftermath will be affordable, will face a possible evacuation or possible discomforts with more lucidity.

The scale of damages is likely to determine furthermore how the experience is perceived individually and how much time it will require to be elaborated. Many factors will contribute directly in determining grieving features, as the presence of emotional support or the social capital that will create a stronger community self-help background. Similarly, it is generally acknowledged that preparation and planning for natural hazards can help to avoid or reduce damage and losses and thus lessen many negative socio-psychological impacts. There are many ways in which people can prepare and plan for floods. Key factors are: flood experience (often related to length of residence in an area), awareness and acceptance of the risk and a desire and ability to take mitigation actions.

Awareness is often related to past experience of flooding. It is particularly difficult to raise awareness where no history of flooding exists and this has implications for areas with a low probability of flooding but where the potential consequences could be high. Past experiences and local pattern could determine as well the citizen's care for municipalities' advices or compartmental codes: if floods have been already in place it's harder to deny their possible risk, but the credibility of possible alerts and mitigation measures will rely also on the level of trust in institutions. The involvement of local stakeholders in the awareness campaign is important for reaching the larger audience possible. Tenure has been shown to be a factor in risk awareness in the UK (Tunstall et al., 2006): homeowners in particular may seek out information on flood risk as the home represents a



significant financial investment. Renters are often unaware of such risk. There is often a tendency for people to deny personal flood risk. Although many perceive their local area to be generally at risk, people do not necessarily translate that risk to their own property. All of those perceptions and behaviours are related to people's social constructions and evaluation of the risk. Renn (2008) also highlights the closeness in the connection between knowledge and values; the stage at which risk is framed and defined will inevitably involve social values in determining what risks are socially significant and the setting of goals. The information deficit model widely used by flood risk managers in the past is said to neglect the socially embedded and contextualized manner in which people make sense of the worlds. Risks need to be viewed in the context of evaluations of local life and local environment. People must also be motivated to take preventive actions. There is therefore a need to increase awareness not just of the probability of floods but also of the negative consequences upon households and communities, including the length of the recovery process.

Preparedness actions taken by households and businesses can range from keeping alert for flood warnings during high-risk months, not keeping irreplaceable items on ground floors and acquiring sandbags, to moving valuables, personal property and cars to safety. However Harries (2008) argues that one reason why people do not prepare for flooding is because such measures are perceived as endangering other needs that are more immediate and pressing such as protecting their idea of security (the home as a safe place) which may result in denial of being at risk. For others, flood mitigation measures such as flood gates were rejected as they lessen the visual conformity of their homes to an idealized norm and are often perceived to reduce the value of properties by alerting potential buyers to the flood risk.

EFFECTS OF FLOODS ON PHYSICAL AND MENTAL HEALTH

Among the natural disasters, floods are often the most lethal (Alexander, 1993). Data about flooding in Europe are impressive. During recent years, they have been the most common natural disasters in the Community's border. During the period 2000-2009 7 of the 20 most important floods, if evaluated in terms of number of affected people occurred, were recorded in Europe. Even if deaths for flooding are limited in developed countries, more than 1000 people have been killed in the Union and over than 3.4 million people have been affected in the last 10 years (International Disaster Database EM-DAT 2012). The effects of flooding on health assume different forms, and those are amplified by the interaction of the disaster with the precarious situations that were already in place before its impact. The collapse of a sewer system for the extra- amount of water present in place, won't limit the problem itself just to build back the sewer efficiency: it will be necessary to limit the contamination of white potable water system, avoid that the population to assume risky attitudes and provide health care for those who had contact with contaminated water. The World Health Organization (2002) taking as reference Menne et al. (1999) distinguish clearly among the direct and indirect effects of floods on human health. A logic relation between the possible causes and their health implications could be established and allows schematizing as follow the health effects of flooding:

- *Direct Effects.* They include main physical and geographical characteristics, as the territorial land features, the speed of floodwater onset, depth of floodwater, absence of warning, and fast waters carrying debris. The intensity of the event could finally increase physical and



emotional stress that could generate in some cases higher sensibility to psychosocial disturbance and cardiovascular incidents.

- *Indirect Effects.* The possible damages to infrastructures and facilities could generate chain reactions that have the capacity to slow down or heavily weaken the social machinery. In time of globalization, the higher interconnection among locations makes most territories dependent on transportation and all kind of supply. The disruption of transportation system is likely to determine food shortage or condition the emergency response, while the damages to storage tanks and underground pipes are likely to generate chemical pollution with potentially chronic effects. Similarly, every dynamic that involves the destruction of primary food products could cause food shortages, as well as the interruption of normal health services could imply insufficient access to medical care. If floods affect the availability of clean water supply or sewage disposal is interrupted different symptomatic or vector borne diseases could spread.

According to a major classification of European health impact of flooding from the International Disaster Database (Guha-Sapir et al. 2010), it is possible to create an alternative classification based on the relation between the impact and its features. The main cause of mortality can be addressed in drowning, while injuries and disease have typical incidence of zones without heavy pathologies as malaria or cholera. If compared with the WHO classification the chronic illness could be more settled with High Developed Countries' matters, as in case of erratic blood sugar levels or high blood pressure. The mental health impacts are underlined in their multiple assets, from higher stress levels to the comparison of nightmares including main symptomatic for affecting children/young adults. A wider importance is recognized finally to main social disruption and relief failures, as increased referrals, lack of coordination and standard measures between rescuers and authorities as well as system disruptions.

The disaster often causes the disruption of ordinary routines, with possible interruption of other important aspects of lives. Diet and exercises, for examples, can be substituted with low quality food: when there is no possibility to cook or the access to kitchens becomes harder, people may have to rely on takeaway foods and that clearly affects nutritional status. Similarly, if social programmes or normal health care provisions are suspended people subjected to chronic illnesses could suffer from problems in accessing basic therapies as insulin. During last decades the impacts of floods specific mental health impacts have been recognized (Tapsell and Tunstall, 2006), even if most studies describe high or middle income countries as United States, Australia, Poland and United Kingdom. Some evidence is dated back to the 1968 Bristol floods, but only with the evolution of reach and the growing evidence, individual psychiatric symptoms were linked to common social impacts. The perspective of the community dimension of floods could be derived for example by the autumn 2000 flooding in Lewes (UK) (Reacher et al. 2004). In this case, common mental disorders were highly associated with floods 10 months after the event, with evidence about a fourfold higher risk of psychological distress in adults belonging to flooded households when compared with non-flooded ones. Tunstall et al. (2006) investigated further the psychological effects at the individual and community levels with a research that covered 30 locations affected by fluvial flood events in England and Wales since 1998. Results underlined that 59% of flooded respondents attributed some



physical health effect from to flooding. Psychological effects were commonly reported after flooding as for example of anxiety symptomatic: the study suggests that the effects of flooding on mental health have the capacity to increase the burden for health care systems even in the long run because they can affect people's capacity to copy. Evidence from the north of England suggests indeed that flooding could reduce the quality of community life and produce a sense of community breakdown while conditioning the activities that usually create a sense of cohesion (Tapsell and Tunstall, 2001). The post flood disruption and the long recovery process that has to be faced seem to be the cause for the most significant stressor for people's health (Tapsell and Tunstall, 2001; Tunstall et al., 2006). Stanke et Al. (2012) sustained recently that flooding are normally stressful for long time after water's withdraw while people's experiences are determinant for the psychosocial impacts more than the event itself. Similarly, even if a majority of people experienced distresses, the attributes of resilience and the value of secondary stressors should be contextualized and referred to local reality's features in order to be adequately understood. Psychosocial experiences are really shaped by how relief has been delivered, and it is fundamental to recognize the vital importance of families and communities in promoting resilience. However, the threshold by what could be a normal response and a symptomatic of psychological illness is a grey area where often research lacks focus on the local morbidity before the disaster.

According to a research developed by the United Kingdom's Health Protection Agency (Paranjothy et al. 2011) mental health symptoms were two to five-fold higher among individuals that experienced flood in their home, as well as whom experienced the disruption of the essential services increased negative psychological outcomes by two to three fold. Furthermore, people hit in their finances were more likely to report probable anxiety, depression and psychological distress. Interesting differences among regions were visible and were probably related to methods and timing of data collection, but even to the different levels of social deprivation as well. The World Health Organization Regional Office for Europe underlined in 2010 the presence of long term impacts of flooding that could be related to main factors as psychological impacts, disruption of main essential services, and environmental matters. These elements are often less visible, and particular population groups could be especially subject to their effects: s a sensible background characterized by particular weaknesses can involve for example the elderly, the young, the ones suffering from chronic diseases or belonging to lower social and economic status. For a long time, intangible psycho-social aspects of flooding were not included in policies or in practice (Tapsell, 2011). The tangible effects of damages ware the one more studied and developed, as they were easily quantified in monetary terms and technological solutions.

Thus, the response to flooding hazards was dominated by a "command and control" mentality which was focused on the basic response practices as cleaning up and rescues the survivors. The social effects could be addressed instead as "the people's dimension" of floods: a degraded life quality could have consequences in the long run and could require more importance in public expenditures and governance decisions especially in climate change scenarios (Tapsell et al. 2002).

A particular relevance in mental health impacts has been acquired by Posttraumatic stress disorder (PTSD). It is associated with a stressful event of exceptional catastrophic nature, and it could be associated with different symptomatic as intrusive memories, excessive vigilance or sleep



disturbances. PTSD could affect both people subjected to floods and relief forces. Even if the real incidence and the culture specificity of its diagnosis have been questioned, a large number of studies show increases in PTSD after floods in Europe and United States (McMillen et al. 2002, North et. al. 2004). For example, after the 2002 floods in Austria (European Federation of Psychologist's Association 2010) many cases of acute stress were where some individuals lived a re-traumatization as old people reminding of "war".

NATURE OF THE MITIGATION OPTION THAT IS PROPOSED

Mitigation options of post crisis management acts on tangible and intangible effects of floods. On the one hand, increased efforts on dissemination, education, involvement are suggested. On the other hand, actions on critical facilities, warning system and evacuation plan are considered and integrated in the Decision Support System (DSS).

DEFINITION OF INFORMATION, EDUCATION, INVOLVEMENT

Three main critical elements can be identified as pre-requisite for any non-structural mitigation option: Information must be effective, citizens must be trained or educated on what to do, and stakeholders must be involved. These features could be seen as constantly interacting and overwhelming among each other in evolutionary adaptation process.

Information is determined by cultural and local patterns which determine both input needed for action and the way of life and the behavioural reception of alert messages. Demographics, community characteristics, specific features of local campaigns and relation of local stakeholders with central agencies are clearly central collective elements, as information is likely to be elaborated in the personal sphere derived from experience, local knowledge and trust in information's providers (Burningham et al 2008). Thus, understanding the social context and capitalizing knowledge means providing intuitive advices that could influence people's reactions (Evans 2011). Dissemination process can be seen as critical element in information effectiveness, as for example if information about suitable actions to undertake is available in the local emergency plans but citizens are not aware their existence their reaction will be less coordinated.

The effectiveness of their behaviour is derived indeed from experience and *education*, meaning simply the "I know what to do" concept. The alert messages must be understood and should generate appropriate measures of self- defence, while preparedness in the long run should start from providing knowledge of appropriate actions to undertake before critical moments. Education about flooding risk, could help as well in overwhelming the process of denial or disbelief and activate immediate and planned dissemination of warnings as well as other preparedness measures (McEwan et al. 2002). Education has indeed a prominent role in creating awareness of risk and empowering people, while a balance between freedom of individuals and responsibility of society should be achieved in the field of risk management and should be properly coded in legislation (Bruen and Gebre 2001).

The third element is finally determined by the political approach used to provided information and education: *involve* citizens and associations. On the one hand, local communities and governmental agencies usually represent different players with different strategies. On the other hand, small



municipalities fail often in delivering appropriate measures because their own decisional processes do not provide enough possibility of participation decreasing trust in decision makers' actions. According to The WMO (2004, 2009) the dialogue among different levels in decision making process is the essential base for effective flood management, while a concrete shift from top down approach will produce benefits in all the phases of disaster cycle. For example, the involvement of the local stakeholders and the civil society acquires a main role for the effectiveness of warning systems because they could suggest the right methods to improve the diffusion of alert signals or provide the support of other community networks.

DEFINITION OF WARNING SYSTEM

In 2004 the World Meteorological Organization underlined that *an absolute protection from flooding is neither technically feasible nor economically or environmentally viable* (p. 12). Field evidence shows that some technical failures or human error will always be possible and they can be reduced only with preparedness and mitigation measures. The way in which an imminent risk is communicated with the goal of producing an appropriate disaster response is defined as the *warning*. During slow onset events, the emergency managers should activate many time before the hazard activity. This could be done by constant monitoring and assessment of the situation to anticipate the conditions of hazards for increasing citizens' safety and security. In prolonged warning periods as hurricanes, a challenge could be related to the citizen's maintenance of the vigilance and readiness necessities for mobilization (Paton and Auld 2006). Thus, the existence of possible hazards and vulnerabilities do not cause by themselves the activation of measures to prevent and contain risks. The dissemination of a particular warning doesn't cause necessarily the expected reactions in citizenship, as many things influence the credibility and the perception of the message as information and education levels. Lindell et al. (2007) point out three main stages about how the citizens assimilate a warning:

- *Information must be received.* Attention should be given to the instruments and timing used for the diffusion of warning. Television and radio can be used to communicate the message but attention should be paid to warning spreading time, as for example only a few minorities of people will be asleep watching news at 4 p.m. in the night. Similarly, advices diffused by Short Message Service (SMS) will probably reach some social groups more than some others. Finally, even door to door advice by civil protection or police officers must be sustained by a parallel policy of chain effect relapse to be effective.
- *People must pay attention to them.* Citizens that have busy lifestyles or that are often involved in activities with high concentration levels might not note the warnings. Notifications should be located in strategic places and contain where possible informal expedients to raise attention (ex. colours for leaflets or k- word recurrence for vocal announcements).
- *People must comprehend the information.* Clear signals with immediate meaning and common interpretation should have been established. For example, a foreigner tourist in Venice during the "Acqua Alta" (High Water) period may not be able to comprehend immediately what does the loud sound of night sirens mean if nobody explained him before.



In the same way, the communities with high multicultural or touristic presence should provide advices in the main different languages in place.

According to Handmer (2001) the creation of shared meaning is the basic step for any success in the dissemination of warnings, but it could become harder as the society becomes more atomistic. Furthermore, insufficient attention was paid for a long time to the specific local considerations that links warning and communities, not only in the dissemination process but in the structuring of warning systems at large.

DEFINITION OF CRITICAL FACILITIES

The United Nations International Strategy on Disaster Reduction (UNRISD 2009) defines critical facilities as the primary physical structures, technical facilities and systems which are socially, economically or operationally essential to the functioning of a society or community, both in routine circumstances and in the extreme circumstances of an emergency. They are elements of the infrastructure related to the essential services that should be provided in the society, as they include main transportation facilities (airports, ports), basic supply (electricity, water and communication network), healthcare, relief and public services (hospitals, public administration offices, fire and police stations). Referring directly to the documentation released by the U.S.A. Kentucky Division of Geographic Information, Simpson and Human (2009) list different critical facilities as the sum of hospitals, schools, potable water, waste water, electric power, natural gas, Emergency Operation Centres, communication facilities, fire stations, emergency operation centres, and police stations. The Federal Emergency Management Agency (FEMA 2007) underlines furthermore that they commonly include all public and private facilities that a community considers essential for the delivery of vital services and for the protection of the community (FEMA 2007 p. 2). Thus, they have the potential for serious disruption of vital socioeconomic activities in case of destruction, critical damages, or functional burden related to major disasters. During last years, economic constraints and renewed care to the psycho-social effects of crisis underlined the need of structuring post-disaster management strategies to achieve the best effectiveness of relief actions. Practitioners and field operators begun to analyze how could be possible to activate chain relapses on social systems, acting on the idea that the communities have capacities for developing self-help measures if properly stimulated. As the role of Geographic Information System (GIS) for urban planning and disaster preparedness is evolving, new data and planning options are becoming available. If looked with an interdisciplinary approach, the map shows that some particular places and buildings could assume multiples roles in action. There can be found at less three different dimensions acquired in the same time by some key facilities:

- An organizational dimension where they can be seen in their possible function of recovery and coordination centers for relief
- A symbolic dimension that identifies them as points of aggregation
- A physical dimension that outline their sensibility as infrastructures.

Intuitively, these structures assume particular relevance in disaster management they assure higher level of responses and their failures could compromise the relief coordination or the reprise phase. Similarly, their integrity stimulates faster return to ordinary social activities. For example schools are



often indicated as emergency shelters, but their role is fundamental even in ordinary times for collective action and individual behaviors. After they have been damaged by a disaster, parents and kids could have to travel to another school rising stress levels, children' social networks could be strongly modified and confused, the symbolic value of school as "safe place" could be questioned. Similarly, in emergencies where the structures necessary for disaster management are compromised the cycles of relief and reprise are harder and more difficult. The presence of high tourism could obviously increase pressure on the structures.

DEFINITION OF AN EVACUATION PLAN

The definition of an evacuation plan used for post-crisis management is the one reported by in appropriate chapter of the guidelines, so please refer to the appropriate section of the guidelines for any technical detail. Thus, this section will consider in particular the psycho-social aspects that involve the behavioural and social patterns conditioning the effectiveness of evacuation plans as local presence of information, education, involvement practices and local cultural specificities.

GROUND TESTING OF POST CRISIS MANAGEMENT

Local features determine how risk is perceived and the possible countermeasures that could be considered. The *cultural setting*, the *experience* of a community and the *history* of individuals are the background patterns of policies. Thus, ground testing was particularly necessary for post crisis management because the understanding of behaviours and experiences may be helpful in promoting the social acceptance of instruments adopted by local managers and determine their own view of governance's goals. Qualitative and quantitative instruments have been used together to allow in-depth analysis of those different elements. Next paragraphs will explain the different methodological aspects and will underline the main findings that characterized post –crisis management in Cesenatico and Bellocchio's area. The chapter will be divided into three parts:

- Questionnaires with residents in coastal areas
- Interviews with stakeholders
- Direct observation

All three methodologies have been applied in Cesenatico, while questionnaires and direct observations were used in the Bellocchio area (intended as the villages of Porto Garibaldi, Lido degli Estensi, Lido di Spina, Lido degli Scacchi, and Lido delle Nazioni). Indeed, the choice was to concentrate main research efforts in Cesenatico because of its higher population density, geographical homogeneity and political relevance. Anonymity and confidentiality were assured to participants during all the research, while permission to record personal interviews and to take notes was properly asked according to Ethical issues.

METHOD USED FOR AND RESULTS OF GROUND TESTING (QUESTIONNAIRES AND STATISTICS)

The quantitative data collection investigated the opinions of residents and workers in study sites. Questions referred to different aspects of risk erosion and flooding, effectiveness of risk management measures, individual and collective levels of preparedness. The first section of questions enquired about perception of coastal erosion as severe, harmful, visible, controllable, or risky for future generations (Prati e Cicognani 2011). Individual and collective preparedness was



investigated with questions on the knowledge of evacuation roads, information used, possible warning /alert systems used. Direct questions investigated the perceived effectiveness of structural measures adopted locally, as for example rock barriers while the level of agreement with possible future mitigation strategies was measured. Thus, even if the locations were very near in space, the different cultural and local features of Romagna coast required the elaboration of two different forms for Cesenatico and Bellocchio area. A common frame on the relation between coastal erosion, floods, climate change, and personal flood experience were maintained. Different questions regarded countermeasures, long term strategies of mitigation and specific local features as the alert system or the alert siren (Cesenatico). A total amount of 304 hardcopy questionnaires has been completed during THESEUS research sessions, 228 of whom in Cesenatico and 76 in the Bellocchio area. Their compilation required 15 minutes each for Cesenatico form and 10 minutes each for Bellocchio one. A first ground session has been done in the period of March - June 2011 in Cesenatico city centre, followed by a second one during early July 2012 in both the areas of Cesenatico and Bellocchio. In Cesenatico case, the majority of the questionnaires were self-administered (167/228) while in Bellocchio the major amount of material was represented by interviewer-administrated questionnaire (61/76).

The results of questionnaires can be organized in three sections: a general overview on risk perception including both Cesenatico and Bellocchio, a focus on personal and collective preparation in Cesenatico and a review of personal and collective preparation in Bellocchio. This distinction has been chosen to underline the relation between structural measures, dissemination and experiences in the two territories, while maintaining a common background on general issues. Thus, respondents that experienced floods defined a common frame of moderate economic damages, with higher values of discomfort perceived in Cesenatico (Figure 35). Ground testing in Bellocchio area was characterized by a significant percentage (22.4%) of second house owners among respondent, which were in place for holiday or as a consequence of 2012 earthquake that hit Emilia-Romagna and the Ferrara area. Indeed, many people in the epicentre zone decided to voluntarily evacuate in the so called "Lidi ferraresi", using second houses and eventually anticipating summer break.

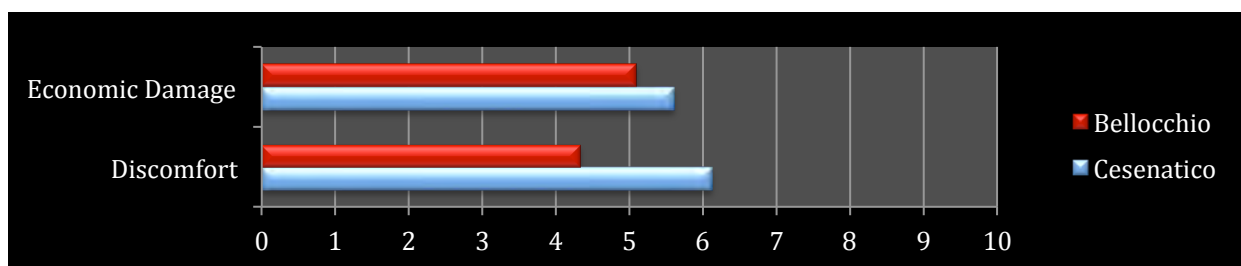


Figure 35: Economic damages and discomfort reported in Cesenatico and Bellocchio, range 1 to 10

General overview of risk perception in Cesenatico and Bellocchio

In Cesenatico the majority of the respondents were males (54.6%) whereas mean age was 40.2 (SD=14.3); in Bellocchio the majority was composed by females (51.4%) whereas mean age was 45 years old (SD= 15.29). According to Figure 36, the perceived risk of coastal erosion phenomena was above the midpoints in both cases. Therefore, participants felt that risk of coastal erosion was significant and will affect future generations. It is perceived as characterized by visible and severe

consequences, but still relatively controllable and dreadful. Citizens feel that to be moderately exposed to coastal erosion risk and moderately relate it to climate change. The possibility to maintain it under control was significantly different in Cesenatico and Bellocchio, but was always above the midpoint. Furthermore, participants reported that the main risk related to coastal erosion was damage to ecosystems, with higher values in Bellocchio. Damages to tourism and beach recreations followed with similar values in both areas, while flooding in the city center and salt water ingression in ground water had significant lower values. Answers collected in Bellocchio reported a higher number of “other” solutions, as in many cases people refused to separate between type of damages and problems as for example ecosystems and tourism (Figure 37).

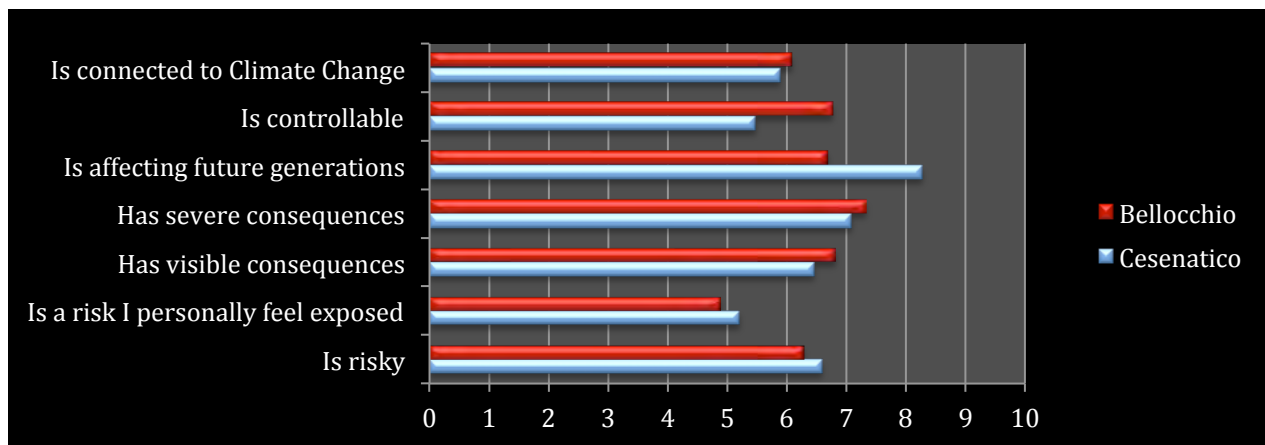


Figure 36: perception of coastal erosion risk in Cesenatico and Bellocchio (mean value from 1=not at all to 10=extremely)

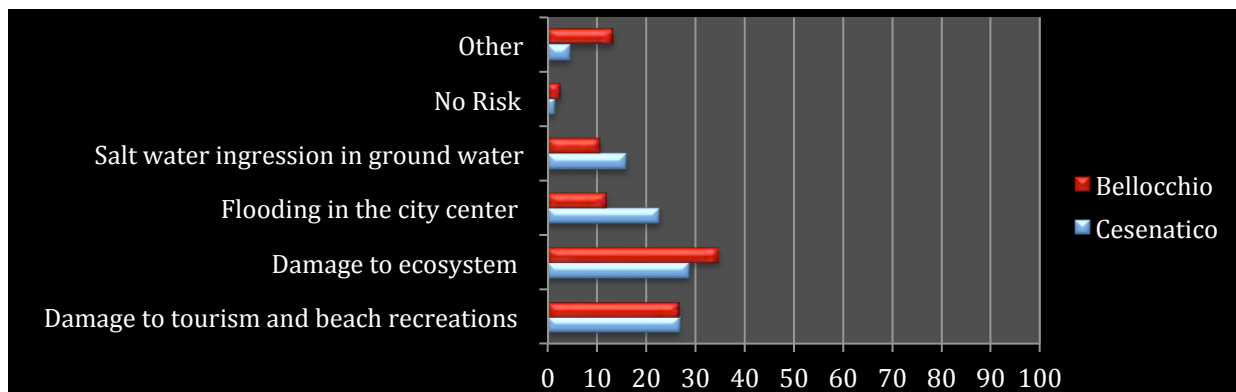


Figure 37: Perception of main risk related to coastal erosion in Cesenatico and Bellocchio (percentage of answer)

Personal and collective preparation in Cesenatico

Information, training and involvement appeared immediately as critical elements in local crisis management: respondents reported that they did not feel adequately informed about flooding risk in Cesenatico ($M = 4.25$, $SD = 2.70$, range 1 to 10). If a minority of citizens did not search any information about flooding (13.6%), the role of official communication underlined problems in the dissemination process. On the one hand, Port Authority’s advices were reported as only source by 10.5% of respondents and were associated to other sources for further 5.6%. The role of drills as



information sources was nearly irrelevant (less than 1%). On the other hand, information passed by word of mouth was reported as the only source by the 12.3% of citizens and associated to other sources for further 13.8% of them. Alert warning system by mobile phone (SMS) was known only by the 20.1% of citizens, among which only a small minority was effectively registered to the service (15.4%); however, it was rated useful by most of the participants ($M=7.34$ $DS=2.68$, range 1 to 10) underlining a critical failure in the dissemination process. The alert siren was heard by participants 4.28 times ($SD=4.2$) during their lifetime, but this data includes a significant proportion of respondents (33.8%) that the never heard it. Thus, the three most common reactions after hearing its sound were warning other people (28.7), researching further information (22.9%), and activating measures for the protection of property (21%). However, participants did not feel adequately prepared to cope with flood risk in Cesenatico ($M=3.93$, $SD=2.72$, range 1 to 10) but despite the quite low perceived risk preparedness, respondents felt more able to protect themselves and their family during a hypothetical flood in Cesenatico ($M=4.68$, $SD=7.74$, range 1 to 10). About three out of five participants reported that they did not know evacuation routes in case of a flood (61.9%). Low levels of perceived institutional support were related to previous flooding experience ($M=3.23$, $DS=2.35$). The interventions of Port Authority were perceived as scarcely effective ($M=4.80$, $DS=2.85$), as well the ones of the Civil Protection/municipality ($M=4.91$, $DS=3$) and Emergency Medical Services ($M=5.37$, $DS=2.76$). Firefighters were considered sufficiently effective instead ($M=6.15$, $D=2.88$).

The structural measures adopted in Cesenatico received medium and low average scores when considered in range 1-10. The new Harbor Gates (in Cesenatico "Vincian Gates") were perceived as the less effective measure ($M=3.58$, $DS=2.52$), followed by submerged barriers ($M=4.23$, $DS=2.44$) and transverse rocky cliffs ($M=4.43$, $DS=2.38$). Sand nourishments were perceived as the most effective measure even if they did not reach sufficiency ($M=5.02$, $DS=2.65$). Age was negatively associated to transversal rocky cliffs perceived effectiveness ($r=-.21$, $p < .05$). Respondents never expressed the maximum grade of agreement even when asked about the possible future mitigation strategies. The possibility to have damages covered by insurance was considered the best strategy ($M=4.03$, $DS=1.23$ in scale one to five, where one represented totally disagree and five totally agree), followed by more restrictive land use planning ($M=3.79$, $DS=1.17$) and coastal line withdrawal ($M=2.64$, $DS=1.12$). Both retreat from the coastline ($M=3.20$ $DS=3.27$) and the attribution of a different use to particular buildings near the coastlines ($M=3.20$ $DS=3.27$) had neutral value. Converting bathing establishment was negatively evaluated instead ($M=2.57$, $SD=1.3$).

Personal and collective preparation in Bellocchio

Respondents reported a weak level information about flooding risk even in Bellocchio ($M=3.43$, $SD=2.49$, range 1 to 10). As happened in Cesenatico, participants in Bellocchio did not feel adequately prepared to cope with flood risk ($M=2.96$, $SD=2.45$, range 1 to 10) but reported that they felt more able to protect themselves and their family in case of flood ($M=3.77$, $SD=2.94$, range 1 to 10). Thus, those values had lower standard deviation probably caused by smaller sample size or by different local patterns. If the amount of people not searching information was lower (7.9%), none of the respondent indicated drills as information source and only the 7.9% indicated the Port Authority. The majority of people (52.1%) was aware of roads for evacuation, but low levels of perceived institutional support were related to flooding experience ($M=3.09$, $SD=2.82$, range 1 to 10) as



happened in Cesenatico. The interventions of Port Authority in floods were considered discretely effective (M=6.61, DS=1.61 range 1 to 10), as well the Firefighters' intervention (M=6.52, D=3.12). The lowest values were given to interventions by the Civil Protection/municipality (M=5.57, DS=3.4) and to the Emergency Medical Services (M=5.28, DS=2.75). Interventions on the sewer systems were perceived as the most effective mitigation measure (M=8, SD=2.48 in scale from 1-10), as many problems were associated with bad water drainage especially in Porto Garibaldi. Sufficient scores were given to sand nourishment (M=6.52, DS=2.56), Wave Farms (M=6.31 SD=2.9) and transverse rocky cliffs (M=6.2, DS=2.71). However, submerged barriers were not considered sufficiently effective (M=5.2, DS=2.83). The preservation of natural habitat was considered the most effective strategy to be adopted in future (M=4.28, DS=1.13, in scale one to five where one represented totally disagree and five totally agree). The possibility to increase restrictive land use planning was considered good as well (M=4.14, DS=1.06), while the access to flood insurance was considered slightly neutral (M=3.41, DS=1.39). As happened in Cesenatico, both retreat from the coastline (M=3.58, DS=1.56, in scale one to five where one represented totally disagree and five totally agree) and the attribution of a different use to particular buildings near the coastlines (M=3.7 DS=1.40) had neutral value. Converting bathing establishment was negatively evaluated as well (M=3.06, SD=1.62).

METHODS FOR AND RESULTS OF GROUND TESTING (STAKEHOLDERS INTERVIEWS)

Face to face interviews with local stakeholders have been undertaken during the project. Semi-structured standards were applied to maintain homogeneity. Eleven representatives of local associations, cooperative companies and the municipality of Cesenatico have been listened in November and December 2010 in order to record personal experiences and political points of view. Two other face to face interviews were done in July 2012 with local emergency volunteers to investigate how flood management was perceived by ground workers. The meetings were self-recorded and transcribed in different files. Content analysis of dialogues was done on critical issues for post crisis management. Table 19 presents the general features of interviews, including the institution of affiliation and its relevance for ground testing. The in-depth screening of transcriptions was used for dividing the content into three different categories:

1. General beliefs and suggestions, including effectiveness of structural measures adopted, opinion about policies, general critical issues, and perspectives for improvements;
2. Perception of evacuation plan and emergency measures, as specific overview on non-structural measures;
3. Presence and level of warnings, as perception of a specific local service and dissemination process.

Table 19: Overview of interview in Cesenatico

Date	Institution	Relevance
3/11/2010	Confcommercio	Confcommercio is a the leading representative of enterprises in Italy.
3/11/2012	Cesenatico municipality (administrative)	The administrative personnel of the municipality follows the development of policies despite the decision makers' changes in elections.
13/12/2010	Assohotels Cesenatico	Assohotels is a private association representing 2-3-4 stars hotels.



3/11/2010	“Casa del Pescatore” cooperative company	Cooperative Company focused on fishing and mussels farming.
13/12/2010	Cesenatico municipality (elected member)	Local representative elected in the Municipality and in charge for certain Policies up to 5/2011.
3/11/2010	Cesenatico municipality (administrative)	The administrative personnel of the municipality follow the development of policies despite the decision makers’ changes in elections.
3/11/2010	Produttori Armatori E Operatori Della Pesca	Cooperative Company focused on food processing.
3/11/2010	Confartigianato	Confartigianato is a confederation representing artisans, handcraft companies, small and medium enterprises.
3/11/2010	Confesercenti	Confesercenti is one of the leading business associations in Italy
3/11/2010	Cesenatico’s municipality (elected member)	Local representative elected in the Municipality and in charge for certain policies up to 5/2011.
3/11/2010	Cooperativa Esercenti Stabilimenti Balneari	Cooperativa Esercenti Stabilimenti Balneari Cesenatico is a cooperative company of lifeguards.
05/07/2012	Radio Soccorso Cesenatico	Radio Soccorso Cesenatico is an association of volunteers that support the local Civil Protection.
05/07/2012	Radio Soccorso Cesenatico	Radio Soccorso Cesenatico is an association of volunteers that support the local Civil Protection.

The following tables provide an overview of the opinions expressed by the interviewees. The Categories identified are *Beliefs and suggestions*, *Warnings*, *Emergency measures*. They explain the different aspects underlined according to possible mitigation measures to be adopted.

Category	Comments from interviews
<u>Policy recommendations</u>	<ul style="list-style-type: none"> • “Buildings should be higher, while having ground floors empty. Lack of coordination among municipalities and the negative effect of invasive measures are critical. More drills and information for citizens are needed.” • “It is necessary to develop information campaigns and education of citizens.” • “Many things are still under realization, but concrete results have been achieved in the last 15 years both in security practices and defence structures.” • “Civil protection system should be improved. Problems are still related to internal waters management and to coordination of actions (Local, regional and national level).” • “More dialogue is needed between different municipalities.” • “Structural defences improved but risk persists because of the sea force. There’s a good emergency organization, the institutions activate rapidly.” • “Some structural measures have to be further discussed at inter- municipal and regional level because they modify subsidence.” • “The technical staff that planned structural defences is reliable, but Nature has the power to override barriers. Some problems are the limited tools of the civil protection and the effective practice of emergency measures.” • “The limited time horizon of policies is a problem. Higher comprehension of erosion and stronger interventions should be promoted at all institutional levels. Finally, there’s a scarce time lapse between warnings and water rise in the city centre.”



	<ul style="list-style-type: none"> • “The municipality developed many structural measures as barriers. Public buildings in zones at risk have been equipped with pumps. Actions undertaken and programmed are most experience-based”. • “Interventions and political measures should be developed in the long run. The root causes of erosion and floods should be addressed acting on subsidence.” • “Since 1996 physical barriers have been built, the territory has been monitored and the Civil Protection Plan has been adopted. Maybe some particular vehicle should become more available on ground. The population’s volunteering in relief associations should be promoted and the information levels should be raised.” • “The civil protection improved a lot over the years. It should be useful to improve the dissemination of meteorological alerts, and have new founding for tools and vehicles.”
<u>Warnings</u>	<ul style="list-style-type: none"> • “Investments have been made on alarms: there’s a siren for high water in the Canal Port area, and groups for dissemination exist. The municipality implemented a telephone switchboard where citizens can ask information on tides; it even calls all the registered people in case of high water.” • “There’s a siren in the Canal Port area, and some groups have the duty to call other people when they hear it.” • “The advices by Port Authorities are effective: there’s an emergency plan to avoid the collision of ships when the harbour gates are closed.” • “Leaflets or lunar calendars have been sometimes distributed in the critical periods, but only in main risk areas.” • “Met Office’s online service appeared in a National Geographic special, it seems a great idea but it is very expensive.” • “The siren is not enough and there have been few adhesions to the telephone switchboard because of insufficient dissemination. The municipality should increase the distribution of direct advices at less in the city centre.”
Emergency measures	<ul style="list-style-type: none"> • “I don’t know any evacuation plan or emergency measures in Cesenatico” • “I don’t have any idea about them. I just hope I will not be here during next flood.” • “Amphibians vehicles have been used for emergency assistance, but I have no experience of that after 1996 floods.” • “I have never heard about Evacuation plans in Cesenatico. I believe that they have not been implemented.” • “Evacuations have never been needed, but others emergency measures as the alert of main relief chain have been activated.” • “I have not any knowledge about emergency plans in the municipality.” • “Safe practices for the physical evacuation of people during the acute phase of flood exist.” • “I brought people to safety during the 2011 flood, I carried them on my shoulders.”

METHODS FOR, AND RESULTS OF, GROUND TESTING (DIRECT OBSERVATION)

Qualitative methodology for ground testing integrated direct observation and informal interviews.

These instruments are typical of disciplines such as anthropology, ethnography and sociology, which



often assume fieldwork as essential elements of empirical research. In our case, they have been used to integrate, contextualize and verify the large amount of materials provided by questionnaires and semi –structured interviews. According to Russel-Bernard (2006), informal interviews are versatile and useful in studies that require both textual and numerical data. They are used throughout ethnographic fieldwork to uncover new topics of interest that might have been overlooked. Thus, informal interviews are characterized by a total lack of structure or control, and generally the researcher just tries to remember conversations heard during day on field. In our research, they were conducted after the supply of single interviewer-administrated questionnaires, as well as in different phone calls with local stakeholders during the data finding for the DSS in 2012. In some cases, people that refused to have the questionnaires for their time duration gladly accepted short informal question focused on their perception of local matters or flooding experiences. Field notes were developed during the interviews or in the immediate aftermath and were integrated in daily sessions. In some cases the “comment” space of the questionnaires has been used in agreement with respondent.

Finally, direct observation was done during field visits because as stated by Russel-Bernard “when you want to know what people actually do, there is no substitute for watching them or studying the physical traces their behaviour leaves behind”. In our case, direct observation was focused more on the geographical, environmental and structural features of urban land. It was necessary to perceive the real dimension of possible flooded area, the type of buildings and infrastructures present in place, to verify the socio-economic pattern on ground and the structural measures adopted. Unobtrusive and nonreactive strategy was adopted for focusing on those dimensions, but possible ethical issues were avoided with the use of specific University of Bologna’s Shirts that signalled the affiliation. Furthermore, detailed information about research activity was given to interested citizens.

Informal interviews referred about personal flooding experiences, suggested possible political options or defined problems present both locally, regionally and nationally. Thus, they often motivated some points of the questionnaire as, for example, the ones that referred to institutional trust. The importance attributed to “environment” was more diffused than believed as reported even in quantitative data and verified by many shopkeepers that reported tourism as consequence of environmental balance.

In Bellocchio area, the environmental features designed huge diversity even among small spaces, with many localized features. For example, the owner of a bath in Lido di Spina reported “What erosion? I have the opposite matter! My beach grows too much. If you walk 500 meters away you will find no beach. But here the sea is always more far”. Similarly, a shopkeeper said that “In Porto Garibaldi the sea was “eating” the beach, but then they built the barriers”.

The interviews underlined that the mitigation options suggested in THESEUS hit criticality on the nail. Information and communication were perceived as main problems both in Cesenatico and Bellocchio. Another shopkeeper in *Lido degli Scacchi* reported that communications plans were needed because “it seems we are still 60 years ago”. Two men in different places required directly evacuation plans and increased information/communication on meeting zones and evacuation



routes. They had activities in Porto Garibaldi and Lido di Dante, but they were commuters from Ferrara and Ravenna. One of them was just returned from Thailand, where the 2004 Tsunami hit, and proposed to adopt the same signals for evacuation zones and routes. Similarly, a diffused need for higher information about events, training on instrument and practices was associated to the request of higher involvement in the decisional process, especially in Cesenatico Canal Port area. A woman was heavily worried about flooding because her activity was in the critical zone and she clearly had bad experiences with the phenomena. She felt the need of improved strategies, and when asked about warning already implemented she said “The siren? When you hear it, the water is already arrived”. The adoption of shared measures and diffused information on decisional process was confirmed again by the low values attributed to submerged barriers. The education of citizens, especially young people, was perceived as essential and was associated with high level of importance given to environment. For example, a woman in Porto Garibaldi reported that respecting was a cultural matter and both kids and parents should be educated. Similarly, the need for involving and sharing the management of environment was required by many people, both male and females. The idea of natural cycles was diffused, as well as the idea of Nature as a whole and of its overwhelming forces. In Porto Garibaldi, a girl pointed out that the ecosystem was perceived as fundamental, and they were proud of the Po River Delta’s Park, while another girl simply stated “stop polluting” as mitigation option. Thus, some people underlined the need to achieve a balance even between environmental discourses and developmental issues.

The invasive process of building new urban areas was perceived as critical in many cases, even if this perception was not always related to specific questions on land use planning in the questionnaire. The explanation for this data is probably related to the existence of local regulatory plans in place, while invasive urban growth was perceived in relation to national governance matters. Thus, many respondents suggested commitment in long term actions and policies, as constant nurishments, while they often required wider studies and comprehension of root causes. These points of views are critical because they basically require a real inclusion of citizens in the decisional process. Diffused low trust in institutions was visible, especially if related at the national level. For example, a shopkeeper in Cesenatico said: “What do I recommend? ...Write down to steal less money”. Similarly, insurance’s answers were most related to the reputation of insurance companies, trust in institutions, to the belief in social state, or the perceived taxation levels.

Those elements were determinant both in Cesenatico and in Bellocchio. For example, many people while filling out the questionnaire asked a simple question: “Who will pay for that?”. When explained, possible sceptical answers were related to high rate of taxation or low trust in insurance companies. Political beliefs influenced some evaluation, as for example in Cesenatico: in one case high perceived utility was associated with the idea that the community should allow collective access to insurance because has the right to make his house safe. Other values in the questionnaires are further explained by informal interviews. The low levels of effectiveness perceived in Civil Protection’s interventions could be related to the existence of unsolved coordination matters present at less in Cesenatico. A man who reported a nearly averaged score reported for example “The Civil Protection’s volunteers are good guys but they make always a huge mess.” Thus, during data finding for the DSS it emerged that possible problems could really exists but were not perceived by professionals. An officer of the Cesenatico Civil Protection was interviewed for receiving details



about quarters used during evacuations. However, he explained that they did not use evacuation plans as they knew which zones were likely to be flooded and they preferred to adapt to the event. During the talk most importance was finally attributed to structural measures and top down initiatives, while the role of citizen's preparedness was totally missed.

The relevance of social and personal spheres in determining the answers to the questionnaire have been underlined by specific considerations. For example, different roles could be related to behavioural patterns as pointed out during an informal interview with a local stakeholder of Confesercenti. She said "The businessman has the great problem to make his activity safe. His head says: How much sand will I loose tomorrow?". Similarly, values associated to personal preparation and ability to protect the family was associated to high levels of emotional involvement. For example, during the questionnaire a woman that signed low levels of risk preparedness reported high value for the ability to protect herself and her family. She said rhetorically "Sign me that. When the family is involved, we do our best don't we?". As hypothesized in quantitative area, different age and experiences are likely to generate even levels of trust/mistrust in some structural measures as happened during interviews in Lido di Dante.

POST CRISIS MANAGEMENT AS A MITIGATION OPTION INCLUDED IN THESEUS' DSS

Post Crisis management's mitigation options included in the DSS were developed for being easily replicable on different case studies. They have been translated in two different functions: an estimation of life losses and injuries, and an indicator of social damages. They have been structured to contain simple instruments for verifying how impacts could possibly with the adoption of the suggested mitigation strategies. Thus, the qualitative character of psycho-social damages implies the necessary exclusion of unquantifiable effects related to individual patterns and community frame as information, education and involvement.

POST CRISIS MANAGEMENT AND THE SPRC STRUCTURE

Post Crisis management is characterized by the presence of qualitative and quantitative changes in The Source, Pathway, Receptor and Consequences structure:

- Warning and Evacuation Plans modifies the vulnerability of the Receptors changing the Consequences expressed in number of death and injuries. Qualitative implementation of warning systems are translated in different levels of approximated risk that affects the general overall function of losses.
- Critical Facilities modifies the receptors too, but they use physical damages and approximated levels of social consequences to provide general levels of social damages that remains main qualitative.

Clearly, possible changes in the pathway are likely to determine how the mitigation options are applied, but post crisis management in the DSS has been developed to maintain a constant dialogue in the cause-effect relation. For example, the different ways of inundation will involve different Critical Facilities or require the evacuation of different zones that will be reflected in the output. All the mitigation measures proposed are related to the presence of a normative framework that could increase the accountability of the system as whole and provide the systematic application of best



practices. This responsibility clearly remains of coastal managers, and post crisis management in the DSS will assume that every measure will be considered both in its technical and legal aspects when implemented.

INCLUDING POST CRISIS MANAGEMENT WITHIN THESEUS DSS AN OVERVIEW

Evacuation Plan and Warning as mitigation options have been integrated in the model of life losses by Penning – Roswell Hazards et al (2005). They determine two different factors in the proportion of the population exposed to a chance of suffering of death or injury (for a given flood) in demographic area.

Clearly, their effects on resilience affect social patterns at large, but their reduction into a replicable function for simulations was simply not possible. Thus, only their effects as possible life saving and risk reduction instruments were considered: the activation of a properly developed evacuation plan allows to be not in place at the moment of flooding, while effective warning systems allow to “gain time” and activate safety measures among the population.

Similarly, according to main psychological and social literature, it was impossible and unethical to quantify the features on patterns that are mainly qualitative. For example, is it possible to quantify the consequences for a child that had both parents killed in a flood?

The adoption of “Collateral Social Damages index” as mitigation option implied the development of a new model for the THESEUS project based on Critical Facilities. The first step of its elaboration considered that differences among places were not only in the type of buildings presents, but also in the functions and in the symbolic values acquired by the structures. While behavioral elements are not possible to be translated in numbers, the possible damage level is related to the involvement of buildings, to the water depth and to the duration of flood. Even if this is a simplification, it is realistic to assume that higher damages and higher involvement of physical structures with key roles in social functions and emergency management are proportionally related to higher behavioral and social “damages”. The implications for DSS are consequential: mapping and scoring the different buildings on field while relating them to damages and to the presence of tourism, allows the definition possible risk levels for social and individual patterns. The mitigation integrated in the DSS according to technical limitations, is than the possibility to choose if convert the functions of buildings by territorial and social planning. Next paragraphs will outline how mitigation options have been defined in details. For any information about the type of data needed for the implementing the model please refer to the DSS manual available in THESEUS internet site.

INCLUDING CRITICAL FACILITIES WITHIN THE DSS

The DSS function on critical facilities is composed by different elements: a score attributed to the social value of buildings has been multiplied for the value related to the different levels of damage and water giving what we proposed to call “Critical Social Facility Index”. This has been integrated with two more numerical values derived from coastal managers’ choice options on flood duration and on tourism, normalized on 0 -100 scale. In a logical function, this has been expressed as:

$$\underline{\text{Collateral Social Damages Index} = \text{Critical Social Facilities Index} * \text{Duration} * \text{Period of Holiday Season}}$$



What has been intended as “Critical Social Facility” is equal to the sum of the critical facilities involved by water depth, multiplied for the social attributes of the structure (Approximated Social Value) and the Damage caused by water depth. The “Approximated Social Value” reflects building’s role in social machinery and has been derived from existing score and categories (Hillsborough County -Florida 2009, Simpson and Human 2009, University of North Carolina 2009, FEMA 2007). It express a scale from one to five points, where one represents lower importance structures and five represents highest importance structures as reported in Table 20. No critical facility involved in flood is associated with 0 (zero) value, while the total sum of critical facilities multiplied represents the maximum damage. Clearly, the cultural and geographical contextualization determines how and if the single structures should be included in each one of categories. For example, Cesenatico has not major military facilities related to “national security” or other key structures for “global economics” but has sensible points as the Hospital or the safe house: the local regulatory plan (Comune di Cesenatico 2011), the Civil Protection Plan for Cesenatico (2004) and the dialogue with the municipalities’ technical offices has been used to identify the main areas that could present particular sensibilities. However, what has been obtained represents an approximation. Its goal is providing a main idea of possible social damages for simulations and it doesn’t pretend to be exhaustive. The exclusion of other structures indicated in literature as banks or postal offices was mainly due to feasibility reasons, as the access to the shape files necessary for running the DSS. This does not exclude the integration of other buildings in case studies where wider data are available, according the simple categorization criteria reported in Table 20.

Table 20: Building and ASV scale: a sample from Cesenatico

Definition of Critical Facilities	Points ASV
Critical structures that could compromise the emergency action, the coordination chain, and public health in the long term. Structures that could compromise the emergency action, the coordination chain, and public health in the long term if involved. Examples: Hospital, Safe House, and Coordination Centre.	5
Facilities that provide significant public services and should be activated within 24 hours. Included: army facilities, purification plan. Dump ground is included because if damaged it produces the high level of pollution or disease spreading is possible. This category contains even the 2 sports facilities suitable for citizen’s reception and 1 camping suitable for emergency reception.	4
Facilities that provide important public services but should be sequent to critical facilities ranked 4 and 5 points. The public buildings including municipal theatre and Schools, as well as fish market (port). Churches and main religious structures (but excluded burial grounds) are included for their symbolic and aggregation role.	3
Facilities that provide public services but that are less critical for the community as sport facilities.	2
Other type of facilities: Burial grounds are included here as their damage is mainly symbolical. Two convents are furthermore included for their symbolic value	1

The ASV of each structure has been than related to the water level that involves each Critical Facilities (CF). The inundation level has been derived from the water depth deduct the height of the area involved, meaning the water level at ground floor and referring to the damage scale provided by Schwarz and Maiwald (2008). Assuming the presence of masonry walls as prevalent solutions and



non linear curve of damage, the possible relation between Damage Grade (Dm) and Inundation level at ground floor (hgfm) has been schematized in Table 21. The THESEUS DSS let to end users the possibility to modify the inundation levels related to damage, in order to adapt the function to the main materials present in place. For example, traditional wood structures will receive higher damage with lower water height while reinforced concrete will be requiring higher inundation level even for being slightly damaged.

Table 21: Damage grade for inundation level

Damage Grade of the area	Inundation Level (m)
1	0.1-0,5
2	0,6-1,5
3	1,6-2,5
4	2,6-5
5	H>5,1

The second element to be included in the calculation of Collateral Social Damages is flood duration, as intuitively it is inversely proportional to its effects on society and structures (excluding flash flood phenomena). Long duration floods, even if relatively concentrated in spaces, widely compromise social functions: a bridge blocked for a week for example could compromise trade routes or tourism attractive. Three choices have been given to coastal managers in a scale 1 to 3 where one is short duration (hours), two is medium duration (days) and three is long duration (week/week).

It has to be considered finally that the physical structures have to be contextualized in the local situation and on the patterns determining its social vulnerability (Cutter 1996). In Cesenatico as in many other coastal areas, the main variable that orients ordinary social activities should be considered the presence of tourism. This element could have great influence on emergency response and on social impact: floods happening during holiday seasons could involve a higher number of unprepared or inexperienced people, while the larger number of people in place could imply higher pressure on critical infrastructures. The United Kingdom's Department for Environment, Food and Rural Affairs (2005) stated that "one of the factors that have been shown to have the greatest impact on levels of awareness is lack of previous flooding experiences", as it can be presumed the tourist could be. The tourist presence should be considered for integrating the impact on critical facilities with a value reflecting seasonality in a scale from 1 to 2 points, where one is low impact and 2 is high impact. According to the Tourist Office of Cesenatico, the medium season nearly does not exist, while High season is clearly defined in the summer period from 16 June to 31 of August. Christmas and Easter periods are also considered in High Season. End users will have the possibility to activate the choice option and evaluate the final impact of tourism on social vulnerability.

The final value of the possible social damage should be conformed to a common value of 100 as to allow replicability on case studies. Thus, collateral social damages are considered as an equation range from 0 to 100. As damage is represented by a non linear function, the median line is taken as divisor between two different scenarios. In the first case, the excess of the median line ($x \geq 50$) will assume that the number and damage of the Critical facility results simply as a catastrophe. The



values below the median line are divided in quintiles as the damages are expected to grow exponentially. For the same reason, fourth and fifth quintiles have been joined together. The final range as reported in the DSS will be schematized as follows (Tab 22):

Table 22: Range of social impacts

Value	Effect
0	No collateral social damage
1-10	Possible malfunctions in citizen's ordinary life are possible but can be prevented. The damage is limited and could be managed with experimented procedures and stakeholders activation. The situation could require more details about which critical facilities involved, and planning of alternative solutions.
11-20	Malfunctions in citizens' life are expected. The damage is still limited but diffused (or high and very concentrated), and requires higher mobilization for the rehabilitation process
21-30	Social damages are concrete and visible. A major involvement of local relief and reprise resources is expected. The presence of external help is suitable and should be activated in advance in order to avoid higher losses
31-50	High social damages of in ordinary period or medium involvement of critical infrastructure in high touristic period. Massive damages could be managed with timing alert and planning, but the presence of external help is needed.
51-100	Exceptional damages, calamity. The situation could have terrible social damages and should be mediated with external help and cooperation at the highest level possible

The integration of Critical Facilities as mitigation option has been possible by giving coastal managers the possibility of shifting the Approximated Social Value for each building. As the score is related to function, we assumed that after the flood simulation end users could notice some critical buildings in hazard zones and aim to redefine their use. For example, a coordination centre at risk could be relocated and the building reduced to secondary municipal functions shifting from 5 ASV points to 1 ASV points and impacting on the total points both for the effect of reduced ASV and the lower multiplying effect of water damage. This approach reflects the idea that the DSS could be used for increasing effective mitigation and preparedness strategies for reducing the impact on crisis and post crisis management.



INCLUDING EVACUATION AND WARNINGS WITHIN THE THESEUS DSS

The model elaborated by Penning – Roswell et al. (2005) has been used and adapted in THESEUS DSS for providing the amount of flood death and injuries. Thus, it was possible to integrate in its features two mitigation options as the activation of evacuation and the implementation of warning systems. The total number of death and injuries (NI) is derived from the function $N(I) = X / Y$, where X is the proportion of the population exposed to a chance of suffering of death or injury (for a given flood) in demographic area and Y is the proportion of those at risk in demographic area. The number of death and injuries is then derived from the sum of values derived from the population exposed to a chance of suffering death/injury (for a given flood) in demographic area divided with the proportion of those at risk of will suffering death or injuries in demographic area. Hence, a schematization of the function will help to understand where the mitigation options suggested in the DSS will interact. For the complete model and data insertion, please refer to the DSS manual.

The X variable is a number derived by the relation between the total number of people involved by flood water depth and the multiplication of Hazard rate and area vulnerability indicators. Hazard rating and area vulnerability products indeed a percent value, that represents the people affected by flood in the DSS simulations. Thus, Hazard Rating is equal to velocity added with a constant (1.5) and multiplied for water depth and debris factor (if distance is less than 100 m from the seaside) as reported in Tab 23 Coastal managers will have the possibility to decide a different debris factor according to their geographical areas (Mediterranean or Ocean).

Table 23: Hazard rating in our life losses and injuries model

Hazard rating	Water depth (d) in each demographic cell	Water velocity (v) In each demographic cell	Debris Factor (DF)
$d(v + 1.5)DF$ if distance from the seaside is $\leq 100m$ \wedge $d(v + 1.5)$ if distance is $\geq 100,1m$	Elaborated from DSS physic model and is intended for shape	Elaborated from DSS physic model and is intended for shape	Debris is considered relevant in the zones not further than 100m from the sea. Two options are possible according to coastal manager's choices. DF=1 in the Mediterranean Area. DF=2 in the Ocean area (Fixed Value)

The second factor necessary for determining X, is defined as Area Vulnerability, and is derived by the addition of the three variables Warning level (W), Flooding Onset (Fo), and Nature of area (Na). As they will reflect the adaptability of our DSS to different territorial settings, they will reflect different basic scenarios chosen by coastal manager that will refer to fixed values in DSS routines. No one but them could be able indeed to say if warning is present locally or not, if their typical floods have fast or slow onset, if floods usually happen during day, night or touristic period. In details, it is possible to identify the variable as follows:



- Warning refers to a fixed range 1-3, where 3 represents the absence of warning system and is related to high risk; 2 represents the presence of unimplemented warnings and medium risk; 1 represents the presence of well working warning systems and low risk.
- Speed of onset is related to a point factor where 1 represents slow flooding (many hours), 2 represents gradual flooding Gradual flooding (an hour or so) and 3 rapid flooding Rapid (less than an hour).
- Nature of Area involved by flood (where water depth is >0) is related to the choice among different scenarios (Day, Night, and Touristic Season) and identifies for each area in different periods three levels of fixed score: low risk (1), medium risk (2), and highest risk (3). The zones used for determining risk are derived from ISTAT demographic areas (Italian National Statistic Institutes): similar data should be available from other European Statistic Institutes, and even if they could differ in specific labels the relation applied between their use and name is intuitive and should allow homogeneous replicability. The use of zones determines their danger, and the pattern of social activities varies between periods determining different uses of spaces. For example, the diurnal activity is concentrated in the production area or in schools, and the night in houses. Similarly, touristic presence has great impact on coastal areas: most hostels could be open and full of people for a few months, while they could be closed and empty during the year. In a touristic place ordinary activity varies much and so happens to the risk of zones (schools are closed, places usually closed are open). Touristic season doesn't differ between night and day for simplification. Thus, the generation of X variable can be derived as follow:

N(z)	Hazard (Hr)	Area vulnerability (AV)	H*AV	TOTAL X N(ZE)
100	12,5	7	87,5%	87 people involved
150	10	3	30%	45 people involved

The function is completed by the Y value, expressed in percent and comprised between 0 and 100. It is derived from the addition of the percentage of Population Aged and the presence of Infirm, disabled and long-term sick. The Population Aged (Pa) is defined as ≥ 65 years as defined in international standards (University of North Carolina 2009), and is derived from demographic data or national middle average conformed to a common value of 50. The level of infirm/disabled/ long-term sick (ID) will be derived by the coastal managers according to local level referred to national average. The options will be related to fix scores as Low Presence of ID (10%), Medium presence of ID (25%), High Presence of ID (50%). Y amount is than derived as follow:

Area	People older than 65 (Pa)	Infirm/disabled/sick(ID)	Y (expressed as %)
1	10(normalized value)	10 (fixed value)	20
2	30(normalized value)	25(fixed value)	55

The final X calculation will result than as in the following sample:

Zone	X	Y	Number of people involved
1	22	50%	11
2	34	10%	3



Two mitigation options will be integrated in the X variable, and will contribute to determine different amounts of injuries and life losses. They will act indeed directly on the number of people involved (Evacuation Plan) and on area vulnerability (Warning).

The inclusion of warning levels as mitigation option has been very natural once the model has been observed and adapted to DSS needs. Indeed, introducing the choice option related to warning system for determining Area Vulnerability, already included the possibility to consider different results in the total amount of people injured or dead simply by changing warnings levels. A coastal manager of a territory where warnings are not present, can for example evaluate those elements simply considering increases in implementation. As regards Evacuation Plan Coastal managers will have the possibility to include the effect of an evacuation plan by Yes/No Option. For affirmative option, the simulation will give two possibilities:

- Activate the “Evacuation calculator” by the Centre D’ Etudes Techniques Maritimes et Fluviales that will interact directly with the DSS. The flooding simulation provided by hydraulic modeling will create real time areas and population involved, that will “dialogue” with the evacuation calculator to show the possible effect of an evacuation plan on the amount of population involved.
- Determine the expected amount of population evacuated for area, choosing on a range from 1% to 100% expressed in deciles (10%, 20 %...). This option will allow the estimation of evacuation’s possible effects even if not all the data necessary for the Evacuation Calculator will be available, while giving the possibility to consider different levels and “play” with evacuation range by considering different evacuation capacity.

The organization of those solutions has been done in order to provide adaptability and replicability on other case studies. Still, many simplifications have been necessary for acquiring technical feasibility and for detail please refer to DSS manual.

POST CRISIS MANAGEMENT AS A RESILIENCY ENHANCEMENT LEVER

Why some communities are hit more than others by the same types of disasters? What are the instruments used to cope with a crisis? Natural disasters as floods represent a risk since the first human aggregations. The evolution of societies implied the creation of adaptive strategies that could make the communities stronger against adverse events. This process needs three main conceptualizations to be applied disaster management: understand the vulnerability of a society, undertake adaptation strategies, and develop of resilience.

As often happens, the etymology of the word “Vulnerability” provides a clear idea of the social background associated with the word: it is derived from the Latin adjective “*vulnerabilis*” that represents the verb “*vulnerare*” (to injure). The notion originally diffused in literature was related to physical damages. The main aspects were focused on the risks posed on structures as houses, schools, hospitals or damages to infrastructure as roads or harbours. This approach became outdated during the last decades, and a new paradigm combined physical issued to social vulnerability assets. The definition given by the Intergovernmental Panel on Climate Change (2007) refers directly to the impact of environmental change, as it can be read in the Glossary (Baede et al.



2007): *“vulnerability is the degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate change and variation to which a system is exposed, its sensitivity, and its adaptive capacity”.*

Thus, vulnerability may include different components derived from its contextualization in space and in time. A disaster strikes on a territory and the ability of the community to cope with the threat is determined both by cultural patterns, the strength of social networks and the amount of informal reserves of reactive capacity in place. The existence of adaptive circles that dominates the evolution of societies acts as a main receptacle where the different phases and measures of disaster management can be settled.

The glossary by the Intergovernmental Panel on Climate Change (Baede et al. 2007) defines “adaptation” as the “Initiatives and measures to reduce the vulnerability of natural and human systems against actual or expected climate change effects”. Holling (2001) provides a main representation of adaptive cycles defines constant flow of events (Figure 38: a main trajectory is composed by alternated periods of accumulation and transformation of resources (K, r), with short periods where innovation takes the form of reorganization and release (V, A). In this potential are included both ecological, economical, social, and cultural capital as well as unexpressed chances of mutation. During the phase from exploitation to conservation (R to a) stability increases from the skills, networks of human relationships, and mutual trust that are developed incrementally and integrated during the progression. On the opposite side of the scheme, the phase of reorganization and release (V to a) is rapid and means change and variety. The figure evolves further as the adaptive cycle proceeds, integrating the two opposites (growth –stability, change –variety) with a third dimension: Resilience. As the phases of adaptive cycle proceeds, resilience expands and contracts giving the possibility of novelties to be fostered in the part of the cycle when connectedness (control) is low and resilience is high (back loop of the figure). Translating that vector in term of social systems, resilience could translate the need to cope with changes and adapt in social changes.

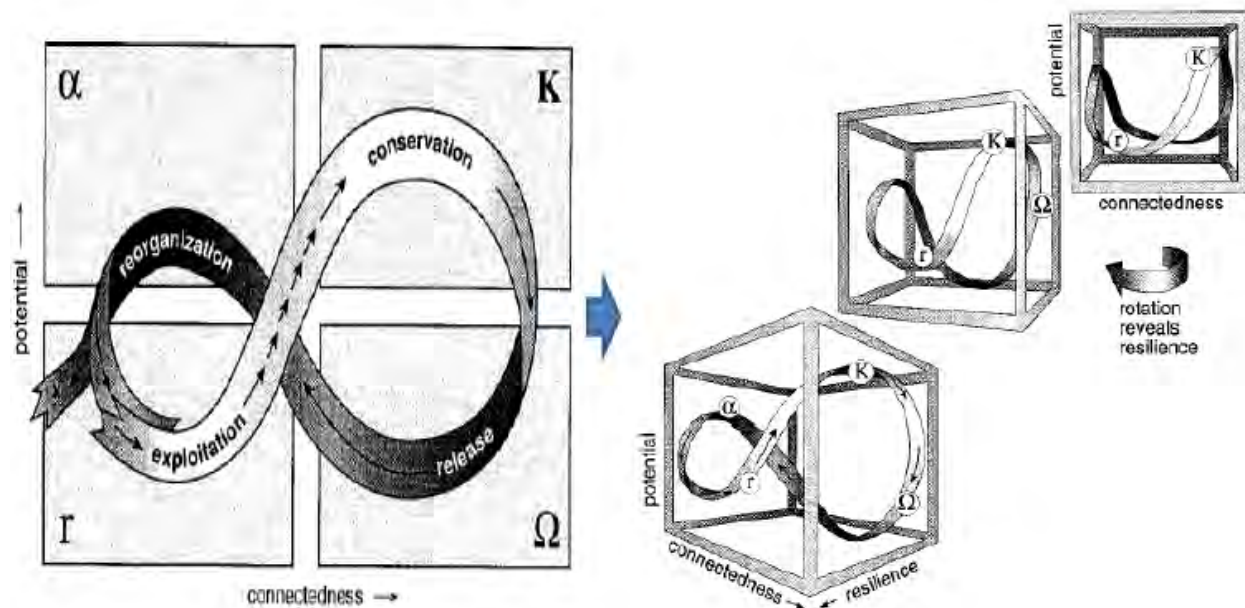


Figure 38: Adaptive cycle including resilience

The word “Resilience” been taken from materials’ engineering studies, and means properly the *resistance to breaking from dynamic stress determined with an appropriate impact test*. It is derived from the Latin word *resiliere*, meaning “jump back” to a previous state and in disaster management it implies the role of environment as the *context* of any human action. Thus, the concept evolved considerably during years and in the Glossary by the Intergovernmental Panel of Climate Change (Baede et al. 2007) resilience results as *the ability of a social or ecological system to absorb disturbances while retaining the same basic structure and ways of functioning, the capacity for self-organisation, and the capacity to adapt to stress and change*.

The overall idea refers to socio ecological systems as guided by evolving dynamics acting at multiple levels. According to Paton et al. (2006), this can be translated as *the capacity of maintaining effective ways of coping despite the challenges and adversity that suddenly break ordinary*. The role of the individuals and the community could be seen as integrated by each other, as well as dependant on ecological sustainability. Consequently, the emergency management planning should consider properly that environmental protection and reduction of natural hazard to people and society are part of the same process. Individual roles and networks should be joined to interrelated institutional collaborations and coordination into a cross – level activity. This seems to be necessary because the *notion of adaptation implies capacity to respond to change and even transform social-ecological systems into improved states* (Folke et al. 2005). Furthermore, major challenges could be in the common domains of vulnerability, adaptation and resilience. A dialogue between resilience and vulnerability implicates the adoption of two different time scale: resilience is more oriented in the long term of climate change adaptation and natural resources management, while vulnerability could be related to shorter–term disaster planning (Tomalla et al. 2006). Their relation could contribute in the integration of a more holistic approach where the relation between human and



environmental systems acquires higher importance for hazards' evaluation. This evolution seems necessary for achieving an emphasis on the system's capacity to absorb and adapt as a *whole* and maintain the future -oriented view necessary for dealing with uncertainty and changes. According to some scholars, resilience can be seen indeed as *the flip side of vulnerability* or the ability of linked social ecological system to deal with hazards can be seen as a way to make the system itself less vulnerable (Berkes 2007).

The elements identified as mitigation strategies in post crisis management acts on many aspects of resilience because they increase the fluxes of action that are part of basic systemic adaptation capacity as reported by Holling (2001). Indeed, both experimentation and learning are necessary elements when major systemic changes have to be faced, and this process includes the translation of governance intentions into effective practices. Increased information, education and involvement are than possible effective instruments for increasing resilience as they determine individual/collective behaviours that are the basis for social adaptive cycles and chances of mutation in the systemic interaction.

Warning Systems, Critical Facilities and Evacuation Plans can be seen than as instruments oriented in time and space that create linkages between ideas, behaviours and environment. Thus, they appear as points where subsystems overwhelm among each others: for example, warning systems need forecast and dissemination instruments that could translate environmental patterns into social messages.

A resilience approach makes the system less prone to disturbances, enables quick and flexible responses, and is better capable of dealing with surprises than traditional predictive approaches. Local actors frame resilience as a fluid approach to adaptation that would be more suitable and tailored to local situations than rigid top-down regulations. In addition to a change in policy, it would require a more pro-active mentality among the population.

According to this main contextualization, Warderker's principles (2010) have been included in the analysis of the Italian study site, applying them both in the questionnaire to residents and in interviews (Table 24). This schematic relation has been developed for defining post crisis management implementation's strategy, and will be used in next chapter for sustaining actions for mitigation in order to maximize effects on general coastal resilience.

**Table 24: Wardekker pinciples in the analysis of the Italian study site**

Wardekker principle	Brief description	Questions included in the questionnaire to Residents (R) or interview to Emergency manager (E)
<i>Homeostasis</i>	Multiple feedback loops counteract disturbances and stabilize the system.	What are the early warning mechanisms? What is the level of social cohesion in this place?
<i>Omnivory</i>	Vulnerability is reduced by diversification of resources and means. Multiple approaches can be used alongside each other	What other options of energy supply are there in case of crisis? What other options of transporting goods are there in case of crisis? What kind of coastal activities can be relocated in other parts of the town in case of crisis?
<i>High flux</i>	A fast rate of movement of resources through the system ensures fast mobilization of these resources to cope with perturbations	Do you think there are some constructions on the coast that might be rebuild inland? Or some elements that can be reused? Do you think it is easy to modify the land use on the coasts? How high tides are notified to public and residents? How quick is this notification?
<i>Flatness</i>	The hierarchical levels relative to the base should not be top-heavy.	What kind of procedure do you have in case of a crisis? Who is the leading actor? Who is coordinating post crisis recovery? Who decided the emergency plan? Were people or associations involved in the emergency procedures? Have you been involved in the emergency planning?
<i>Buffering</i>	Essential capacities are over-dimensioned such that critical thresholds in capacities are less likely to be crossed.	Are there water retention areas? Are there some elevated area that might serve as flood refuge in case of crisis? Are there some main roads that can be used for evacuations? What is your knowledge about main road of evacuation? How did institutions communicate that to you?
<i>Redundancy</i>	Overlapping functions; if one fails, others can take over.	Are there multiple ways to reach a flooded area? Are there some building that can be accessible on the upper floors? Are there alternative accommodations for evacuated residents? Are there alternative schools, hospitals in case of crisis and evacuation?

SYNTHESIS : GUIDELINES FOR IMPLEMENTATION

Flood risk management improved during last decades. The adoption of new European standards as the Flood directive (2007), the implementation of a coordinated civil protection (European Commission, 2007, 2008) and the increases in technical effectiveness have been central steps for safer Coasts. Thus, effective integration of practices and strategies for managing the *water cycle as whole* is far from being achieved and further work has to involve the pattern of individual and collective behavior. Climate Change and spreading of extreme weather events require further development in the adaptation capacity of territories. In our opinion, a concrete evolution could be sustained by the appropriate use of European legal framework: common measures for increasing individual and community resilience have to be coded as soon as possible and disseminated at any level of the decisional process. Indeed, a strong shift is needed by citizens, local disaster managers



and policy makers: residents and planners in coastal areas should mature a diffused culture of “Integrated hazard management” based on the relation among individual practices, safe community and participatory approach in governance.

The European Union has the potential to stimulate an effective collective action among states, regions and localism by proposing a clear and agreed vision on risk and perspective challenges. This process could be sustained by the diffusion of sustainability culture and climate -related sensibility, which attributed more importance to shared dialogue on environmental management. Indeed, Withmarsh (2008) underlined that environmentalist values are associated with a higher risk perception and an increase the possibility of active environmental safeguard behaviors. The global pressure on coastal zones for their role in trade and services increases the local vulnerabilities exacerbating the patterns of anthropic process. For example, the property speculation that determines urban growth in sensible areas was highly reported during all our ground testing. The different actions taken by decision -makers could reinforce or weaken local resilience acting, for example, on the formal or informal norms in the use of coastal areas or contributing to the diffusion of appropriate behaviours by investments in information and education. Socio-ecological system should enhance adaptive capacity for facing climate change and uncertainty related to large scale changes, but this could be done only with the appropriate enforcements of effective multi-level governance (Adger et al. 2005).

Progress and mistakes are part of evolutionary process, but the contextual movement of environment increased consciousness of positive and negative interactions. In Cesenatico, the situation was simply not the same as it was during the main local flood reported in questionnaires: new volunteer associations were created to support disaster management, new barriers were developed and a local civil protection plan was implemented. Still, most actions were focused on structural measures. Citizens’ behaviors and experience remained marginalized in the general process of decision making. Information and dissemination failures were reported and opportunities for training at the community level were not found. Some higher coordination among stakeholders was provided especially by the Harbor Authority, but no permanent discussion group was planned at large. Furthermore, respondents emphasized the initiative and strategies used in different contexts, as probably the past public expenses and interventions were perceived as not adequately capitalized in term of effectiveness. The low value of perceived institutional support during past floods and the possible low trust in institutions are important elements to improve in the future, as the trust in authority (Eiser et al. 2012) and the perceived response-efficacy in measures adopted (Rimal e Real 2003) are central elements for higher involvement of the citizens in environmental risk management. Those critical problems are reported in the literature at large.

Handmer (2001) underlined a failure in the conceptualization of warning task, where agencies put themselves in authoritarian position more than recognizing that floods are “owed” by the communities where they are settled. According to his view, warnings remain more connected to the area of relief than to the achievement of long term empowerment of communities, while different levels of governance are often in contrast eroding the possibility of cooperative actions. Even if the general frame for flood intervention is changed since Handmer’s study, institutional factors still orient a deterministic response to flood forecasts. Strong efforts should be necessary to improve the



institutional capacity of translating new technical improvements and new available information into effective flood management (Demeritt et al 2012).

Similarly, Haines and Asche (2012) pointed out that an important element in understanding the behavior of public and private sectors *is the short-sighted vision of many decision makers*. Protection measures appear related to intangible future benefits, while the interconnections and interdependencies among the different actors, the measures and the solutions proposed are underestimated or simply ignored. The involvement of local stakeholders, the activation of learning and training activities should be implemented as well as exercises and simulations, but this should be possible only with strong political commitment and durable institutional capacities (Basher 2006). According to Merz, Hall, Disse and Schuman (2010) decision making should include new criteria as robustness and flexibility that could complete the traditional approach of maximizing performance for adapting to the long term uncertainty related to change. Grounded scenarios should be supported by the consideration of the worst case possible, including flood defense failures in flood forecasting and warnings.

This was verified even in qualitative and quantitative ground testing by the diffused suggested request of long term planning, by the perceived need for addressing the root causes of the problems and the request for wider knowledge and studies on environmental patterns. The importance of lesson learned should be finally adopted as priority by decision-makers, while possible virtuous cases should be brought as example and shared with citizens. An important adaptive flood strategy that could be taken as Model for implementation in the European Union could be the Delta Programme developed in The Netherlands (Zevenbergen et Al. 2012). After the installation of the Delta Commissioner in 2010, the programme initiated a planning process where government agencies at national, regional and local levels collaborated with community groups and private sector. While challenges have been identified in short and long term, preferential strategies for long term adaptation are developed in the so called "Delta Decisions". Main features of this approach are the promotion of flexibility, the incorporation of "low regrets" responses to intervention and the achievement of a long term focus to foster shared political commitment for investments.

The mitigation guidelines for implementation of post crisis managements addresses directly those matters. As illustrated in the logical frame of Figure 39, actions on three main root causes will generate individual and collective resilience and improved governance. Thus, information, education and training process will be considered as central elements in our strategy as they most influence cultural and local patterns, while they could determine huge changes in behaviors at large. The environmental setting at large will be considered as the context where people grows and develop both social and personal experiences, orienting how information, education and involvement have to be structure to effectively produce resilience. The whole structure of policies will defined as constantly interacting with those patterns during an evolutionary process of adaptation that should generate both individual safe actions and the collective adoption of mitigation methodologies as improved Warnings, Critical Facilities and Evacuation plans.

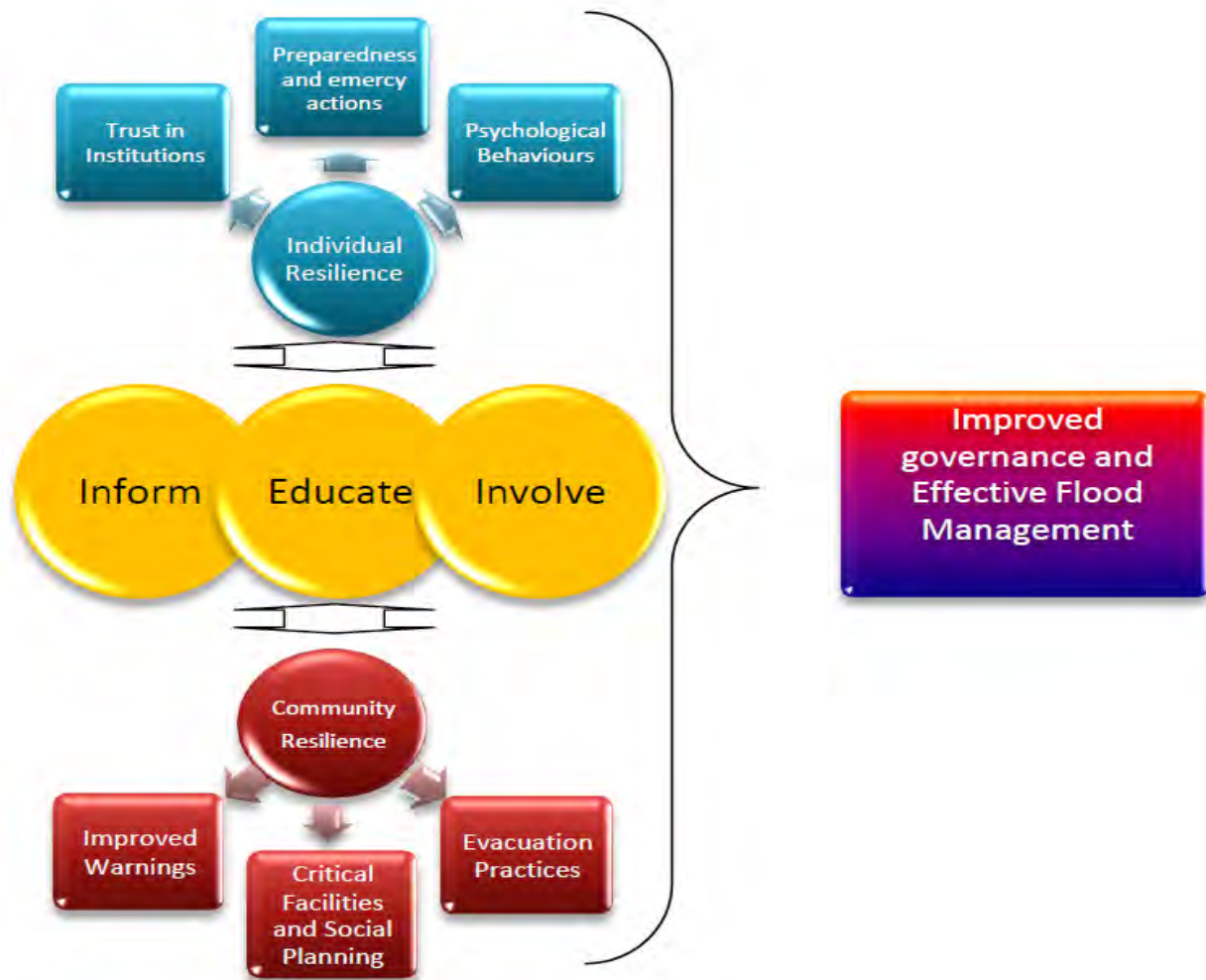


Figure 39: Interaction among mitigation measures proposed for post-crisis management, resilience and integrated flood management

GUIDELINES FOR IMPLEMENTING INFORMATION, EDUCATION AND INVOLVEMENT CAPACITY

The behavioral responses of individuals in flood risk situations can be various. They are a result of many underlying processes, but their result is binary: to take or not to take the risk. Information, Education and Involvement are the basic elements for the adoption of any non-structural mitigation measures: without appropriate information, education, and involvement, warning will lose their effectiveness, weakening the effects of an evacuation plan. Similarly, the role of critical Facilities will be marginal if they are not framed in a community and in a cultural setting, while without education of coastal managers their conceptualization will be totally useless.

According to literature, the context is very important both for preparedness and for the evaluation of a risky situation. Parker, Priest & Tapsell (2009) agree that different factors related to the context are crucial to any understanding and interpretation. For example, quantitative ground testing in Cesenatico and Bellocchio areas evidenced low levels of information and preparedness that seems to be highly common as can be verified for example by Krasovskaia (2005). Her research demonstrated that less than the 20% of the North European citizens interviewed adopted cautionary measures for flood risk reduction or for emergency preparedness. Similarly, a comparison of 2002



and 2006 floods in the Elbe region (Kreibich et al., 2011) underlines that most households improved their preparedness after the first flood, but 29% of the businesses didn't take any precautionary measures to reduce damage even before 2006 flood. The features of decision - making in households and firms could have a significant role in this dynamic, as the different levels of working force experienced floods from opposite points of views: managers focused on financial impacts of floods while workers were involved in direct damage reduction. The long term planning required in business is likely to have removed the event implications that were perceived mainly in short term implications.

The role played by local knowledge and personal networks, beliefs and culture should be considered indeed as a central element in the diffusion, interpretation and response to alert messages. The involvement of unofficial and informal dissemination process should become a complementary element in flood agencies' policies assuring local participations in risk managements (Parker and Handmer 1998). Thus, the different phases of warning (evaluation of forecasts, dissemination of warning, and response to emergency) are often missing the appropriate communication on community background. Their effectiveness is determinant for other measures as evacuation plans. In developing countries, for example, widely marginalized households have higher need to protect their neighborhood, and the risk of losing control on vital resources could be perceived as more devastating than the possible risk of hazard (Twigg 2003). Similarly, Parker et al. (2008) found out that people, who own their house, are more active to save flood damage than house renters. Also, the social status plays a role, with people in lower social grade being less likely to respond to flood risk, partly because they have less material goods to save.

Flood Risk Communication

Flood risk managers have to be transparent concerning the process of flood risk communication, and they have to be able to admit when they made errors. Similarly, the accountability process has to be strongly enhanced at any level of governance. A system for feedbacks has to be implemented to create trust and involvement. Social media and web sites could be used as multi tool instruments even at local and regional levels, contributing both to the diffusion of information and to the creation of a "reciprocal" information flow. Applications for Smartphones could contribute to create new patterns in flood risk management, and to step over the top down dissemination of information which is still dominant and offers little opportunity for the engagement of end users and the reception of constructive dialogue (O' Sullivan et al. 2012).

Thus, the decision-making process is also influenced by emotions rather than by rational judgment or probability theories. Flood risk managers and experts have to take this into account when designing action plans of flood risk communication. Wider changes in citizen's attitudes and behaviors as being aware of leaving in a risky area do not imply necessarily the adoption of protection measures (Burningham et al. 2008). Researchers such as Parker et al. (2009) and Raaijmakers et al. (2008) agree that to improve flood warning responses in the future, flood risk communication should present several characteristics. In order to enhance the critical thinking in people and to develop a self-responsible mentality, public flood risk communication has to give an opportunity for non-formal learning. Education should produce questions and wondering to create the psychological basis for the research of new information. The rising of uncertainty could help



indeed to create successful public campaigns and activate non formal learning working both on individual and collective behaviors (Parker et al 2009). People have to wonder about their environment and to question their safety in it. If uncertainty is created, processes of informal learning and information sharing with peers, families and friends will start, and motivation will increase, which is the key to learning. This can be achieved with the help of public education campaigns formulated for a diverse audience, for example for individuals that already underwent a flood risk situation, or that differ in age, gender and ethnicity. Another way of reinforcing relation within the public community is to develop a collective memory about past flood risk incidents. For example, it could be thought of establishing a virtual or physical flood museum with photos, videos, and expert analyzes etc. This would help to keep flood risk situations in the collective memory. As a result, residents would prepare themselves better they would be more aware about present or future flood risks.

One way of non-formal learning is learning-by-doing which implies activities such as setting up and informal communication networks within the local community, setting up arrangements to help the people with special needs in an emergency and working on ways of increasing community and building resilience. Ground testing underlined further the need of implementing the drills while increasing the perceived effectiveness of the civil protection. The direct involvement of both volunteers and relief professionals will contribute to raise educational levels but will also increase institutional trust. We recommend the application of regular drills, involving especially primary and secondary schools to maximize long term effects of education. Furthermore, the economic damages related to floods and the general perceived absence of compensations requires the involvement of local associations' representative to share common practices and increase institutional trust. A practical objective should address citizens before emergencies to limit some physiological behaviors that are usual in crisis situations: when disaster happens, people seek further information for example by calling the emergency service or seeking the advices of flood management experts. Therefore, enabling information access is very important to permit individuals to formulate an opinion and to facilitate the decision-making process. However, this process has to be addressed giving basic assumptions before the critical phase of emergency. Flood risk managers and experts have to take this into account when designing action plans of flood risk communication, while they should be aware of that human responses are elaborated in a binary mode (do or don't) orienting their messages as consequences. Both our formal and informal qualitative ground testing verified the perceived need "to increase the control of the situation" or simply "don't crush firefighter's switchboard".

The development of online educational videogames as the one provided by the Southern California Earthquake Center (<http://www.dropcoverholdon.org/>) should be taken as model and developed properly for become complementary instruments in flood management. A simple methodology could be the diffusion of internet forums and public assembly where qualified emergency personnel presents a general overview of the problem, explains basic concepts in question and answer moments, stimulates the discussion in working groups. Indeed, people should be encouraged in thinking independently, taking full responsibility for their destiny and the outcomes of the flood risk situation. They should be encouraged in working out a solution themselves, or together with peers, families and friends. Self-responsible and critical thinking could also help to make citizens more



resilient and to develop better coping strategies. Thus, this should be done with instruments properly supported by flood risk experts and institutions, relief managers and volunteer emergency workers to increase the sense of community as a whole.

An important element to be adopted for stimulating those reactions is the so called “Sensemaking” theory that helps to enhance group communication and coping. It is referred as the ability to individually use information from the environment and be able to react by creating a collective action plan. Therefore, “Sensemaking” originates from the individual’s initial perception and then transforms into the ability to react collectively. “Sensemaking” is fundamental in teamwork (Weick, 1993), and fortunately it can be learned. In the following list we will address some crucial aspects of Sense-Making that can be transferred to flood risk situations.

- Trust in the distribution of team responsibilities. Each member should assume his/her role and act accordingly.
- Collective interpretation of the situation of uncertainty. Flood risk managers as well as residents should analyze the first signals, which indicate that a flood is coming up. At this point the team members should exchange information in order to act together.
- Optimum performance. Adopted measures should go hand in hand with the gravity of the situation. In the case of false or inappropriate warnings, measures were not related to the gravity of the situation.
- Climate of trust. Action measures are influenced by “sense-making” and by stipulated norms. This can be seen in flood risk situations through the reaction of some flood risk experts or residents, who assumed more responsibilities than their job position required, and who coordinate the risk decision process or information transmitting process.
- Social influence. “Sense-Making” is a social process in which a collective reaction takes place and the behaviors of some do influence those of others. The leader of the team has to act accordingly to the situation. Then, in turn, this reaction could facilitate that the one of the rest of the team practice the same behavior.
- Role of emotions. Emotions are a fundamental part of “Sense-Making” and also of the judgmental process about the flood risk situation. Initial worry creates a situation of uncertainty.

An action plan has to be implemented to create an effective “Sense-Making”, translating this situation into relief and success. Similarly, other measures derived from our review of evidence could be schematized in practical suggestions for improving flood risk managing.

Table 25 shows the actions that can be suggested to implement Inform, Educate and Involve capacity according to Wardekker’s principles (2010).

Table 25: Actions to implement inform, educate and involve capacity according to Wardekker's principles (2010)

Principle	Actions
<i>Homeostasis</i>	✓ Define the roles and responsibilities of each stakeholder: create a contingency plan where the basic actions of participants are defined



	<p>before, during and after emergency.</p> <ul style="list-style-type: none"> ✓ Increase accountability and establish a partnership: citizens have to activate self-help and self-protection strategies aided by authorities. ✓ Use social media to establish feedback mechanisms: introduce evaluations and dialogue channels not as instruments of judgments but as improvement strategies.
<i>Omnivory</i>	<ul style="list-style-type: none"> ✓ Use different instrument and strategies: face- to -face information and internet based source are complementary instruments to access wider people as possible. ✓ Implement internet dissemination by social media and online video games. Develop different kind of information for different targets. ✓ Educate and train students in schools and in citizens in cultural centers. ✓ Educate enterprises, shopkeepers (etc) to use appropriate measures for fast recovery as emergency business plans.
<i>High flux</i>	<ul style="list-style-type: none"> ✓ When critical periods of the year arrive, provide frequent updates at regular intervals. ✓ Increase information flux defining “ad hoc” informal channels both using word to mouth dissemination and social media. ✓ Train emergency personnel in risk communications: Binary response, Sense making. ✓ Implement the use of social media as bottom up instruments of data refreshing during all the disaster cycle. ✓ Implement the use of social media as instruments for information dissemination during all the disaster cycle (including post flood management).
<i>Flatness</i>	<ul style="list-style-type: none"> ✓ Provide the instruments for self-sufficiency and self-organization to the population: create local committees and discussion groups. If possible, create a channel on YouTube for sharing good practices. ✓ Have information always accessible in public areas and internet sites. ✓ Develop a collective memory about past flood risk incidents. ✓ Discuss and inform on practical measures to be adopted in families, shops and companies at structural levels. ✓ Use online instruments and interactive networks for planning and allowing feedback mechanisms. For example, create a feedback and dialogue area in local civil protection’s web page. ✓ If possible, activate courses for reducing digital divide.
<i>Buffering</i>	<ul style="list-style-type: none"> ✓ Stimulate the use of buffering solutions with local laws or with the creation of fiscal incentives. Establish long lasting routines of information and training that could be easily accessible to citizens. For example, establish open meetings two times a year in institutional locations. ✓ Increase participation for example by stimulating the volunteering in Civil Protection since school years.



	<ul style="list-style-type: none"> ✓ Explain clear and safe actions to undertake. <u>Underline the importance of cooperative behavior during those phases.</u>
<i>Redundancy</i>	<ul style="list-style-type: none"> ✓ Maintain open always more than one solution if different choices for are possible: define both public meetings, media and create internet forums; use informal and formal channels. Organize drills alongside with direct information dissemination. ✓ Assure that critical content are repeated in more than one message for accessing all actors.

GUIDELINES FOR THE IMPLEMENTATION OF WARNING SYSTEMS

Technology, social sciences and economics are part of the same holistic approach that identifies how the system will receive the hit and react to the changes. It is evident that effective warnings involve every action of decision making. The generation of an effective service is based on the knowledge about the performance of each component to increase the development of the system as a whole (Montz & Gruntest, 2002).

Quantitative ground testing pointed out some main evidence related to warning systems in Cesenatico and Bellocchio: many ways of disseminating alerts exist and are currently used. Face to face advices are sometimes disseminated by officers, while traditional instruments as alert sirens could be applied with more or less success depending on political choices. As demonstrated by our qualitative informal interviews and quantitative evidence about information sources, an integration of the methods for dissemination should be useful as it is likely that a particular warning system on its own could fail or if have low effectiveness levels. According to international literature at large, many types of warnings are actually available and ready to be applied, using different technological levels and integrating different contexts. Thus, the great challenge seems to acquire the best implementation strategy to avoid waste of economic resources and social potential. For example, SMS Warning service in Cesenatico (Figure 40) is mostly unknown even if the questionnaires underlined that it could be widely appreciated by citizens. The participation of local stakeholders before any investment and during the dissemination process is necessary to assure the effective use of particular warning methods, as well as to create dissemination improvements.

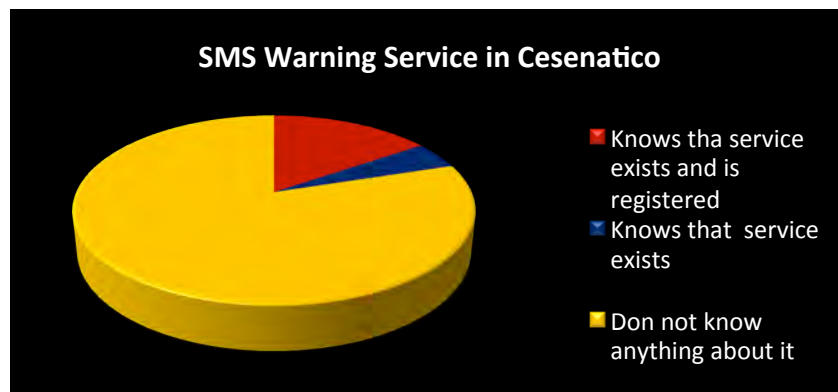


Figure 40: SMS warning system in Cesenatico

The nature of flood warning communication can have a big influence on behavioral responses of their recipients. Therefore, it is important for the experts and flood risk managers to adopt a careful and responsible way of transmitting flood risk messages to the residents, as any mistake in this message can have bad impacts on the health of the community. Emergency operators have to be properly educated to produce the correct warning message, both in face to face or media alert. The most effective messages are specific about the character of risk, locations and time of the impact and propose proactive actions to undertake. They are characterized by consistency and certainty, maintaining high accountability of sources (Mileti 1995). The effectiveness of measures as flood warning is not only related indeed to the effectiveness of warning itself, but also on the amount of local residents able to respond to a warning, available to do that and able to activate an appropriate response (Penning Roswell e Green 2000). After the communication of pre-formulated warning messages from official agencies, additional messages should diffuse at the local level in coordination with stakeholders (Parker 2003). Parker et al. (2007) underline that messages should be simple and direct to different audiences, reinforcing the idea that agencies act together with citizens and communities. Quantitative and qualitative research developed in different European countries by O' Sullivan et al. (2012) point out further low levels of understanding of the terminology that describes flood magnitude, while communications should improve in general the ability to channel direct, brief and focused contents. The demographics and social diversity of communities suggest that multiple communication methodology should be adopted to reach a broad target, as there can be found a great number of sources used for warnings. The patterns of individualistic fragmentation and scarce accountability of governance could represent heavy limitations as shared meaning is difficult to achieve when the community is not heterogenic and when the informal networks are not involved by the authorities (Handmer 2001).

Different channels and methods of communications should act together to overcome the psychological denial of threat that often inhibits citizens to undertake effective countermeasures in front of flooding events. For instance, elder people actually prefer a knock-on-the-door by a flood warden, and they prefer to have face-to-face communication and discuss about the flood. Elderly also aren't used to operate on Internet technologies, even though it is a powerful and rapid medium to transmit flood warning information. Similar evidence can be derived from case study of the Slovenian city of Celje (Brilly and Polic 2005), where strong differences even inside the same urban area were evidenced. Warnings were considered by people an important element, but the messages



had to acquire simple form and contain clear instructions. As internet use was not particularly widespread, official messages had to be based on radio or televisions or conventional technologies. Thus, the technical methodology selected for dissemination process should be derived itself from the context and should point out immediately a defined target.

In areas with high mobility as holiday destinations, the integration of formal and informal channels should be essential for the effectiveness of warning messages. According to the analysis of 1998 UK floods in caravan parks made by McEwan et al. (2002), the information transfer between the official, semi-formal and informal should be structured with the direct and legal involvement of stakeholders (in this case, caravan managers). In our opinion, an appropriate legal framework should be effectively developed and applied to stimulate cooperative actions both at formal and informal levels with the goal of long term definition of policies and actions for *high flux* synergies. Tapsell and Ball (2007) point out that different level in future public investments could lead to different scenarios in citizens' access to flood risk management and warning dissemination. Large benefits could be derived from the diffusion of new technologies, but it could be limited by social inequalities as different levels of education and income. Vulnerable groups as older and poorer people are likely to be excluded from measures that require large personal income to be adopted. It is true indeed that solutions linking together communities and agencies should be developed according to different short term and long term goals. Main generational differences as the so called "digital divide" suggests that no unique solution is possible, but different strategies should be adopted as complementary elements in the dissemination process.

The diffusion of internet sites, social networks, and mobile operating systems created new instruments for increasing the effectiveness of flood warning. Merz, Hall, Disse & Schuman (2010) suggest that flood warnings could be incorporated in multi hazards systems to maximize economic efficiency and relief effectiveness, as many structural elements as real time data transfer are common to different hazards. In coastal areas, the same platform could be used for informing about heat waves or fires during the touristic season. However, different solutions are possible according to the level of resources available and the political coordination level involved.

In our opinion, the employment of Social Media technologies should be integrated in the existing web pages of every municipality in hazard areas for assuring a capillary and fast transmission of messages. They should be evidenced in the home pages of institutional websites, and provide real time updates if monitoring systems are properly interfaced. For example, they could offer to the citizens the registration in a traditional mailing list, the possibility to activate a "Follow" option in Twitter or the "Friendship" on Facebook. Other social networks could be further used according to their main diffusion and to the technical arrangements required. The possibility of feedbacks should be assured with the creation of proper social media pages, where suggestion on improvements and areas for Questions and Answers should be developed in cooperation with emergency managers. That option could be used even to disseminate information on foods at large offering new channels for networking while stimulating the direct involvement of citizens in voluntary activities or drills. Applications for smartphone have large potential for development tools for providing real time data to disaster coordinators and for providing simple low cost applications for SMS dissemination (e.g., Wazzup application for Android Systems). Anyway, complementary character among sources should

be preferred to substitutive one: internet, face to face alerts and traditional media should be accessed together, while appropriate contacts should be planned in the preparedness phase. A communication plan should involve the constant update of information even in post flood period.

If larger founding is available and the action is coordinated at less at regional level, an interesting model could be provided by the California Resiliency Alliance: they developed an online interactive database with the elaboration of major natural disasters maps, including flooding areas. Net users have access to major information on vulnerability of zones, insurance schemes, probability of floods and possible exposures. An interactive and intuitive flooding map shows further divisions of school, fire and water districts. Similarly, The United Kingdom's national weather service (Met Office) implemented an advice system that joins forecast details to the colours of alert used since a long time for warning. On Met Office's official web site an interactive map (Figure 41) predicts storm and wind severity according to a colour scale that identifies the area at risk is available. Here four warning colours are derived from a matrix that measures the possibility of event in terms of combination of likelihood and impact:

- *Green* that characterize normality status.
- *Yellow* that points out the necessity to be aware of possible bad weather.
- *Amber* that exhort to be aware for severe weather phenomena.
- *Red* that underlines a heavy risk, with the possibility of “extraordinary Measures” as evacuation. In this case it is suggested a direct contact with local councils.

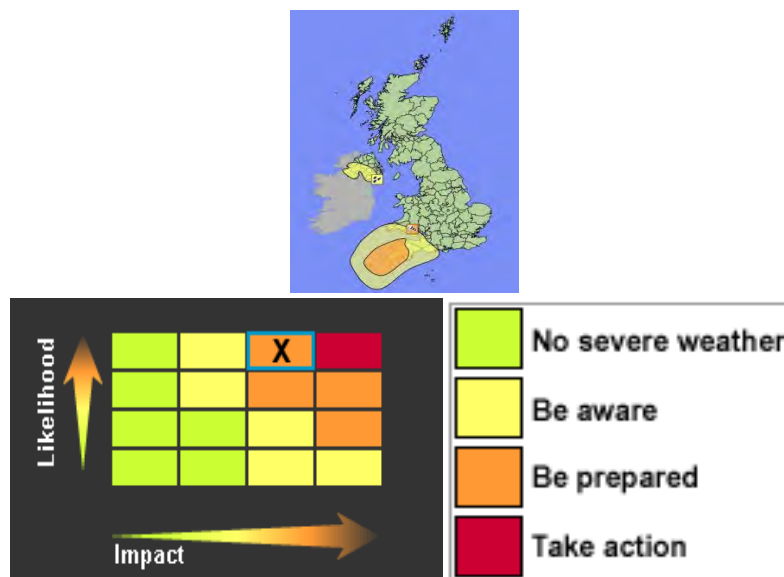


Figure 41: Sample of interactive map (Met Office, June 7 2012) and Key to warning colours (Met Office 2008)

Clearly, Web 2.0 and 3.0 technologies can't be considered on its own for the development of a warning system but should be used as a complementary instrument. Thus, users should be stimulated to contact their personal network to provide the information gained by their access to high flux technology to people excluded for digital divide or scarce access to internet technology.



Actions for the implementation of Warning Systems

Table 26 shows actions that can be suggested to implement warning systems according to Wardekker's principles (2010) .

Table 26: Actions to implement according to Wardekker's principles (2010)

Wardekker principle	Actions
<i>Homeostasis</i>	<ul style="list-style-type: none"> ✓ Implement early-warning systems. Gain further time. ✓ Codify and implement informal dissemination process. ✓ Create contacts and emergency plans to assure media. This should be done in the preparedness phase and should cover all the disaster phase. ✓ Create checklist with best practices for face-to face operators.
<i>Omnivory</i>	<ul style="list-style-type: none"> ✓ Develop multi tools that could be useful for disseminating alerts for more than one hazard. For example, the flood alert could be used during touristic season for heat waves. ✓ Confront and update the instruments becoming available and implement best synergies among them. ✓ Evaluate the presence of tourist and involve directly the local service providers in dissemination process.
<i>High flux</i>	<ul style="list-style-type: none"> ✓ Integrate different technologies and adopt clear procedures to increase mobilization of resources. ✓ Create synergies between formal and informal dissemination process. ✓ Develop checklist for operators to maximize the reaction capacity. ✓ Integrate the use of social media in all the disaster cycle.
<i>Flatness</i>	<ul style="list-style-type: none"> ✓ Integrate the instruments for providing ground feedbacks such as implementing the use of Smartphone's' applications or social media. ✓ Produce regular questionnaires and survey to verify people's perception of the warning system adopted.
<i>Buffering</i>	<ul style="list-style-type: none"> ✓ Create routines to verify and implement the carrying capacity of the technology used. ✓ If possible, use always more instruments that the ones believed to be effective on their own. ✓ Create a legal framework that could stimulate the long term implementation of formal and informal systems. ✓ Create a specific "pre-alert" warning code for high risk areas: this will allow the creation of "cushion" zones for first evacuation or faster emergency intervention supported by the population.
<i>Redundancy</i>	<ul style="list-style-type: none"> ✓ Join together formal and informal channels of dissemination. For example, use together social media, TV broadcasting, and word to mouth dissemination.

Critical facilities are important elements to be acquired in land use and disaster management, but they should also be considered in long term social planning. Often, critical structures are located in zones subjected to moderate risk where the implication of possible hazards are underestimated or simply reduced to possible structural damages. In key buildings, even few centimetres of water can be determinant for creating huge amounts of problems. These episodes are not possible to be quantified in economic terms as their main effects are not tangible and not subject to market process. Figure 42 shows for example the picture of a flooded emergency centre during 2005 Savio's River Flooding in Cesena. As the water was not so high, the structural damages were low. Uneasiness for patients, citizens and emergency workers were clearly wider, as well the consequential psychological relapses of the event.



Figure 42: Effect of Savio's river flooding 2005 in critical facility in Cesena (Photo taken from Radio Soccorso Cesenatico official website)

Similarly, Figure 43 illustrates the results of possible damage to “people or things” evaluated by the Cesena Municipality by Census (2006). The so called “elements exposed” in the hazard areas are always intended in terms of physical damages (structures or death/injuries), while the possible dimension of intangible impacts to social behaviour is missed. Our ground testing demonstrated further that practices related especially to buffering, flatness and homeostasis are not implemented, while the appropriate involvement of stakeholders could produce important effects for long term planning and effectiveness of social functions.

Our proposal is to integrate in the concept of *Critical Facilities* a main view of social perception of functions related buildings in order to create an appropriate *Critical Social Facilities Index* as it was

done in the DSS. The model we presented is just a first step: important progress should be made with the development of proper scales for social damages related with different activation/reactivation lists for post crisis management. Thus, what we defined as *Approximated social value* could be derived directly from the dialogue between disaster managers and citizens to assure that functional needs are assured on bottom up requests. If applied, this approach could have important consequences for land use planning and integrated flood management, as it could concretely help in the development of community resilience: the localization of critical structures could be decided by local managers on the basis of potential risk, but also according to their importance for reducing the interruptions and the behavioral effects of disasters. We suggest a first definition of long term implementation in European framework and the development of common instruments of social perception such as questionnaires and round tables. Research institutes could collaborate closely with decision makers to produce a change in the ways of considering damages in urban planning at large, increasing the reprise capacity of community resilience.

<i>ELEMENTO ESPOSTO</i>	<i>aree ad elevata esondazione</i>	<i>aree a moderata esondazione</i>	<i>aree a potenziale allagamento</i>
Popolazione	366	4.445	35.686
Strutture sanitarie	/	/	15
Uffici pubblici	1	3	20
Uffici privati di interesse pubblico	/	3	53
Strutture scolastiche	/	5	34
Strutture per il trasporto	/	/	12
Strutture per turismo, sport, spettacolo ...	/	5	21
Strutture religiose e cimiteri	1	2	34
Beni storici e culturali	/	/	3
Depositi sostanze pericolose	2	5	35
Principali stab. industriali e att. produtt.	8	65	777
Allevamenti zootecnici	2	2	51

Figure 43: Results of Census on possible damages to people and structures produced by the Municipality of Cesena (Comune di Cesena 2006)

Vulnerability Maps, Social Planning and Preparedness

The protocol on community based vulnerability assessment released by the University of North Carolina (2009) suggests that *critical facilities* should be listed for type and services to determine which of them could be located in areas of hazard. This should allow the development of a map for the rapid identification of possible social and community vulnerabilities that should allow the prioritization of steps for increasing citizen's safety. Of particular importance in our opinion is the use of critical facilities maps in Decisional Support Systems and real-time hydrological risk simulations to verify how climate change phenomena could impact in a certain coastal areas. The decision makers should evaluate which of their sensible structures could be in that "Red Area" that is likely to become more sensible to flooding risk. On the one hand, if we hypothesize the presence in place of a small emergency relief point, the mapping should lead to proper measures for reinforcing, adapting or (if possible) giving other uses to the structures. On the other hand, if an urban plan is expected to create a school or a police station in sensible areas, those should be

relocated to reduce social damages. That perspective has been strongly developed by the FEMA (2007), which underlines the crucial role of mitigation measures for assuring uninterrupted services in the long period.

Indeed, factors related to coastal flooding and riverside should be considered in planning the location and the structural design of new critical facilities. Figure 44 shows a generic coastal flood line, including different elements as the perspective elevation of water line respect actual levels. It includes the limits of flooding and the possible level of floods determined by the possible wave action as result the depth of water, the velocity of the flood and the of duration floodwater. Particular care is needed to identify the *coastal A zone* as explained in FEMA protocols as the facilities near the area should find proper measures for anticipating possible wave and loads. Coastal A Zones presents two main conditions: the expected floodwater depth is sufficient to support waves 46 to 92 cm high and there are few obstruction between the shoreline and the site. Thus, different legal criteria are diffused worldwide and measures in general have to be evaluated site by site.

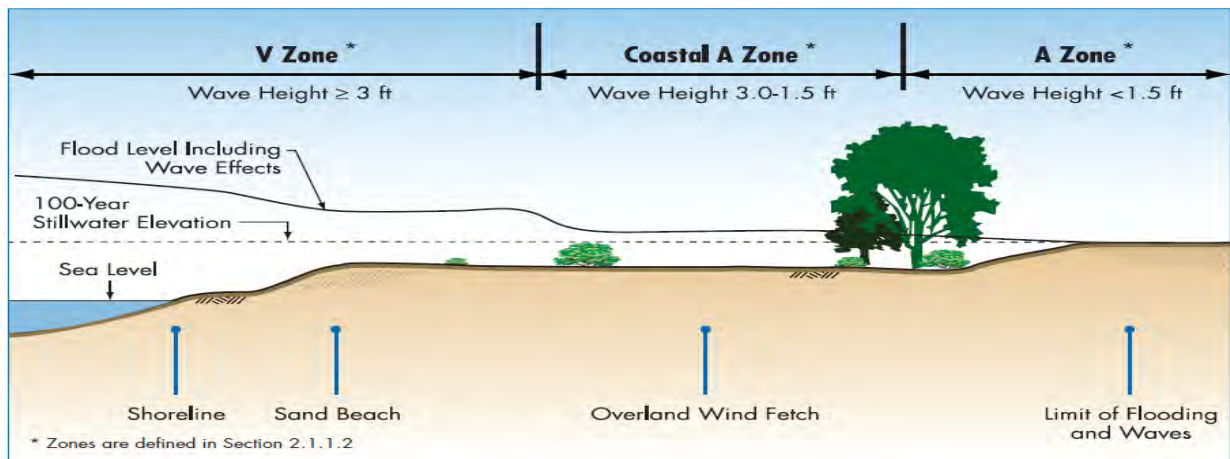


Figure 44: Flooding along an open coast (FEMA 2007)

The FEMA establishes a large number of mitigation measures that could contribute to risk reduction in critical facilities: installation of utilities, as well as site modifications, repairs, renovations and upgrades for building are all possible solutions. However, it must be noted that most protocols and studies regarding critical facilities are developed in United States and consequently evaluate a particular cultural context both in terms of social process, engineering practices, and environmental habitats. The structures built in Europe, for example, have usually concrete walls while different urban planning regulations vary among regions and municipalities. Similarly, options verified in the Atlantic Area could not be feasible in the Mediterranean or in the Baltic Sea. According to the University of North Carolina (2009), Critical Facilities should be completed by other data on environmental threats as chemical facilities. The creation of a localized *social vulnerability index* is suggested for mapping the human sensibility to disaster effect: it is a composite of all the social vulnerability scores calculated using census data and mapped for a variety of factors, including age, income, and disability. Incomplete data sets could determine moreover the standards and the GIS dataset and underline the need to involve local and international basins' authorities in Europe for increasing the effectiveness of urban planning. For instance, a complete map of environmental threat was only partially available in Cesenatico and was integrated in the *Critical Social Facilities*

Index, while vulnerability have been used and integrated in the DSS for life losses and injuries estimation. Figure 45 illustrate an example of environmental threat in Cesena and social vulnerability map in Lima; Figure 46 shows an example of Healthcare Critical Facilities map in Lima and the concentration of Health Care Facilities reported to the distribution of vulnerable population.

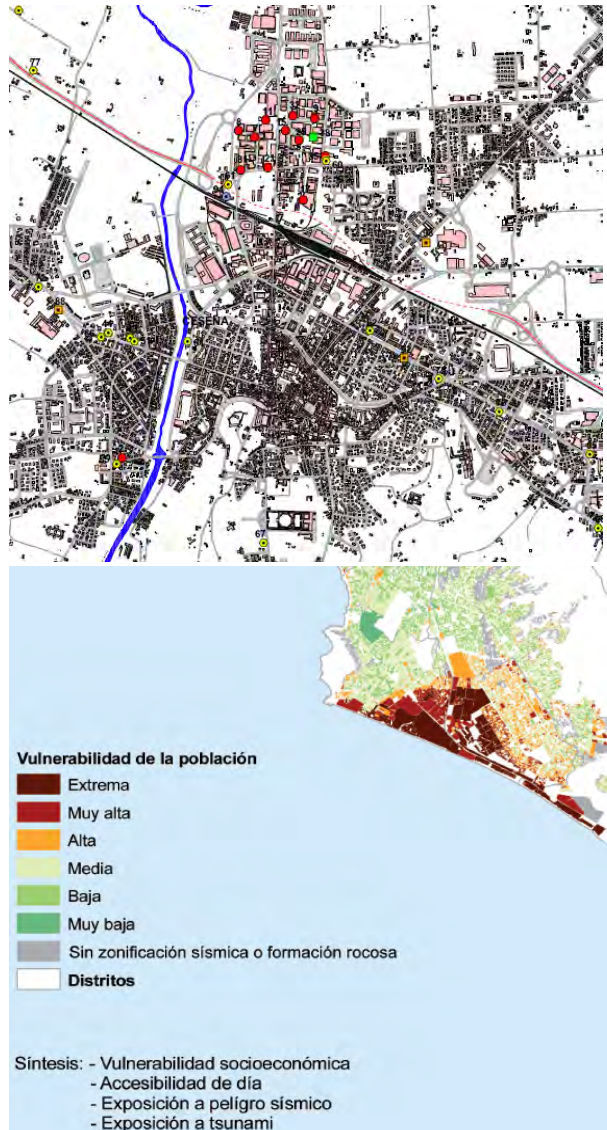


Figure 45: TOP: Example of environmental threat map in Cesena with plastic storage in red, petrol station in red, petrol storage in green (Comune de Cesena 2006). BOTTOM Social vulnerability map of Lima (INDC, UNDP, Coopi, IRD 2011)

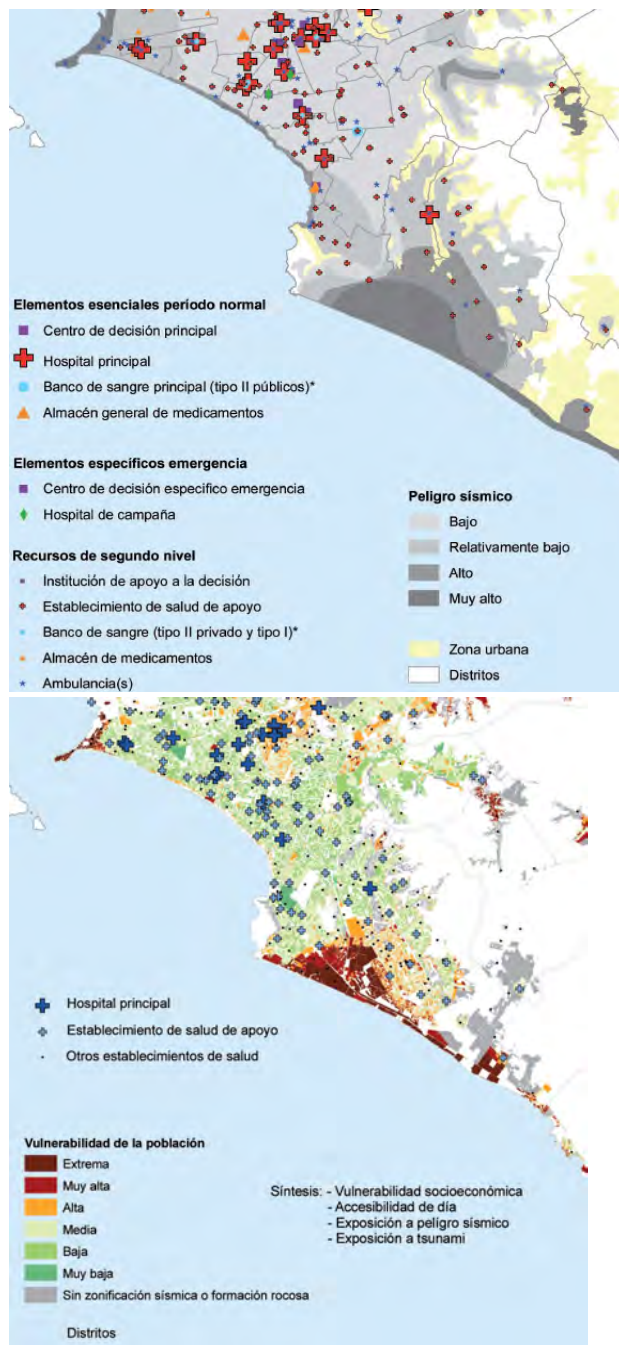


Figure 46: Healthcare facilities in Lima and distribution of healthcare facilities distribution (TOP) compared to the vulnerable population (BOTTOM) (INDC, UNDP, Coopi, IRD 2011)

If the risk evaluations start in the early phases of disaster cycle, the effective implementation of local policies and actions on critical facilities could have direct impact on crisis management even without the re-location of structures in dangerous areas. Direct risk reduction interventions can be done for reaching higher autonomy of the facilities according to safety factors: there can be provided special roads for evacuation, watertight doors for equipment rooms, plumbing water supply, gas lines and electric cables. Similarly, it could be important to plan the installation of potable water and wastewater systems able to resist flood damage, as well as special storage tanks.



A comprehensive ranking of risk sensibility should be developed to prioritize strategies and investments, acting both on the reduction of vulnerability and on the raise of resilience. The Instituto Nacional de Defencia Civil, Programa de las Naciones Unidas Para el Des Arollo, Cooperazione Internazionale –Coopi, and the Institute de Reserche pour le Developpment (2011) stated for example that a disaster has high chances for generating bad functioning or main paralysation of the essential infrastructure in ordinary situation, as water supply or electric grind. Thus, the central elements for normal urban functions and the specific resources necessities in periods of emergencies should be quoted and mapped before the disaster itself to facilitate crisis and post crisis management. When a critical facility lies in risky area, for example, alternatives should be planned to be effectively deployed in the aftermath. Similarly resources should be stored and planned to cover a possible “black out” of services.

Priority list for re-activation and emergency measures

The official documentation about the Local Mitigation Strategy developed in Hillsborough County - Florida (2009) offers a complete priority list of what should be re-activated or maintained after the disaster’s impact. Main critical structures have been ranked 1 to 5, where one represent most critical infrastructure and five the less critical. The list includes:

- 1) **Facilities identified as "critical" to public health, safety or the National or Global Economy.**
These are: Hospitals and emergency medical facilities; Emergency shelters (special shelters and schools used as shelters); Main fire stations , main police stations, prisons/jails; Occupied fire rescue facilities, Master water pumping and wastewater facilities; Major communications facilities (i.e., telecom transmitters); Major flood control structures; Financial institutions with national or global impact; Military installations; Critical electric utility facilities.
- 2) **Facilities that provide significant public services and should be activated within 24 hours** as Nurseries, Major water and sewer facilities, Fire and police stations, Minor flood control structures. Fuel transfer/loading facilities (ports), Airport, American Red Cross, Schools and park facilities used to support other critical government purposes.
- 3) **Facilities that provide important public services but should be sequent to critical facilities in point 1 and 2** as Local water and sewer facilities, local fire and police stations facilities having critical impact on the environment. Planned to resume operations within 48 hours.
- 4) **Facilities that provide public services but that are less critical for the community** as Supermarkets, Banks, Grocery distribution/large cold storage facilities. Planned to resume operations within 72 hours.
- 5) **Other types of facilities** as schools not acting as shelters, hog, fish and poultry farms. Planned to resume operations after 72 hours.

A similar plan could be replicated and adapted to the different coastal areas for increasing the effectiveness of emergency and post disaster management. Social media could be used to update the situation of re/activated or under re activation buildings according to high flux criteria. Cultural perceptions derived by appropriate dialogue with local stakeholders and citizens should be used to define the social importance given to structures and should help the classification balance. For example, the population could attribute higher relevance to certain buildings more than others in



the same category as a particular church or cultural centre. Our ground testing and the review of documentation about local Civil Protection plans underlined indeed that actually the identification of critical infrastructures as emergency centres is most diffused (at least in Italy), but still no complete re/activation list is developed properly. This instrument could be pretty simple to be used on large scale, and could generate the creation of long term planning of structures at large.

However, some “last resort” actions are possible to facilitate recovery process and contain damages in the acute phases, but the importance of critical facilities in disasters should lead local planners to think differently their urban planning process. Indeed, emergency measures are useful only in case of moderate impacts, and are not adequate protection for occupants. According to FEMA list and our field expertise there could be found:

- Sandbags walls. The most common measure for “gain time” during river floods. This solution is less immediate than it could seem, as it requires many workforce and trained personnel to be effective. A large number of failures happen as the erroneous use of sandbags could often lead to leakage and failures. Following the disposal, there should be done regular controls to verify their deteriorations and their stockpiled status. Their tendency to absorb pollutants from floodwaters, should lead to their disposal as hazardous waste.
- Water- filled barriers. Water- filled barriers that could be easily assembled and used in different events are actually available on markets. As they should adapt to site, they have to be sized properly for the zone of deployment. Training of personnel should be regularly done to use them with the best effectiveness, as well as to store them after use and protect the materials for long period.
- Panels for doors and mobile bulkheads. Panels of sturdy materials could be used to fit doorways or other entries. They increase effectiveness if flexible gasket or sealant is provided and the hardware is designed to support pressure. This solution is largely used for example in Venice in occasion of the recurrent “high water” phenomena.
- Sheet Piles. They are largely applied during winter season in touristic areas to contain sand losses and protect buildings. They are usually made in wood, iron or concrete and are sank in deep closely one to another to create a barrier.

If the particular nature of some critical facility is likely to require periodical employment of the emergency measures (e.g.,e.g. the building is in hazard area), buffering strategies should be planned and activated in the early phases of disaster cycle to create fast response and minimize damages as possible.

Actions for the Implementation of Critical Facilities

Table 27 shows the actions that can be suggested to implement a wider use of Critical Facilities according to Wardekker’s principles (2010).



Table 27: Actions to implement a wider use of critical facilities according to Wardekker's principles (2010)

Wardekker's principle	Actions
<i>Homeostasis</i>	<ul style="list-style-type: none"> ✓ Use Critical Facilities' definition and literature to develop social planning strategies aimed at the long term. ✓ Adequate and implement the Approximated Social Value in different local realities. ✓ Create a re-activation list in every municipality to increase the effectiveness of post crisis management.
<i>Omnivory</i>	<ul style="list-style-type: none"> ✓ Create multi-functional spaces and buildings. ✓ If possible, use more than one decision support system or hydraulic simulators during planning.
<i>High flux</i>	<ul style="list-style-type: none"> ✓ Locate easy-to-modify buildings in areas that could become at risk. ✓ Use new technologies to develop real time update of hazard ✓ Use Social media to update constantly the list of structures re-activated or under reactivation in post- disaster period. ✓ Create shared meaning and word use among European civil protection to increase information flux.
<i>Flatness</i>	<ul style="list-style-type: none"> ✓ Define the most important buildings for social patterns with the participation of citizens and local stakeholders. ✓ Create social planning as consequence of dialogue with stakeholders. ✓ Create a priority list of structure to relocate crossing the dimension of effective and perceived risk registered with appropriate qualitative and quantitative instruments.
<i>Buffering</i>	<ul style="list-style-type: none"> ✓ Plan low-lying places to serve as water retention areas. ✓ Use materials that are resistant to water, heat, and ice-drift in buildings. ✓ Create disturbance-proofed, low-elevation spaces and ground-floors, with non-essential functions. ✓ Provide storages for emergency measures near the Critical Facilities. ✓ Create a legal framework at the European Level to stimulate the long term implementation of re/activation and perception of social planning. ✓ Implement and elaborate wider simulation models. ✓ Train personnel in buildings to have higher coordination with agencies during crisis. Provide drills on the use of emergency measures. ✓ Deploy water pump in critical facilities in high hazard areas.
<i>Redundancy</i>	<ul style="list-style-type: none"> ✓ Find counterparts of vital buildings at risk outside the critical area. ✓ Verify the status of critical facilities' evacuation plans and security measures.

GUIDELINES FOR THE IMPLEMENTATION OF AN EVACUATION PLAN (PSYCHO SOCIAL PERSPECTIVE)

A wide and detailed strategy for the Implementation of an Evacuation Plan has been developed properly in THESEUS by the Centre D'études Techniques Maritimes et Fluviales. Our working group applied their guidelines for implementing the DSS in Cesenatico and verified that it were effective and useful. Our ground testing can provide some additional point of view for evacuation implementation under the socio- psychological perspectives.

The first point emerged by interviews, was the need for information about meeting points and evacuation routes. Those elements sometimes are provided in civil protection plans, while they are systematically applied on ground only during the acute phase of emergency or after major catastrophes. The correct development of evacuation plans requires particular integration of information, education and involvement principles. Even simple things as the form, colour and type of signals (Figure 47) should be decided with the participative approach to assure their cultural setting and their socio-psychological acceptance.

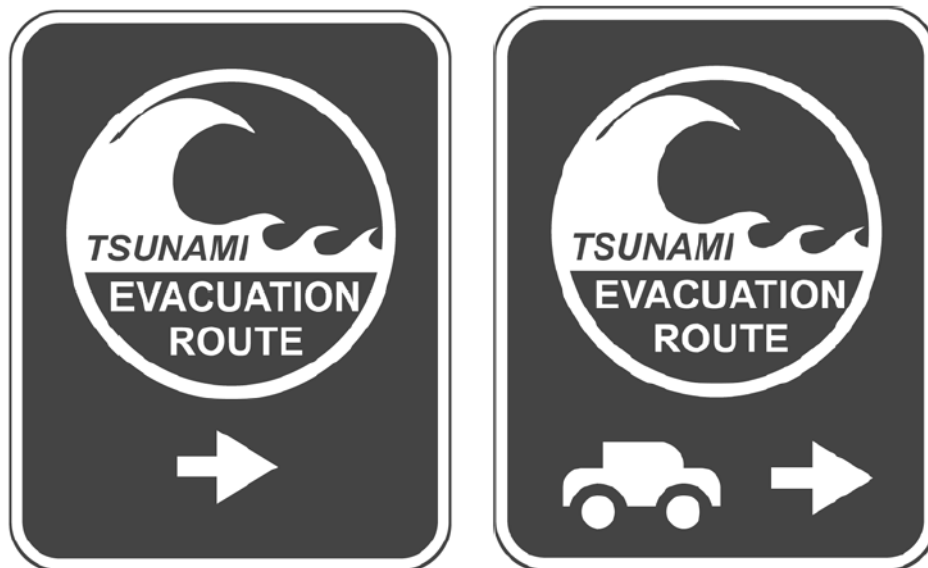


Figure 47: Sample signals for mass evacuation (Ministry of Civil Defence and emergency Management - New Zealand Government).

Similarly, others important factors should be further studied and contextualized. According to Riad et Al. (2001), many individual and collective interactions determine the decision to evacuate or not evacuate. Behavioural analysis of transportations should be regularly updated as they are likely to influence all the evacuation's plan effectiveness. Other structural problems on warnings dissemination and on the quality of information have to be faced before the acute emergency and should be addressed properly in policies. The trust in institutions and the social acceptance of the evacuation order should be increased with the involvement of local stakeholders in evacuation decision or dissemination process since the early phases of planning. Organizing evacuation by neighbourhood as well as maintaining and encouraging social support networks will finally contribute to the recovery process. Vorst (2010) suggests that evacuation modelling should include general knowledge of cognitive, attentive, emotional, and motor behaviour of citizens. The effects of stress on evacuation performances are clearly important as they have a great negative effect on



adaptive behaviour. Furthermore, the influence of characteristics such as general intelligence, neuroticism, and resilience on evacuation is well documented in general psychology. Furthermore, even social vulnerability could have an important role in determining evacuation patterns, as people with special needs could need much more help (Chakraborty et al. 2005). If Maps on Social Vulnerability and Critical Facilities have been implemented, they could be used to provide a first overview of critical areas. Our ground testing underlined that the possible presence of tourism as distinctive feature of coastal zone could become a massive variable in effective evacuation plans. The type of touristic presence should be investigated and used for improving the plans, especially the parts related to dissemination and provision of public means of transports. For example, the evacuation patterns will be different if the area is tangentially destination of caravan-based travellers, middle –high income tourist with cars, or young hijackers because they will need different services and support.

Actions for the implementation of an Evacuation Plan (Psycho social perspective)

Tables 28 shows the actions that can be suggested to implement Evacuation Plans, according to Wardekker's principles (2010).

Table 28: Actions to implement evacuation plans according to Wardekker's principles (2010)

Wardekker's principle	Actions
<i>Homeostasis</i>	<ul style="list-style-type: none"> ✓ Provide flexible supply chain. ✓ Evaluate the impact of tourism in the evacuation plan
<i>Omnivory</i>	<ul style="list-style-type: none"> ✓ Differentiate transportation options and shelters. If new main roads have to be built, use them as auxiliary dikes (incremental effect with buffering). ✓ Integrate the Social Vulnerability Index in developing evacuation models.
<i>High flux</i>	<ul style="list-style-type: none"> ✓ Establish clear standards and instruments for constant ground monitoring during evacuation phase. ✓ Understand local driver behavior.
<i>Flatness</i>	<ul style="list-style-type: none"> ✓ Understand and update data about people not needing shelters (family support, community pattern). ✓ Integrate participative approach in the implementation of evacuation signals.
<i>Buffering</i>	<ul style="list-style-type: none"> ✓ Develop emergency measures for allowing the most important infrastructure to work in any condition. For example, main roads could be planned to be even auxiliary banks (incremental effect with omnivory). ✓ Dispose more coaches for emergencies than the number prevented. ✓ Assure the involvement of all local associations in planning, even if they are not emergency operators. ✓ Consider different flood scenario and create a safe road ranking: list in descendent order the roads reliability and consider it since the



	early planning to reduce shocks.
<i>Redundancy</i>	✓ Have multiple routes and means of transportation, have multiple crisis centers and refuges.

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RISK COMMUNICATION (JEAN-PAUL VANDERLINDEN, JUAN BAZTAN, IDRISSE KANE, NABIL TOULI)

GENERAL CONTEXT

WHAT IS RISK PERCEPTION AND WHY SHOULD IT BE ANALYZED

Risk communication has the objective of reconciling perceptions on risks – through proactive management of knowledge. The analysis of risk perceptions, and potential knowledge management schemes, lies therefore at core of the development of a risk communication scheme. We thus begin with the analysis of perceptions.

Risk is a mental model. Part of this model is linked with reality as it may manifest itself (some will call it the hazard, others will associate a probability density function with the description of an event) and part is linked with the way individual and society frame this manifestation (some may call this the consequence). By “framing” we mean here: how individuals talk about, and then assess, risk, taking into account contextual elements that seems neither directly linked with the probabilistic nature of risk nor with its consequences. This framing leads to situation where risk assessment by experts and risk assessment by laypersons lead to dissonant conclusions that may lead to sub-optimal behaviours, ill designed and/or not well accepted risk management options.

Therefore, what is understood as “risk”, “risk management”, “risk assessment” and the likes may cover diverse realities. While this is not a difficulty in itself, it raises several challenges when identifying a risk worth managing, when choosing the management option and when setting the risk governance mechanism.

The multidimensional nature of risk as perceived by individuals and institutions is very well captured by the diversity of definition that one faces when dealing with the analysis and the management of risk. Slovic and Weber (2002), through psychometric analysis, and Aven and Renn (2009), through extensive literature review have identified the following meanings for laypersons:

- 1) Risk as a hazard, as in, for instance: “By building a village in this low lying area, one has been exposing it to risk”;
- 2) Risk as probability as in “What is the risk of being flooded in the next ten years?”;
- 3) Risk as a consequence as in “What do I risk by building my house in this “no-build” coastal strip”;
- 4) Risk as potential adversity or threat. Example: “How great is the risk of walking along this eroded cliff?”.

Within the expert community things are by no means simpler (in part from Aven and Renn, 2009):

Risk equals the expected loss for Willis (2007); Risk equals the expected disutility for Campbell (2005) or the expected utility for Mc Carthy and Vanderlinden (2004); Risk is the probability of an adverse outcome for Graham and Wiener (1995); Risk is a measure of the probability and severity of adverse effects for Lowrance (1976); Risk is the combination of probability of an event and its consequences for the International Standard Organization (ISO, 2002); Risk is defined as a set of



scenarios, each of which has a probability Π and a consequence X in Kaplan and Garrick (1981); or risk may be expressed through events/consequences and uncertainties: Risk is equal to the two-dimensional combination of events/consequences and associated uncertainties (will the events occur, what will be the consequences) (Aven 2007); Risk refers to uncertainty of outcome, of actions and events (Cabinet Office 2002); Risk is a situation or event where something of human value (including humans themselves) is at stake and where the outcome is uncertain (Rosa 1998, 2003); Risk is an uncertain consequence of an event or an activity with respect to something that humans value (IRGC 2005).

This diversity of definition of “risk”, more than 15 possibilities, has as consequence that developing a common “risk” language is a key prerequisite to its management. Nevertheless, this diversity also reflects the fact that the mental model of scientist and risk experts is not exactly the same than the mental model of the general public. This has been captured through quantitative analysis (psychometric analysis) by Slovic (1992, in Renn 2008, p.144):

“... psychometric research demonstrates that, whereas experts define risk in a narrow, technical way, the public has a richer, more complex view that incorporates value-laden considerations such as equity, catastrophic potential and controllability. The issue is not whether these are legitimate, rational considerations, but how to integrate them into risk analysis and policy decisions.”

Furthermore these “perceptions” must be analyzed within the broad activity of risk management because they tell us what matters for the people; they help us identify tradeoffs; they help us design risk communication scheme.

The purpose of risk perception analysis is therefore to contribute to the robustness of risk analysis and to the salience of risk management solutions that may be offered, including in this case risk communication. This analysis may be rooted in various theoretical frameworks, a selection of which is briefly presented below before presenting the synthesis we will be using in THESEUS.

HOW ARE RISK PERCEPTIONS THEORETICALLY FRAMED?

In the past few decades it has been argued that the organization of many fields of government and social life has been reshaped around techniques and models of risk management, the principal characteristics of risk in this sense are associated with the management of potential harms (e. g. O'Malley, 2000). Several theories constitutes the main stream in risk perception since the 80', the most relevant ones are: The cultural theory of risk, The psychometric approach to risk, The social amplification of risk, The Governmentality approach to risk and the synthesis recently produced by Renn (2008).

Risk perception and the cultural theory of risk

“Cultural” theory refers mainly to Douglas’ work (e. g. “Risk and Culture” Douglas and Wildavsky 1982), where one can read:

“can we know the risks we face, now or in the future? No, we cannot; but yes, we must act as if we do. Some dangers are unknown; others are known, but not by us because no one



person can know everything. Most people cannot be aware of most dangers at most times. How, then, do people decide which risks to take and which to ignore? On what basis are certain dangers guarded against and others relegated to secondary status?"...

Risk and Culture attributed political conflict over environmental and technological risks to a struggle between adherents of competing ways of life associated with the group-grid scheme: an egalitarian, collectivist ("low grid," "high group") one, which gravitates toward fear of environmental disaster as a justification for restricting commercial behaviour productive of inequality; and individualistic ("low group") and hierarchical ("high grid") ones, which resist claims of environmental risk in order to shield private orderings from interference, and to defend established commercial and governmental elites from subversive rebuke.

Douglas considers as fundamental the general account of the social function of individual perceptions of societal dangers. Individuals, Douglas maintained, tend to associate societal harms - from sickness to famine to natural catastrophes- with conduct that transgresses societal norms. This tendency, she argued, plays an indispensable role in promoting certain social structures, both by imbuing a society's members with aversions to subversive behaviour and by focusing resentment and blame on those who defy such institutions (Boholm, 1996; Dake 1991). The second fundamental point of Douglas's work is a particular account of the forms that competing structures of social organization assume. Douglas maintained that cultural ways of life and affiliated outlooks can be characterized (within and across all societies at all times) along two dimensions, which she called "group" and "grid." (Douglas 1986) A "high group" way of life exhibits a high degree of collective control, whereas a "low group" one exhibits a much lower one and a resulting emphasis on individual self-sufficiency. A "high grid" way of life is characterized by conspicuous and durable forms of stratification in roles and authority, whereas a "low grid" one reflects a more egalitarian ordering (Douglas 1986).

Grid and Group define four possible types of social organization :

High grid, high group: Classic bureaucracy or Hierarchy. Everyone has a clearly defined role (high grid), but they feel loyalty to the organization and feel that its inequalities are fair or deserved (high group). Examples: India during the heyday of the caste system, modern government agencies such as the EPA.

Low grid, low group: Classic markets or Individualism. Everyone is free to make whatever choices they want and that seem most advantageous (low grid), but there's no mutual support or belonging between people, and you can interact with anyone you like (low group). Examples: Dotcom start-ups, "Big Men" in New Guinea.

Low grid, high group: Sects or Egalitarianism. Everyone is equal, without leaders or prestige differences (low grid). There is lots of solidarity between members, but also an us-versus-them mentality (high group). Examples: communes, hunter-gatherer bands.



High grid, low group: Atomized Fatalists. Life is constrained by rules imposed by others (high grid), but there is no trust or cooperation between people, who are left to fend for themselves (low group). Examples: Slaves in the antebellum south, prisoners.

“Cultural Cognition” is one approach designed to empirically test the “cultural theory of risk” . Cultural Cognition Theory asserts that people’s beliefs about risk are shaped by their core values. Because of a combination of interrelated psychological dynamics, individuals conform their views about what sorts of activities endanger societal welfare, and what sorts of policies effectively combat those dangers, to their cultural evaluation of those activities (in Kahan & Braman 2006).

The interest of cultural theory within our context lies in the facts that (1) within THESEUS’ we are working on a diversity of regions/countries which most probably means that on will be faced by different core cultural framing of risk and in the fact that (2) coastal zone management is in itself in transition toward ICZM which may translates itself into a temporary oscillation between High grid High group and Low grid Low group, depending on the level of subsidiarity actually enacted thorough the ICZM process. Risk perception may therefore be somehow diversely and dynamically framed.

Risk perception as a dynamic process: the social amplification of risk

The concept of the ‘social amplification of risk’ proposed by Kasperson, one of the pioneers of research into technological hazard, suggested that the actions of the media, government, and nongovernmental organizations, as well as disputes among scientists, can significantly increase or decrease public risk concerns (Kasperson et al. 1988). Another representative of the environmental hazards tradition Kates along with important contribution of psychologists (Fischhoff et al. 1981, Kates and Clark 1977, Slovic 1987) shed more light on the public perception of risk which is related not only to the scientific results on probability of harm, but also to factors mentioned above, such as how well people understand the process, the degree of catastrophe, how equitably the danger is distributed, how well individuals can control their exposure.

The social amplification of risk theory is of interest within THESEUS because of its focus on climate change, a field where controversies have been making the headline news. Furthermore THESEUS as an information gathering, mobilizing and creating activity faces in itself to contribute to social amplification dynamics.

Exploring the determinants of risk perception: psychometry

Psychometrics deals with the quantification and prediction of risk and is probably the leading contender in the field (Sjöberg , 2000) ; for this theoretical and empirical field reference author, Paul Slovic, the perceived risk is quantifiable and predictable and one of the main questions is: “how much risk people say they are willing to accept?”. The three main factors: 1) the degree to which a risk is understood, 2) the degree to which it evokes a feeling of dread and, 3) the number of people exposed to the risk. One broad strategy for studying perceived risk is to develop a taxonomy for hazards that can be used to understand and predict responses to their risks (Slovic and Weber, 2002). A taxonomic scheme might explain, for example, people’s extreme aversion to some hazards, their indifference to others, and the discrepancies between these reactions and experts’ opinions. The most common approach to this goal has employed the psychometric paradigm (Fischhoff et al.,



1978; Slovic et al., 1984), which uses psychophysical scaling and multivariate analysis techniques to produce quantitative representations of risk attitudes and perceptions. Within the psychometric paradigm, people make quantitative judgments about the current and desired riskiness of diverse hazards and the desired level of regulation of each. These judgments are then related to judgments about other properties, such as (i) the hazard's status on characteristics that have been hypothesized to account for risk perceptions and attitudes (for example, voluntariness, dread, knowledge, controllability), (ii) the benefits that each hazard provides to society, (iii) the number of deaths caused by the hazard in an average year, (iv) the number of deaths caused by the hazard in a disastrous year, and (v) the seriousness of each death from a particular hazard relative to a death due to other causes (Slovic, 2002).

These results are critical in order to understand dynamics associated with over or underexposure to risk as assessed by expert knowledge. To summarize we can write that according to the results of psychometric analysis, risk can be considered to have two parallel dimensions: (i) known and unknown (e.g. death rates), (ii) fear and no fear. This decomposition leads to consider risk as the sum of two factors: the one is hazard which is the assessment of risk due to estimated probability of occurrence and the other is the outrage which includes more subjective notions such as personal emotions. Thus, risk = hazard + outrage (Sandman 1987: cited in Morrow, 2009). Amendola (2001) (cited in Morrow, 2009), for instance, defined factors that are found to be associated with what determines the level of outrage such as: voluntariness, control, fairness, process, morality, familiarity, memorability, dread, diffusion in time and space. Traditional values of a society, personal feelings and the power to protect against hazards contribute in the definition of risk and its acceptable levels. In addition, some analysts (Pennings and Grossman 2008: cited in Morrow, 2009) claim that risk attitude which is the general disposition towards risk (a person might be risk lover or risk averse) is another determinant of risk. Finally it is widely accepted that collective experience through social networks are a major determinant of personal assessments. In particular, the feelings, emotions and values that people gain through experience through living in their social networks with which they identify, have a major effect on their reactions towards risk.

Risk perception and the determinants of exposure to floods

While natural disaster and floods do follow the general rules presented above, key results have been obtained through Thames flood analysis by the MFHRC. Through this work 6 factors affecting choices and responses to flood risk have been tentatively identified:

1. Flood experience is the most important factor generating some response;
2. People refuse to accept the someone else is not to blame;
3. The government is there to protects people from threats such as this, or that is what they say;
4. People have a poor understanding of the nature of the threat that they might face;
5. People believe that flood are not dangerous, and only happens to others anyway;
6. People have a poor knowledge of the (small scale) solutions that might help;



The political arena as “the” key to risk perception analysis, the Governmentality approach.

“Governmentality” deal with new style of governance in modernity where the risk is mainly understood as entirely socially it makes no sense to ask for more or less risk or how real risks are (Foucault, 1991/1975). Governmentality provides one of the most influential analyses of the nature and development of risk-based techniques in government over the past thirty years. In contrast to Beck's 'risk society' theory, which sees risk as a unity, governmentality emphasises the diversity of forms that risk takes as a governmental technique, and stresses their very different implications for those who are governed. In contrast to cultural analyses of risk, that concern themselves with the sociological ways risk is associated with particular congeries of social meanings and group processes, governmentality focuses overwhelmingly on governmental plans and programs. A governmental approach to risk is thus little interested in explaining the rise of risk in terms of some grand theory under which all risk is subordinated as an effect of epiphenomenon, nor in how widespread is the social acceptance of governmental plans.

Within this framework it is argued, quite robustly, that the relevant hazards may be unilaterally and centrally defined by the government. As such hazards and therefore risk can be instrumentalized by governments pursuing objectives (hidden agendas) not pertaining to risk per se. Recent debates on world terrorism for instance could be construed as a political move by the Bush administration to remain in power in the US. Within coastal context, climate change may be an opportunity for government to regain control of coastal areas land use.

An integrative model of risk perception

Combining these various theoretical and empirical approaches, Renn and Rohrman (2000) and Renn (2008) have been proposing an integrative model of risk perception (figure (1) below, from Renn 2008).

This model acknowledges the fact that risk perceptions are influenced both by collective influences and the personal manifestation of these influences. Furthermore this model acknowledges the fact that these influences belong to the cultural sphere, to the socio-political arenas, to cognitive affective factors and to heuristic and information processing (Renn 2008).

These determinants lead through their integration to claim by risk stakeholder dealing with

1. what is good, tolerable, and/or acceptable (normative claims),
2. what deserves attention (relevance claims),
3. what are the causal linkages at work (evidence claims).

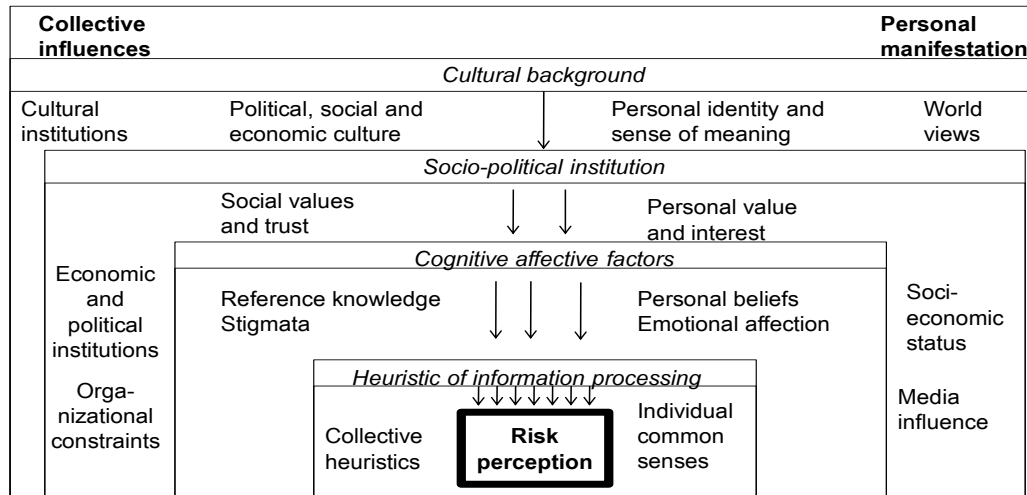


Figure 48: An integrative model of risk perception (Renn 2008)

POTENTIAL RELEVANCE TO THESEUS AS A WHOLE AND TO THESEUS' RISK COMMUNICATION SCHEME: THEORETICAL CONSIDERATIONS

Integrating all this for the purpose of THESEUS

Rather than designing another standard “risk communication scheme” using overused and abused theoretical and empirical approaches, which are ontologically narrow, within THESEUS we chose to start from Renn’s theoretical synthesis presented above and ground it into the experience of flooding and erosion by key individuals and the general population in study sites. We will therefore focus on the idea that coastal flooding and erosion risks under climate change is to be approached through the analysis of the Relevance, Evidence and Normative claims that capture the various determinants of perception discussed above. The goal in the risk communication scheme is therefore (1) understand how those affected by flooding and erosion risk theorize the risks they are facing; (2) understand how this local theorizing of risk is fed by questions of costs and benefits, is fed by knowledge and is oriented by values; (3) from these understanding see how risk can be managed in technological terms, governance terms, and political terms through a proactive understanding of risk perception and the importance of contexts in the shaping of these perceptions. Finally these three goals will be integrated into the communication scheme that is proposed.

Defining risk

As shown above, defining risk may be quite challenging, at least in a dialogic or deliberative context. It seems therefore critical within a science based risk governance scheme such as THESEUS to develop not only a common language on risk, but also a deeper understanding of what risk means to those affected: when considering flooding and erosion risks, are the European populations talking about probabilities, hazard, hazard’s probabilities, events, events’ probabilities, consequences, expected consequences and so forth? This is not only a matter of semantics; it is a matter of



developing innovative tools that will be accepted by policymakers and populations as addressing the issues that they understand. It seems therefore that within THESEUS it will not only be critical to work with a common definition of risk but also to work proactively at every step at developing an understanding of how the definition used by THESEUS relates to what is understood by flooding and erosion risk by policymakers and the population at large.

Current management practice and the Relevance claims under deep uncertainty

A key element here will be to understand what risk stakeholders consider worth managing. This raises three dimensions. First observation of current management practices and risk identified by stakeholders can be seen as a safe indication of “relevant” risk. Yet within THESEUS we are working with a double layer of uncertainty. First, as THESEUS is dealing with the changes associated with climate changes, current practice are not sufficient to assess relevance. Second as THESEUS is an agent of change through the development of innovative management strategies and technologies, relevance in terms of trade-offs will be changed.

Multiple knowledge sources and evidence claims

As a producer of knowledge rooted in science, THESEUS will unavoidably generate knowledge base that will differ from the knowledge base of stakeholders. This has two important consequences. First, the building of knowledge by THESEUS will somehow need to be integrated with collective and individual heuristics of stakeholders. Second, the tools (technological or governance) developed by THESEUS will need to take into account this integration explicitly for future applications.

Protecting coastal areas on moral grounds: Normative claims, floods and erosion

Envisioning and developing governance and technological options for safer European coasts there will necessarily raise questions of resource distribution (who will benefit from these tools) and of redistribution (some of these tools may create perception of gain and losses). Furthermore, flood and erosion control mechanism are rooted in history and as such in culture. Technological options may therefore be preferred not on technological or economical ground but simply because they are “valued” in terms of historical acceptance. Finally, flood and erosion mitigation options do interact strongly with nature and landscape. Tinkering with relationship between human activity, nature, and landscape has a huge potential of raising concerns rooted in local values.

RESULTS OF THE INITIAL PERCEPTION ANALYSIS WITHIN THESEUS

Corpus description

For the Gironde 9 interviews and one focus group were conducted. For Santander 16 interviews (50 minutes on average, min 27 minutes, max 73 minutes) were conducted after preliminary saturation analysis, 10 were transcribed (2037 words on average, min 928 words, max. 3089 words). For the Adriatic coast, 11 interviews were conducted and transcribed (1696 word on average, min 882, max 2353).

Within the three sites where focus groups and interviews are now finalized the following results emerged quite robustly. These results have been confronted to two more corpuses, collected in Varna and Gdansk and were thereafter validated.



Talking about flood and erosion risk

Quite coherently across interviews, participants associate risk with the modified state of the receptor or the consequences of flooding and erosion. Very seldom do participants mention the probabilistic nature of flooding and erosion risk. It seems therefore safe to consider that for interviewees in the Santander, Cesenatico and Gironde areas risk=consequences. When the probabilistic nature of flood and erosion risks is mentioned, it is only as part of an evidence claim associated with (over) exposure (see below) by living or having an economic activity on either the pathway or the receptor.

This is a quite fundamental result for THESEUS. One of the initial cognitive drivers of THESEUS lies in the fact that, because of climate change, the probability density function of extreme events will be modified. At the core of THESEUS' development lies the definition Risk= probability times consequences. This means that, if one wants THESEUS' contribution to safer European coasts to deploy itself in society and policymaking, it will be of paramount importance to convey the probabilistic nature of flooding and erosion risk.

On relevance claims.

In general terms, relevance is established by the interviewee through a mix of expert-based knowledge and personal heuristics, yet interviewees generally express the fact that pertinence is proxied by actual current investment in risk mitigation and that investment decisions are pushed by a mix of technocratic and economic considerations feeding political decisions that are themselves mostly run by normative claims (see below). In Santander interviewees considered investment planned for the future as proxies of relevance as well.

When going into more specific a clear distinction is made by the interviewee in terms of

1. relevance as a product of past experience – i.e. this risk is worth addressing and the proof lies in the fact that it has been addressed in the past -- which of course is quite tautological;
2. relevance as a product of climate/flood/erosion scenarios rooted in science based foresight tools – i.e. looking at the products of climate/flood foresight we may consider that under current technologies and past socio-economic conditions this risk is worth managing.

In Santander, these elements are often used to highlight the adaptive capacity of Santander's population. What is often meant is that: Santander's population have been capable of assessing relevance in the past and will in the future. This mixes neatly with evidence claims in a foresight context.

These results raise a key issue, already raised theoretically, associated with relevance assessment under deep uncertainty: how can one assess relevance not knowing what the future holds in store meteorologically and technologically. Furthermore when being explicit about relevance, respondents clearly state that priorities should be given first to risk of human losses, second to losses in dwellings, and third to losses in economic activity. Very few respondents considered that ecosystem losses were sufficiently relevant to justify risk mitigation. Finally when pushing the



analysis further relevance claim made where essentially presented as conditional to policy decision for which the key determinant identified was congruence with the normative claims expressed by stakeholders/voters.

On evidence claims

In the Gironde corpus 31, quotes containing evidence claims have been identified. In the Santander corpus, 65 quotes containing evidence claims have been identified. In Cesenatico the preliminary corpus exploratory analysis in three interviews allowed the identification of 10+ quotes. These quotes allowed for two levels of analysis regarding flooding and erosion perceptions associated with the two following question (1) What are, according to interviewee, the causes and effects of flooding and erosion and (2) What are the interviewee basis for their belief on the causes and effects of flooding and erosion.

In Santander, Cesenatico and Gironde, interviewees stress the importance of individual and collective behaviour as the main cause of past flood event and as the cause of erosion. This is an extremely important result: meteorology, local topography, and the likes are not seen as the main cause of vulnerability, human behaviour is. This “cause” of food as expressed by the interviewees can be divided into individual centred behaviour and collective behaviour. Cesenatico differs slightly as subsidence has also been identified as a clear causal factor.

When attributing floods to individual behaviour, interviewees stress the impact of human activities on either flood management infrastructure (interfering with dykes, storm sewer and the likes) or with sensitive habitat (sand dunes mostly). Furthermore interviewees stress the fact the sometimes individual (at the household, community or local government levels) flood control actions (raising grounds, putting breakwaters) are responsible of floods and/or erosion elsewhere, interviewees stress here issues of coordination, which of course is connected to collective behaviours (see below). Finally, when considering individual behaviour interviewees do mention exposure yet it is only framed as part of normative claims (see below).

In terms of collective behaviour leading to floods, the interviewees identify ill designed policies, mostly poor land use planning, administrative segmentation and lack of administrative coordination, “absurd” engineering infrastructures, and funding. Basically, when considering the causes of flooding and erosion risk, participants did identify a critical lack of risk governance.

When considering the knowledge base that may be mobilized within relevance claims, participants stress the importance of individual and collective heuristics. Yet, this reliance on personal and collective heuristics is seen as the cause if the flood generating behaviour that are described in the former paragraphs. What interviewees see is that flood event, and visible erosion events, are so rare that they fade off from the memory of individuals and institutions. This is the only case where the probabilistic nature of floods was mentioned by interviewees. Cesenatico differs slightly from Santander and Gironde as floods are occurring on more regular basis and erosion is readily observed. This leads Cesenatico interviewee to stress the need for constant efforts, which are lacking according to them, and most importantly better coordination.



When pushing further the analysis shows as well that, for participants, the reliance on personal heuristics is unavoidable because (1) they state that the science that is available shows problems of scale (i.e. available evidence concerns areas that are too small to be representative of flood event at risk management scale), (2) they state that the complexity of flood dynamics cannot possibly be captured by science as it is practiced, (3) they state that floods are multifactorial events, where the human factor is very rarely recognized, and (4) in Cesenatico, there are clear statement about the fact the proof of the robustness of personal heuristics lies in the inadequacies of the technological choices made in the past.

On normative claims

Normative claims were at the core of the interviewee statements. Very briefly said the results show the following line of thought. (A) Risk management is a political decision → (B) Political authorities will only move if their move is accepted by the affected population or by the affected economic agents → (C) Acceptability is contingent upon the redistributive nature of the decision to be made → (D) Coastal flooding and erosion boils down to the normed acceptability of the options envisioned → (E) In the end the risk may very well not be managed in a way that makes sense in terms of increased safety.

This causal chain, quite interestingly, manifested itself first and foremost when putting in balance the collective benefits and individual losses of a risk management option. Yet in many cases the “losers” of the management option considered were also the ones most affected by floods. Normatively it was clearly expressed that the only acceptable option is an option where the cost of flooding risk and management options is born collectively, even if the assets protected benefit to a minority. This can be rephrased the following way: risk management strategies that are good collectively cannot really be implemented if they harm individual interests. Analysing this line of discourse shows that this “rule” suffers one exception: if the overexposed population chose overexposure in order to reap benefits that are seen as “exaggerate” by the interviewee, then no public money should be spent on managing the risk they are exposing themselves to.

On another normative front, it was clearly identified by respondent that it is legitimate to invest collectively in risk mitigation for future generation even if this entails changing course radically for current generations – provided that the burden is born by all, again.

When analysing further the normative statements, it appears that political decisions are very much influenced by the social amplification of the decision’s impact. Two instances were given. First, land use planning decisions, and their redistributive consequences, have been radically amplified by press coverage. This led to the impossibility to pursue the land use planning options originally envisioned. Secondly, Environmental NGOs have amplified the consequences of decisions impacting specific natural habitats; this led to a change of plan.

Finally, some respondent raised the fact that flood and erosion risk decisions, in order to be accepted, have to be made by decision maker having a high level of legitimacy, and that the only individual having such a legitimacy are policy makers.



Claim sequencing and prioritizing

In all study sites it appears that resolving conflicting normative claims are at the core of flooding and erosion risk management decisions. This result, while being a quite standard result in the world of risk management, is critical for the purpose of contributing to safer European coast by reducing flooding and erosion risks. Any risk mitigation option that will be developed will necessarily pass through a deliberation process regarding its acceptability.

DISCUSSION WITH FOCUS ON THESEUS AND THESEUS' WP5

These results are quite challenging within the context of THESEUS. These challenges lie at three levels (A) use of the knowledge generated by THESEUS; (B) use of the technological and governance option developed within THESEUS, and (C) use of the decision support tool that is being developed by THESEUS.

Use of the knowledge generated by THESEUS

When analysing the perception of risk by the interviewee one is forced to admit that there is currently very little space in these perceptions for science-based knowledge. The knowledge used to frame risk belongs to the world of individual and collective experience. Within THESEUS there will therefore be a need to find a way to make the knowledge generation process a process that is integral to the communities' individual and collective experience. Without such an achievement, while the knowledge generated will be of high quality, this knowledge will not be able to deploy itself in society in a useful manner. One of the key elements here will lie in integrating uncertainty and robust foresight into people's thought processes.

Use of the technological and governance options developed within THESEUS

What appears, from the interview conducted, is that for the interviewee the essential determinant of risk management option adoption is its congruence with local values. The efficiency of the option envisioned seems to have less to do than its impact in terms of redistribution or relationship to nature. Therefore, any assessment of a technological choice or a governance option should include an analysis of the way it risks being normatively framed. This is quite challenging to achieve and will need serious consideration within THESEUS' WP4 and across all THESEUS WPs.

Use of the decision support tool that is being developed by THESEUS

The decision support tool that is being developed will face both the issue of knowledge generation and technological option choice. If designed in a way that allows for constant connection with society it might be the way to solve the difficulties associated with the determinant of risk perception that we have identified here. This is the key founding point of the communication scheme that is being proposed.

SHORT SYNTHESIS OF THE BACKGROUND

Risk communication within THESEUS has been approached by taking stock of the perception surveys and analysis that have been conducted. These yielded the following key results.



- 1) Risk is understood by stakeholders as the consequences of an event, the probabilistic nature of the event is only taken into account to justify “memory lapse”.
- 2) Normative claims are the priority framing elements when stakeholders envision risk.
- 3) Foresight by stakeholders is based on their (partial) recollection of the past and on the current state of technologies.
- 4) Evidence claims (i.e. claims pertaining to the way the risk functions) is solely or mostly based on the stakeholder personal or collective heuristic. Science has very little place in this process.

These four results are particularly critical within the context of THESEUS as in THESEUS:

- 1) We are preparing a DSS rooted into the Source-Pathway-Receptor-Consequence model, yet stakeholders focuses on consequences as the entry point, not sources, and in this model the probabilistic behaviour of the source is highlighted, yet stakeholder do not seem to take this probabilistic nature very well into account.
- 2) As a science based exercise, THESEUS faces the risk of not being explicit in terms of normative claims, yet for the stakeholders this is their first, and sometimes sole focus.
- 3) Foresight in THESEUS is based on the scenarizing of plausible changed futures, yet stakeholders, for the time being, do not have a ready cognitive access to these changed futures.
- 4) THESEUS is a robust, science based exercise, yet the practice of science is not central, to say the least, to the stakeholders individual and collective heuristic.

Considering these four elements, it is felt critical that the communication scheme that is proposed is geared at the four challenges that are briefly presented here above.

NATURE OF THE OPTION THAT IS PROPOSED

The challenges identified here above indicate that the perception management scheme that we are offering needs to promote the convergence between stakeholders’ perception and the scientific basis of THESEUS’ developments. They also indicate that we achieve this through the embedding of the DSS into the stakeholders experience. Finally it indicates that in order to be adopted the DSS and all its users and conceiver need to understand each other in quite general terms. Not only should evidence claim converge (the knowledge) but also normative and pertinence claims.

We are thus proposing a communication scheme that is centred on THESEUS’ DSS and its use. It consists of a mix if proposed procedural step (what to do and when) and of the identification of key indicators that need to proactively followed if one wants to optimize the adoption of the DSS as a tool and of the DSS as a trusted help in decisions that will impact coastal communities. The communication scheme that is proposed has been presented in OD 4.1 “General framing document for the development of a coherent portfolio of risk management approaches

For practical purposes we present this scheme again here:

FIRST LEVEL OF COMMUNICATION – INTEGRATING STAKEHOLDER HEURISTIC WITH SCIENCE BASED KNOWLEDGE.

On risk as consequence an consequence as a cognitive entry point

As presented above, participants associate risk with the modified state of the receptor or the consequences of flooding and erosion. Very seldom do surveyed stakeholders mention the probabilistic nature of flooding and erosion risk. It seems therefore safe to consider that, for most coastal stakeholders, risk “equals” consequences.

This is a quite fundamental result for THESEUS. One of initial cognitive drivers of THESEUS lies in the fact that, because of climate change, the probability density function of extreme events will be modified. At the core of THESEUS’ WP5 development lies the definition Risk= probability times consequences. This means that, if one wants THESEUS’ contribution to safer European coasts to deploy itself in society and policymaking, it will be of paramount importance to convey the probabilistic nature of flooding and erosion risk, through public deliberation.

The first element of the communication scheme to be designed is thus to stress the fact that while the DSS that is developed relies on the SPRC model, information exchange, aka risk communication, must in its initial step be focused on the consequences. This choice of cognitive entry point will allow a progressive reconciliation of stakeholders, i.e. future DSS users and their client/constituents, perceptions with the knowledge base that is prevailing in the course of the DSS development.

Once this entry point identified, the DSS should allow for a progressive “backward” move from Consequences to Receptor, from Receptors to Pathways, from Pathways to Sources, and from sources to their probabilistic nature. This leads to the conceptual figure below (Figure 23):

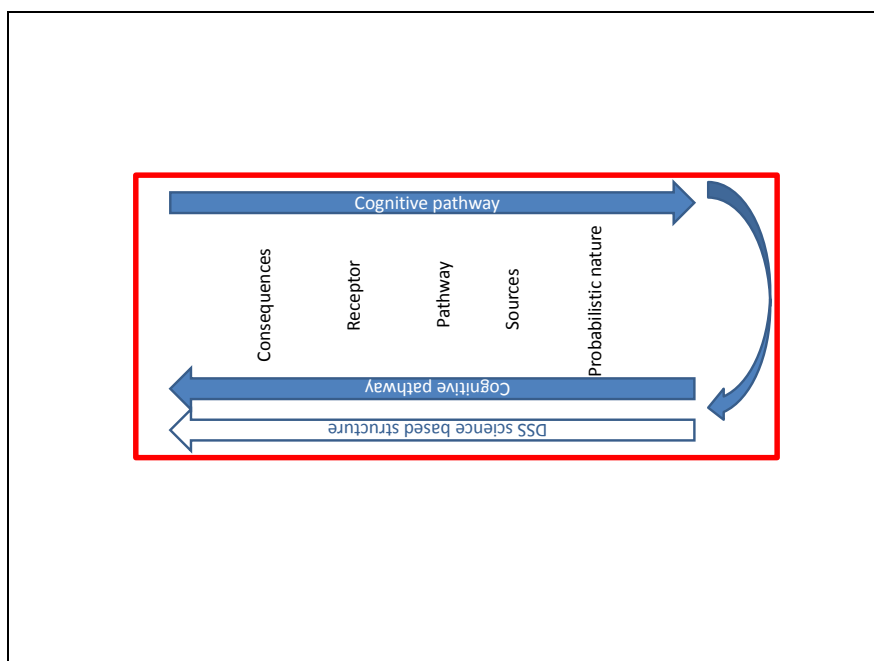


Figure 49: General structure of the risk communication scheme

Outside of the critical nature of the entry point, this cognitive pathway should allow for a merging of stakeholders heuristics with the science based conceptual model that is used, but this is allowed after the initial “backward” loop thus allowing a convergence of evidence claims (i.e., claims expressing causal linkages) .

Information gathering and exchange along the cognitive pathway

As underscored above, risk perceptions are treated here through the analysis of pertinence, evidence and normative claims. It is thus therefore critical the space be provided for these claims to be expressed as part of the DSS joint discovery process. Relevance claims are claims expressing what matters to society, what are the important phenomena that should receive our attention; evidence claims are claims expressing causal linkages; normative claims are claims expressing what is good, tolerable, and/or acceptable.

In order to achieve this we propose the progressive build up of a “claim” database. When establishing the Consequences, Receptors, Pathways and Sources including their probabilistic nature space should be provided to express: (1) what are the important phenomena that should receive our attention, (2) what are the causal linkages that are expressed, (3) what is good, tolerable, and/or acceptable. This leads to the following refining of the general conceptual representation (see Figure 50 below). This means that the cognitive pathway does not only include only end users with the concerned population or as a proxy of the concerned population, but entails knowledge acquisition by the experts involved into the DSS development. This part of the communication scheme is thus leading to a co-construction of the decisions made in the course of the DSS use.

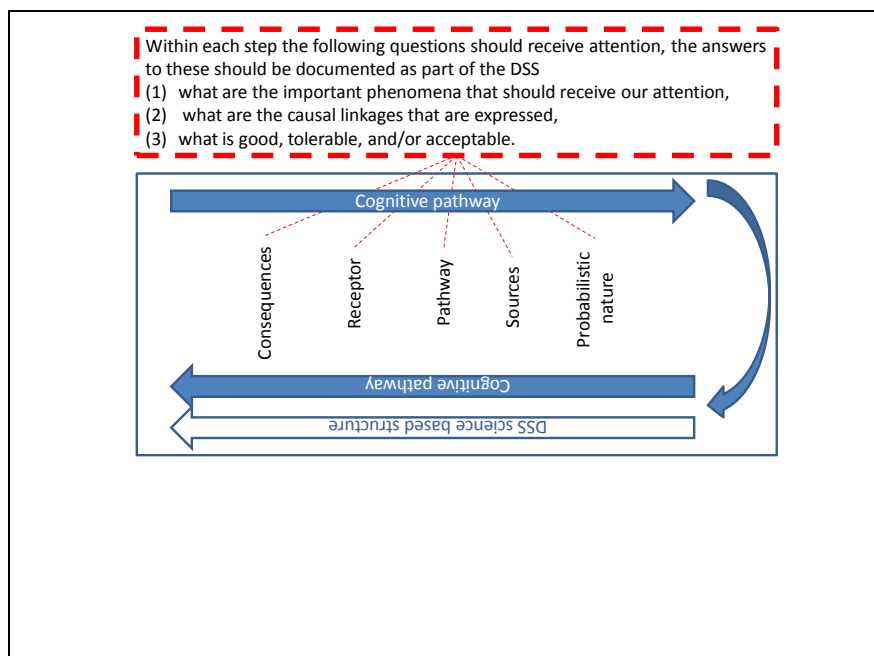


Figure 50: Cognitive pathway including the documentation of the claims that are expressed along the cognitive pathway

It must be stressed however that interviews with stakeholders indicate that normative claims are central to risk governance for stakeholders. Very briefly said the results of the fieldwork conducted

show the following line of thought. (A) Risk management is a political decision → (B) Political authorities will only move if their move is accepted by the affected population or by the affected economic agents → (C) Acceptability is contingent upon the redistributive nature of the decision to be made → (D) Coastal flooding and erosion boils down to the normed acceptability of the options envisioned → (E) In the end the risk may very well not be managed in a way that makes sense in terms of increased.

While the normative statements identified are essentially associated to risk management options, and are thus associated with a latter part of the present deliverable, it seems critical from the onset to allow as much space as possible. This should allow for a clearer understanding of the normative challenges associated with risk management options especially when normative statements regarding consequences enter in conflict with normative statements regarding management options.

On the probabilistic nature of risk and foresight

One of the most critical results in terms of risk communication lies into the sharing of the probabilistic nature of the source. This challenge has two dimensions. First the probabilistic nature of events with relatively low occurrence is often not well understood by stakeholders. Secondly, society tends to be forgetful of events with low occurrence. Within a cognitive pathway, the sharing of the probabilistic nature of the event that is considered is thus a critical hinge point where the sharing of the stakeholders' heuristic with the scientific basis for describing probabilities must be achieved.

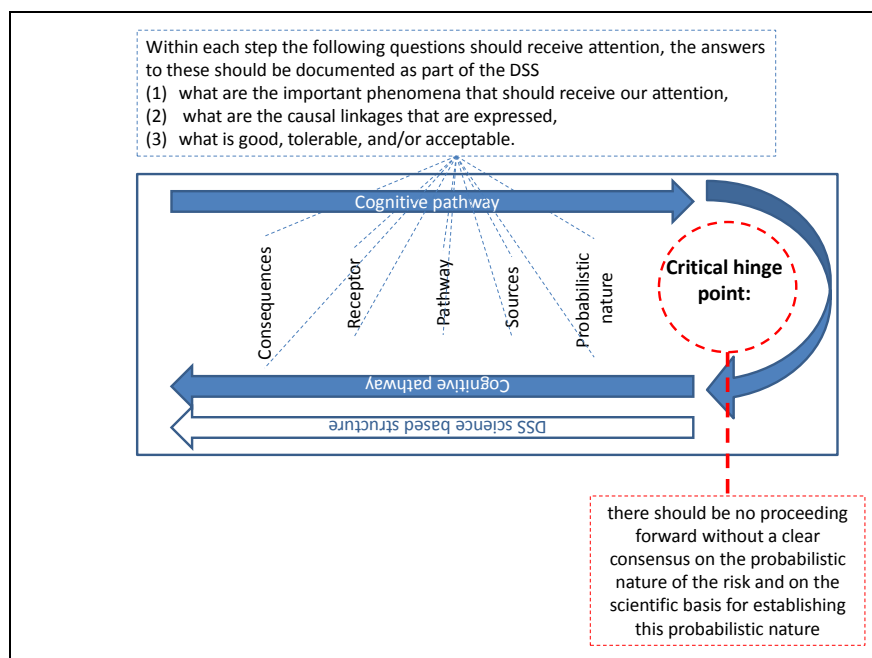


Figure 51: Cognitive pathway: a critical hinge point lies into the common understanding of the probabilistic nature of the risk that is envisioned.



Summarizing issues addressed in this exercise of integrating stakeholder heuristic with science based knowledge.

The contextualized, through the expression of claims, cognitive pathway has the purpose of addressing the following challenges in terms of risk perception:

- 1) For stakeholders the concept of risk mostly limit itself to the consequences of an adverse event;
- 2) For stakeholders the cognitive chain is C-R-P-S while the causal chain underlying the DSS is S-P-R-C
- 3) For stakeholders the probabilistic nature of the averse event is secondary to other considerations
- 4) For stakeholders the causal evidence embedded into the S-P-R-C model are totally secondary, their priority lies into normative claims associated with the consequences under scrutiny.

These four challenges, identified through extensive interviews with stakeholders and their analysis in the course of THESEUS are at the core of the stakeholders risk perception and the dissonant nature of these perceptions when compared with the scientific knowledge based generated and used in THESEUS and that forms the basis for the THESEUS DSS development.

SECOND LEVEL OF COMMUNICATION – INTEGRATING STAKEHOLDER HEURISTIC INTO THE FRAMING OF TECHNOLOGICAL AND GOVERNANCE OPTIONS.

Framing risk mitigation options

Once the cognitive loop that is described here above is achieved options for risk mitigation will be generated. The generation of these options will be contextualized by the various pertinence, evidence and normative claims made that should allow for an initial assessment of the choices that are possible in terms of societal acceptance. A critical dimension of the framework that is proposed lies into the identification of an indicator portfolio that makes sense for all involved. This is another element that calls of a clear expression of the stakeholders' pertinence, evidence and normative claims.

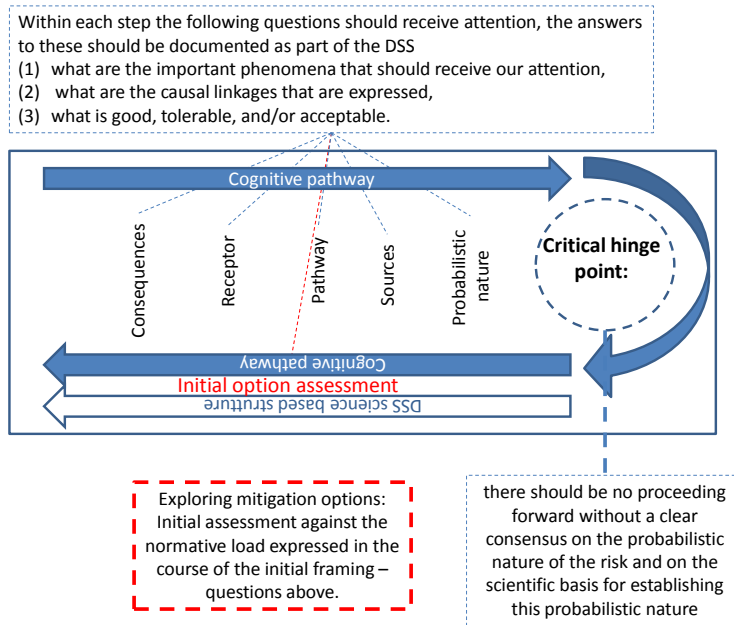


Figure 52: Cognitive pathway: Assessing mitigation option should first be assessed in the light of the stakeholders’ claims

CHANGED PERCEPTION AS AN OUTPUT OF THE RISK COMMUNICATION

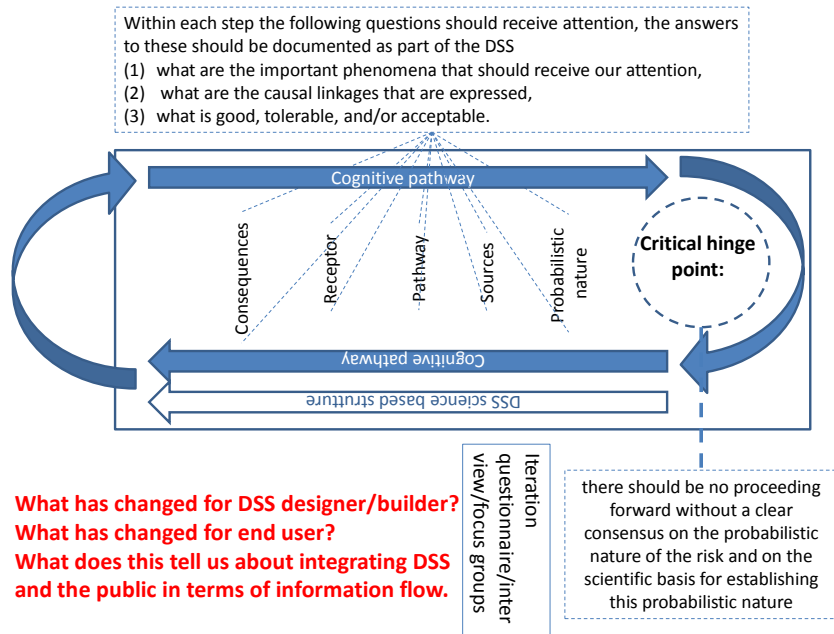


Figure 53: the key questions that will validate the risk communication scheme are embedded in it

GROUND TESTING OF THE PROPOSED RISK COMMUNICATION SCHEME

METHOD USED FOR GROUND TESTING

In order to ground test the proposed communication scheme we conducted an iterative-grounded theorization across three corpuses. The first corpus consisted of the theoretical production around the DSS and its conceptual foundations. The second corpus consisted of the qualitative corpuses collected in the course of WP1 and WP4 interviews with stakeholders across study sites. The third corpus consisted of semi-structured interviews with scientists participating into THESEUS.

The general thrust behind this ground testing was to refine the understanding of potential differences in risk perception and representations between the discursive content underlying the DSS, the discursive content of stakeholders and the discursive content of scientists involved in THESEUS.

Conceptually the ground testing method may be represented with figure 54 below

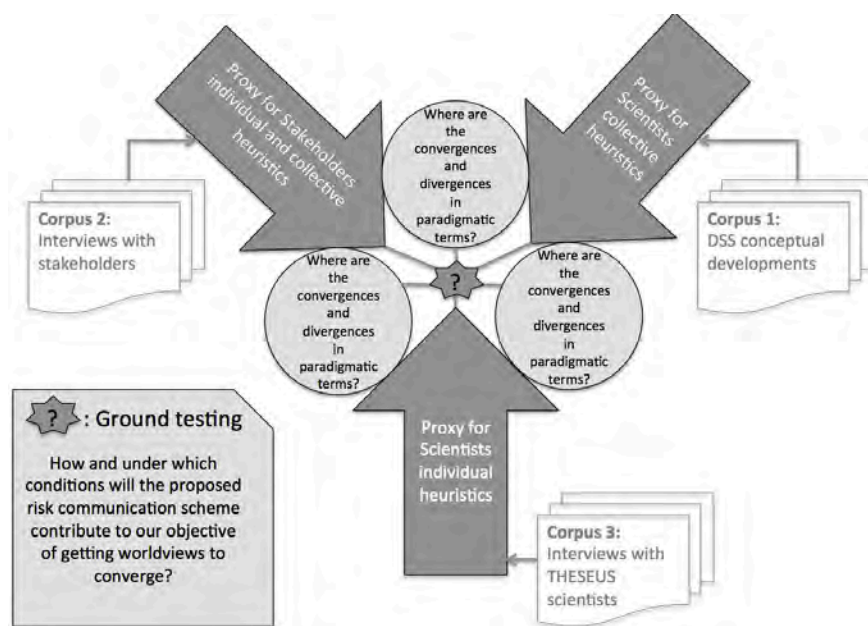


Figure 54: Ground testing of the risk communication scheme

RESULTS OBTAINED FROM THE GROUND TESTING

The elements presented above were confirmed by the ground testing. Furthermore two supplementary elements came out of the ground testing as key innovative opportunity for the development of THESEUS' communication scheme. First the understanding of the deterministic nature of the coastal system and second the existence of norms in the production of the DSS, norms that needs to be conveyed.

Nature of the coastal system



The analysis of paradigmatic views allowed for the identification of a continuum, from the DSS related corpus to the stakeholders' worldviews, with the scientists' worldview being somehow halfway. This continuum is associated to the way the coastal system is represented. While the DSS represents the coastal system as a deterministic system (complicated yet that can be presented as linear causal chain, that can be associated with probability density functions), the stakeholders present the coastal system as a non-deterministic system, characterized by intense and numerous feedback loops, by a high level of indeterminacy. THESEUS scientists are more ambivalent when describing the system. They carry a discourse that seems to acknowledge the chaotic nature of the system while defending that intervention calls for simplified representation.

Things are complexified by the overarching approach that can be used when mitigating coastal risk: should vulnerability be reduced or resilience enhanced. While vulnerability analysis implies the identification of causal linkages, a resilience approach may focus on the system's characteristics (see Wardekker's framework throughout this deliverable). This is where the DSS use is critical as it offers means for vulnerability reduction, through a deterministic linearized representation. The options that are proposed and their choice is therefore rooted in a world view that may be incompatible with stakeholders' worldview and thus perceptions.

These ground testing results call for specific recommendations in the implementation of the risk communication scheme that is proposed.

On values

A second critical result of the ground testing lies in the expression of values within each corpus. The analysis of the stakeholder corpus shows that stakeholders put an emphasis on the justice and the equity associated with the distribution of risk (understood as consequences) and on the justice and the equity questions associated with potentially envisioned mitigation options. The analysis of the DSS related material corpus shows that within the DSS scientific robustness is the DSS's core value. Scientific robustness is understood within the DSS underlying structure as the ability to model reproducible causal chains. The analysis of the corpus consisting of the interview with scientists shows that for interviewee the underlying values are driven by the desire to be pragmatic while retaining scientific robustness.

These values categories are by no mean opposites or incompatible. Yet when it come to framing risks, or when it come to choosing a mitigation option these do not mobilize the same consideration. Therefore, in order to communicate on risks there is a need to explicitly track the values in presence and their importance on judgement, understanding and choices.

RISK COMMUNICATION AS A MITIGATION OPTION INCLUDED IN THESEUS' DSS

RISK COMMUNICATION AND THE SPRC STRUCTURE

As outlined through the initial development, following the perception analysis, and through the results of ground testing, the SPRC structure lies at the core of the challenges associated with the development of the risk communication scheme. It is key objective will for the development of scheme that simultaneously allow for the adoption of SPRC as a conceptual model for stakeholders while increasing convergence in terms of robust understanding of the various causal linkages.



RISK COMMUNICATION CONTRIBUTION TO RESILIENCY

We will present here how the proposed communication scheme contribute to the resilience principles outlined by Wardekker (2010).

Table 29: THESEUS' risk communication scheme contribution to resilience principles

Principle (Wardekker 2010)	Contribution of the proposed risk communication scheme
<i>“Homeostasis: multiple feedback loops counteract disturbances and stabilise the system.”</i>	By providing a series of feedback loop in the course of the DSS use, feedback loop allowing for information flow between DSS users, scientists and stakeholders, the proposed risk communication scheme will increase the homeostatic features of the coastal system.
<i>“Omnivory: “vulnerability is reduced by diversification of resources and means”</i>	By giving access to, and mobilizing several knowledge base (scientific, profane and expert) the proposed risk communication scheme will enhance the system’s omnivory.
<i>“High flux: a fast rate of movement of resources through the system ensures fast mobilization of these resources to cope with perturbations.”</i>	It is not foreseen that the proposed communication scheme will increase the coastal system flux, outside of the effects associated with the greater acceptance of the DSS.
<i>“Flatness: the hierarchical levels relative to the base should not be top-heavy. Overly hierarchical systems with no local formal competence to act are too inflexible and too slow to cope with surprise and to rapidly implement non-standard highly local responses.”</i>	By giving a space for the expression of all stakeholders values, the proposed communications scheme will contribute to the system’s flatness. Flatness that will in turn be more efficient through the appropriation of robust knowledge by stakeholders.
<i>“Buffering: essential capacities are over-dimensioned such that critical thresholds in capacities are less likely to be crossed.”</i>	It is not foreseen that the proposed communication scheme will increase the coastal system flux or redundancy, outside of the effects associated with the greater acceptance of the DSS.
<i>“Redundancy: overlapping functions; if one fails, others can take over.”</i>	



SYNTHESIS: GUIDELINES FOR IMPLEMENTATION

On involving stakeholders

Stakeholders that will be affected by the DSS and its use should be involved as early as possible in this use. Involvement includes the proactive management of iterative exchange and communications.

On following a cognitive pathway

Using the DSS and involving the stakeholders implies that all people involved follow a cognitive pathway where new knowledge is acquired. This knowledge acquisition process is THESEUS' risk communication scheme. This knowledge acquisition process will follow a pathway that is called a cognitive pathway. This cognitive pathway is explicitly designed in order to take stock of perception studies and THESEUS ground testing. Ideally this cognitive pathway should explicitly be discussed with all stakeholders in order to integrate into their individual and collective heuristics.

The cognitive pathway entry point

While the "natural" entry point for scientist in a SPRC structured model is the "Source". Empirical evidences shows that the consequences are a far better choice as an entry point for stakeholders. Consequence as a cognitive entry point to the DSS should be privileged.

The cognitive pathway sequence

Starting at the consequence, the cognitive pathway used should follow a Consequences-Receptor-Pathway-Source-Probabilistic nature of the source-Source-Pathway-Receptor-Consequence sequence.

Building an indicator system to foster risk communication

Indicator systems lie at the core of knowledge management. Considering the empirical results it is of utmost importance that the indicator system contains qualitative meta-information associated with all information (this includes data) that is mobilized. At each step of the cognitive pathway, and for all information that is mobilized, the answer to the following questions should be gathered and associated to the information under scrutiny (this should be documented unfiltered, and exchanged among stakeholders):

1. What is the phenomenon that is under scrutiny and why does one find it important or not?
2. What are the causal linkages that are expressed? On what basis are these causal linkages expressed?
3. Are there ways of associating judgement to this information? Is this information threatening to values held dear by a group of stakeholders?



Sharing an understanding of the probabilistic nature of the source

Moving up the cognitive pathway sequence the most critical dimension lies in the sharing of the meaning associated with the probabilistic nature of the source. The critical recommendation here is NOT TO PROCEED before all stakeholders develop a common understanding of the probabilistic nature of the source. An understanding of how future probability density functions are obtained should be part of this sharing process. One of the key challenges here lies in the nature of climate change. First attribution issues may very well be questioned. These questions must be faced. Second accepting climate change may be a challenge for some (see Kahan et al. 2012).

Envisioning mitigation options

When envisioning mitigation options, these should be assessed not only in terms of risk reduction, but also in terms of congruence with the stakeholders' values and beliefs. These stakeholders' values and beliefs will be documented as part of the indicator system (see above). If the mitigation option conflicts with these values and beliefs it is critical not to proceed before deliberation occurs in order to assess the mitigation option acceptability.

Taking stock of the first iteration of the risk communication process

Once the cognitive pathway sequence has iterated once, all stakeholders should convene and assess collectively whether their perceptions have changed, in terms of causality, relevance and norms. This is the point where the deterministic and non-deterministic characteristics of the coastal system must be discussed. This is also the point where the blending of resilience enhancement and vulnerability reduction measures should be discussed collectively.

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MITIGATING LIFE LOSSES THROUGH INNOVATIVE EVACUATION PLANNING (FRANÇOIS HISSEL)

GENERAL CONTEXT

Each year, 20 000 people across the world are reported dead or missing because of floods [16]. Flood risk is the only kind of risk which spreads over the whole planet, whether it is caused by sudden storms (flash floods), at a slower pace by a river which level raises due to abundant rains, or by the sea entering on the coastal zones (submersion). This number will increase in the near future because more and more people are living on territories at risk (higher vulnerability) but also because the hazard may become stronger as a consequence of climate change, especially on coastal zones. Dikes and current mitigation measures may not be enough to protect residents from the flood risk. Thus well prepared evacuation plans might be a good complementary measure against this increasing level of risk.

This option aims at reducing the number of people in a flooded area before the flood actually happens. This can be achieved, either by evacuating people outside the threatened city or by bringing them to safe places. Evacuation is usually decided before strong events, but careful planning can make it happen faster and with less impact to the population.

NATURE OF THE MITIGATION OPTION THAT IS PROPOSED

In this document, an evacuation is defined as the organisation of the movements of a large part of the population to a safe place prior to the occurrence of a natural disaster, with the aim of bringing the highest proportion of it to a safe location in a constraint time frame. In the framework of the Theseus project, the focus is given to flood events on coastal zones but the methodology could also be applied to other kinds of natural events provided that the basic assumptions are fulfilled.

An evacuation plan is a book which aims to give very accurate instructions about how the authorities in charge shall deal with the evacuation process when the event is occurring. The set of instructions is tailored to one flood-prone region and holds references to local resources and stakes. The methodology for the preparation of the evacuation plan is a list of guidelines defining the studies which have to be carried out during the process of preparation of the evacuation plan. It strives to keep as generic as possible so that it can be applied in different countries with only minor adaptations.

Even with these definitions, one can distinguish different classes of evacuations:

- Mass evacuation vs. small-scale evacuation: when we are faced with the topic of evacuation, two major classes of problems are dealt with. The first one, which we call small scale evacuation, refers to the issue of making people leave a building or a closed space as fast as possible when the place is threatened, for example by a fire or by the dispersion of a toxic substance. The main problem in this case is that the exits of the building are limited and can only allow for a small flow of population to the outside. The behaviour of the population is



an essential component of these micro-scale studies. This guide focusses on mass evacuation, a larger scale approach dealing with the displacement of a whole city district, sometimes with several thousands people. The number and the capacity of the exits are still an issue but now one also has to address the problems of communicating information and recommendations to the population, dealing with uncooperative residents, managing the operations of rescue services...

- Emergency vs. preventive evacuation: the time available to organize the evacuation is a key variable in the decision process. For unpredictable events (earthquake, tsunami near a coast, airborne attack of a city), the authorities may not have enough time to summon their resources. The first thing to do is to alert the population and give some basic instructions about the state of the situation and the location of safe places. Sometimes the safest reaction is to stay at home. People are then left alone to flee from the threatened zone or to protect themselves and their family, at least until the rescue services have been able to solve the most urgent problems. On the contrary, there are situations where the disaster can be predicted. This is especially the case for flooding for which the possibility of the event is foreseen one day before its occurrence, even if most of the time the forecasts hold a lot of uncertainties and errors. The information is nonetheless very important because it allows the authorities to think about the situation and its distinctiveness and to help the citizens evacuate. Since this methodology mainly deals with flooding, we assume that the evacuation is prepared and that the authorities are alerted 24 hours before the event.
- Evacuation to shelters vs. evacuation to safe havens vs. in-place sheltering: according to Kolen et al. [10], several types of evacuations can be distinguished under the previous assumptions. Shelters are high and strong buildings inside the exposed area which may accommodate some evacuees and provide them with primary goods necessary for a living. Safe havens are places outside the exposed area, for example elevated and dry spots. Finally in-place sheltering is an individual preparation to the event with people moving to upper levels of their own buildings. An evacuation strategy is a combination of all these types of evacuations so they will all be considered in the methodology.

When a disaster is foreseen, the most urgent need is to evacuate people, who represent the higher-priority vulnerability of a town. Mass evacuation plans in this methodology therefore refer only to human evacuation. In some cases, a decision maker may also want to evacuate animals (pets and cattles) as well as goods if they have a high value, but this process is not tackled by the methodology since it requires even more specific transportation vehicles, a thorough knowledge of the secondary threats involved by the evacuation, and would call up a large part of the human resources of the city. For private owners whose incomes rely on animals or materials, if they still want to evacuate those sources of incomes, they have to prepare their own evacuation plans.

Lastly, the recommendations of the present guide apply mainly to evacuations in highly-urbanized places. When a disaster occurs on small villages or burgs, with a rather small extent, and is predicted soon enough, the problems are not the same: one does not have to care about road traffic for people have more than enough time to leave their homes and the authorities usually have enough resources to manage the crisis. The problem then shifts from a resource allocation problem to a communication-only matter. This does not mean that evacuation plans are not needed any longer



but those kinds of plans should focus on the warning phase so that every residents are aware of the coming disaster soon enough.

As can be seen in real examples, a mass evacuation of the population of a town is a complex process which spreads over time and space. Most of the scientific work in this field is aimed at the numerical simulation of the displacement out of the exposed zone through the road network. This topic, as challenging as it may be in a mathematical and algorithmic point of view, is only a small part of the whole process. The whole frame can be described as successive steps [17] (see figure 55) :

- continuous watchfulness during times of the year when a disaster may occur ;
- decision of evacuating when a threshold of hazard level is reached ;
- alert of the population and transmission of advices ;
- preparation of the evacuation by the authorities and the inhabitants at the same time ;
- implementation of the evacuation, people moving to safe places and shelters ;
- management of the post-evacuation during the crisis ;
- after the end of the event, return to a normal situation.

Thus, in the framework of coastal risk management, evacuation planning can bring a new mitigation option to coastal cities. The option is to evaluate the flood risk, and then for territories where human life is threatened by the risk to propose a strategy to improve the way the evacuation is led and to avoid as many casualties as proposed. This strategy consists in activating one or more action levers which are decisions that can be taken by the authorities in charge of managing the emergency. Action levers refer to each of the previous steps. For instance, an action lever can be to open new shelters and supply them with primary goods like food and energy production devices before the storm arrives. This can be achieved by identifying public structures that can accommodate people and signing contracts with private organisms that can also private housing. A strategy is a set of action levers that are used to prepare an optimized evacuation plan.

Evacuation is not an innovative mitigation option by itself, but the methodology shown in this report tries to build on different returns of experiences from real events and to gather the best practices in the world and should help the authorities investigate all possible strategies which can lead to a more effective and faster evacuation of population, even in a difficult context.

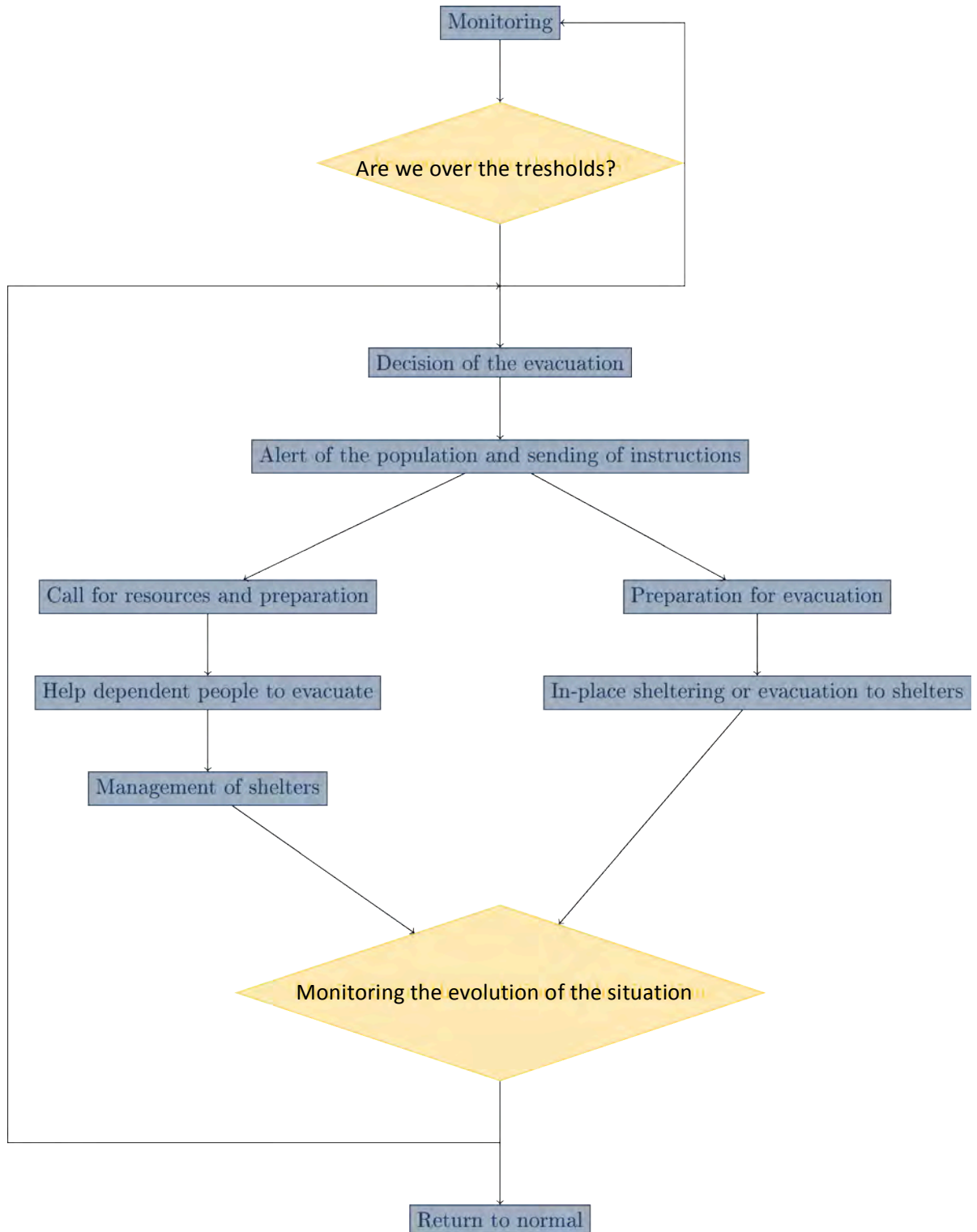


Figure 55: Successive step of an evacuation process



GROUND TESTING OF LAND USE PLANNING

Preparing an evacuation plan requires a comprehensive knowledge of the population of the coastal city and its distribution over the districts, the way it will react to evacuation orders, the human and material resources which can be used to implement the plan, and the possible storms the city may face. Thus ground testing for this task relies both on the collection of quantitative data on the territory as well as surveys over the exposed population and interviews with local stakeholders and authorities.

In order to prepare an evacuation plan over a rather broad territory, one first has to make sure a certain amount of data regarding the description of the territory and its inhabitants is available. Only with a sufficient knowledge of the stakes and the resources one can use during a crisis are we able to derive a relevant evacuation plan. Two kinds of information are needed:

- primary data, which can not be easily quantified. Among them are the actual politics and legal framework and the socio-economic characteristics of the population which will influence its behaviour in an emergency context and may dramatically change the way the evacuation is happening. Those characteristics vary across countries and even across regions and cities. While a general overview of the functioning of a territory can be obtained through thorough interviews with local decision makers and stakeholders, social characteristics can only be tackled by large scale surveys. Moreover, since they are likely to change with the political context or the occurrence of other events far away in the world but nevertheless waking the local awareness of the threat, those surveys should ideally be reproduced at a certain frequency (once every two years for example).
- secondary data descriptive of the region, also evolving in time but usually at a slower pace and which can easily be observed on site provided enough time and money are available to reach the desired level of accuracy. Those data can usually be found in national databases, sometimes spread over multiple governmental organisations.

Face-to-face interviews

Face-to-face interviews should be arranged with representatives of major stakeholders in the considered area. They are useful at gathering knowledge about the organization of crisis management, the responsibilities of the different organisms involved, and the general political context of the site. Usually most of this information is already known by the authority in charge of evacuation planning since it is also a major political actor. However, face-to-face interviews are still useful because they help to share the same view of the sharing of roles and responsibilities between organisms.

Moreover, as many organisms have to be involved in the evacuation as will be seen later in the methodology, one should consider signing commitment contracts between the authority in charge and the organisms involved to describe accurately the amount and types of resources that the latter will provide during the emergency, the actions they will carry out, and the communication with the crisis management cell. The evacuation planner can take advantage of those face-to-face interviews to describe the context and the objectives of the analysis and prepare the future commitment.



Surveys

Large-scale surveys can be carried out to get a better overview of different factors of importance that are not stored in national databases (primary data). These surveys should be made up of questions as closed as possible so as to allow for statistical analysis. When it is possible, one should only let the questioned person choose between several answers. The surveys should at least tackle a representative population in the threatened area but also around it, because it is a known fact that a number of people not directly threatened will evacuate along with the vulnerable population.

The relevant factors cover several fields described hereafter. More details about questions that can be asked to gather required data may be found in Theseus OD 4.1.

- Knowledge of the hazard: the more a person knows the danger he or she is exposed to by staying in a threatened area, the more likely it is he will decide to leave as soon as possible. This knowledge is strongly related to his own experience of past events in his town or in the neighbouring towns, especially where he himself or his relatives were struck by the disaster, and to the communication about the crisis made by the local authorities. This part of the questionnaire is aimed to assess this level of knowledge.
- Behaviour of the population: this information is needed to know the general behaviour of the population in case an evacuation is ordered. The most important is to evaluate the proportion of people who will stay at home even when the evacuation order is issued, and to get a basic idea of the warning acceptance factor and the warning lag factor.
- Communication channels: those data allow for the identification of the best communication media to issue the warning. However, one should keep in mind that all communication media are not equal. Some of them can cope with individual messages whereas other can only disseminate one message for the whole population. Some also have a more “official” image and better impacts on population when disseminating orders from the authorities.
- Dependent people and people needing special care: sometimes health services databases are not sufficient to locate and count people needing special care. Surveys can then give additional information about vulnerable populations.
- Use of vehicles: the number of vehicles used during the evacuation is an important parameter and has tremendous consequences on the movement time and therefore on the decision-making for evacuation. Most often available data on vehicle ownership are aggregated at a large scale, provided by car sellers and previous surveys. One can for example know the average number of cars per family in a city. However, the total wealth in a city is seldom distributed in an homogeneous way. There can be huge differences between the quarters. Since the evacuation will occur at the lower scale of the district, one has to get statistics at this level.

However, as stated in [3], “reliable forecasts of people’s responses to hurricane threats cannot be made solely or even primarily from their answers to survey questions about hypothetical situations”. Survey data are only a starting point for the behavioral analysis but to get a better insight of the reactions of the population, a comparison with survey results in other locations and above all with the experience from actual disasters is needed. In coastal areas, another parameter to take into account is the number of tourists which can raise a lot the total population to evacuate during



holidays. Thus surveys should not only tackle residents but also some tourists whose behaviour faced to a disaster may be different.

According to [3], the main objectives of the survey are the estimation of the following crucial parameters:

- the percentage of vulnerable and non-vulnerable population that will evacuate,
- when the evacuating population will leave in relation to an evacuation order or advice given by local officials, in other terms the warning acceptance and lag factors,
- the probable destinations of the evacuees who will probably divide up between public shelters, relatives and friends, close hotels, or rather go far outside the region,
- the proportion of available vehicles that will be used for the evacuation,
- how the population will respond to disaster forecasts and to the information provided by the authorities,
- the specific behaviour of tourists,
- the percentage of evacuees who would require public assistance for emergency transportation.

Quantitative data collection

Along with the results of the surveys, a number of quantitative informations should be collected to get a sufficient description of the territory and the equipment which will serve as a support for the evacuation. Some of them are usually available through national databases and are distributed by a public organism. Sometimes they are free of charge. Since a lot of geographic data has to be obtained, combined, and processed by spatial analysis functions, it is best to get this data in numerical and Geographic information system (GIS) vector format. For small areas however or in countries where accurate vector information is not available, one can try to manually apply the spatial calculations described in the following methodology on paper maps.

This methodology aims to provide a full description of the data needed for the preparation of an evacuation plan. The collection of data shall be the first step of the writing of an evacuation plan. Those data cover 6 themes described hereafter. More details about topics that must be covered in all those themes may be found in Theseus OD 4.1.

- Forecasting of the hazard: maps and model outputs used to delineate the threatened area for different hazard scenarios.
- Buildings: buildings are essential in evacuation planning for two reasons. First they are concentration points of the population. Depending on their use (offices, residential, shops, public facilities), the temporal distribution of their activity varies a lot throughout the day. Offices bring together a lot of people during working hours, but are usually fully empty at night. Residential homes always shelter several people, days and nights, but the proportion of people at home is expected to vary according to the time in the day. Second, some buildings can also be used as shelters for evacuees when they meet some conditions of distance to the threatened area, availability of primary needs, and access to emergency services.



- **Networks:** networks are a crucial component of the evacuation process. Transportation networks (roads, railways, underground network) are necessary to allow people move to safe areas. Electricity, water and gas networks are needed to provide evacuees with primary goods.
- **Vulnerability of the population:** the total population inside the threatened area as well as the number of people requiring special care, together with their location at different times of the day.
- **Role-players and organisms involved in emergency management:** names and coordinates of every people who would play a role in the emergency management.
- **Real-time information:** during the establishment of the evacuation plan, this information is not available by definition. One has to work with assumptions about what will happen, based on one's knowledge and experience. It is possible to draw different hazard scenarios. However, before the disaster strikes, the real-time observations have to be linked to one of the scenarios previously analyzed. Therefore, one should at least know the type of information that will be available real-time, its uncertainty, the frequency of the observations, and how they can be related to the scenarios.

The list of data shown in this methodology may seem very long for the person in charge of building an evacuation plan, all the more so as some of it may be difficult to gather, but it must not scare him. What must be remembered is that this is not a list of required data but a list of useful data. Every element in this list can be used if available to improve the evacuation plan, but the latter can still be made if the element is not available by estimating its value or even deciding not to consider one minor aspect of the evacuation process. A priority has been drawn to identify most needed informations, secondary elements, and elements of lesser importance

EVACUATION PLANNING AS A MITIGATION OPTION INCLUDED IN THESEUS' DSS

EVACUATION PLANNING AND THE SPRC STRUCTURE

In the SPRC structure adopted by Theseus as the risk assessment methodology, evacuation planning comes up at the very last stage in the evaluation of the consequences of the flood in terms of human casualties. By providing ways to make people evacuate the threatened area faster, evacuation planning reduces the number of exposed people on coastal territories and decreases the expected human casualties accordingly.

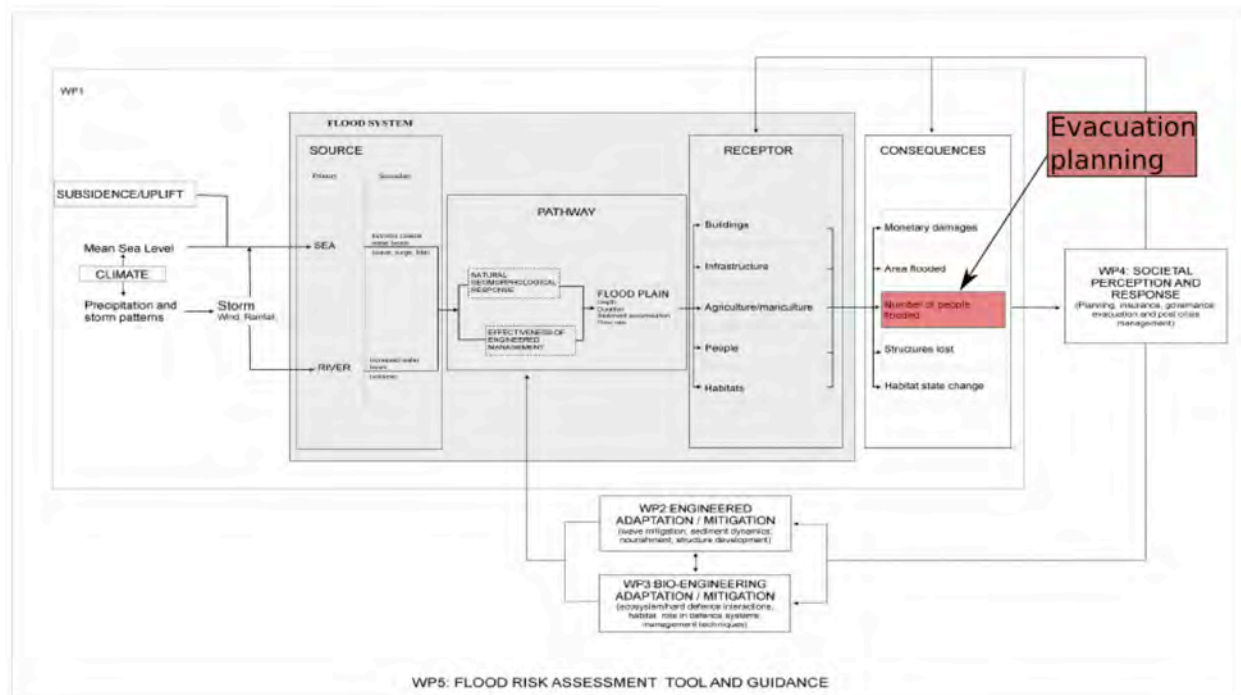


Figure 56: Evacuation planning in the SPRC framework

Apart from this primary and mainly-sought consequence of the evacuation, side effects may also be a reduction of material damages in flooded areas, as many evacuees will take their most precious belongings with them if they think they may be damaged by the flood, and also less psychological distress among inhabitants if they know their relatives are safe. On the contrary, one must not forget the psychological cost of an evacuation order, the longer people have to leave their house the higher. And in evacuated sectors, theft and vandalism can happen if there is no law enforcement, which results also in additional material damages. However, for a first evaluation of the benefits of an evacuation plan, one may neglect those indirect side effects which are difficult to compute and for which positive and negative consequences balance themselves at a certain level.

INCLUDING LAND USE PLANNING WITHIN THESEUS DSS

As stated in the SPRC structure, the main effect of evacuation planning is to reduce the number of people on site when the storms begins. Therefore evacuation planning can be integrated in the decision support system as a module for computing the number of dead and injured people. This number will change depending on the chosen evacuation strategy.

For the purpose of the DSS, a new software was developed based on the Evacuation calculator by the university of Twente and Rijkswaterstaat. This new version is easier to integrate as an optional module of the DSS. Its aim is to provide a method to calculate how much time is required for an evacuation based on different traffic management scenarios. It is now included in the Dutch flood management system. The software was designed with two aims:

- help authorities find the bottle necks of the road network by evaluating the flows on each road during an evacuation;
- estimate the total evacuation time needed for the population to flee the threatened zone.



Overview of functioning

The main advantage of Evacuation calculator over its competitors is its ease of use. To be run on a city or a district, the software only needs to be fed with data available at the national level: basic road network, distribution of the population over the spatial extent and social categories. The drawbacks are that some data need to be estimated with one's common sense and experience. For a more accurate simulation, one should therefore consider either to calibrate it with the outputs of another dynamical software, or to carry out sensitivity analysis to study the impacts of a small change of the parameters on the final result.

The following input data is required to run the evacuation calculator:

- A division of the threatened region into several areas, homogeneous according to the social position of their population, their density, and with similar sizes. In the Netherlands, postcode areas are used because it is at this level that the data about population is available. For other countries, one should select a relevant area based on the availability of socio-economic data. If there is no database of social characteristics of the population, one should at least select areas as small as possible for which the total population is known.
- The identification of several exits of the threatened area. An exit is located at the border of the flooded zone and is a major road bound to be used by many vehicles when the evacuation order is issued. The exits do not have to be associated with the areas at this stage. However, the distance between each exit and each area has to be evaluated. Furthermore one has to provide the model with the capacity of the exit and its relative attractivity. The capacity depends on the type of road: motorways and wider roads have more capacities than local ways. Attractivity stands for how likely people are to choose this exit instead of another: this may depend on the event they want to flee, their knowledge of the traffic on that road in usual times...
- The average velocity at which inhabitants drive to the exit.
- Some basic knowledge about how people will respond to the evacuation order, which will be used to define the shape of the logistic curve. Two numbers are required: the amount of time after which half of the population will have left their home and the additional amount of time required for 90% of the population to leave their home.
- The total population of each area identified previously.
- The share of the population among social categories. Categories can be defined by the user and allow to define different behaviours during the evacuation process. For example, one can decide to distinguish between people over 60 because they are more likely to require assistance during evacuation. One can also choose to distinguish between healthy and sick people. There are no limit to what is possible for the software. The only thing the user has to know is the number of people in each category and the kind of vehicles they will use. For instance, healthy people will use private cars so there will be about 2 of them in every vehicle. Dependent people will use public transportation and there will be 40 of them in each bus.

When all this data is known and put in the software, the evacuation time is automatically calculated according to four different traffic management scenarios, as shown on figure 57 :

- **Nearest exit:** Every resident chooses to evacuate through the exit closest from his home area.
- **Reference:** People in each area are shared over the exits according to their relative attractiveness. Thus an exit which is twice more attractive than another will be chosen by twice as many people. However the reference case is an unrealistic scenario, since it assumes many people will drive through the whole city to reach an exit far from them although another exit was much closer. This case has been introduced to take into account cross flows, with people wanting to go back home or to reach a particular location during the flood even if it is not on their evacuation route. The documentation of Evacuation calculator states that this option was made to give an estimate of the evacuation time in a realistic scenario in which cross flows have been taken into account by artificially increasing the result.
- **Traffic management:** This scenario represents the best case: the authorities are able to dispatch the population flow over the exits based on their capacities. This will lead to the shortest evacuation time.
- **Outflow:** With this scenario, the user is given the possibility to associate areas with exits, as if authorities were issuing orders or advices about the paths people have to choose during the evacuation.

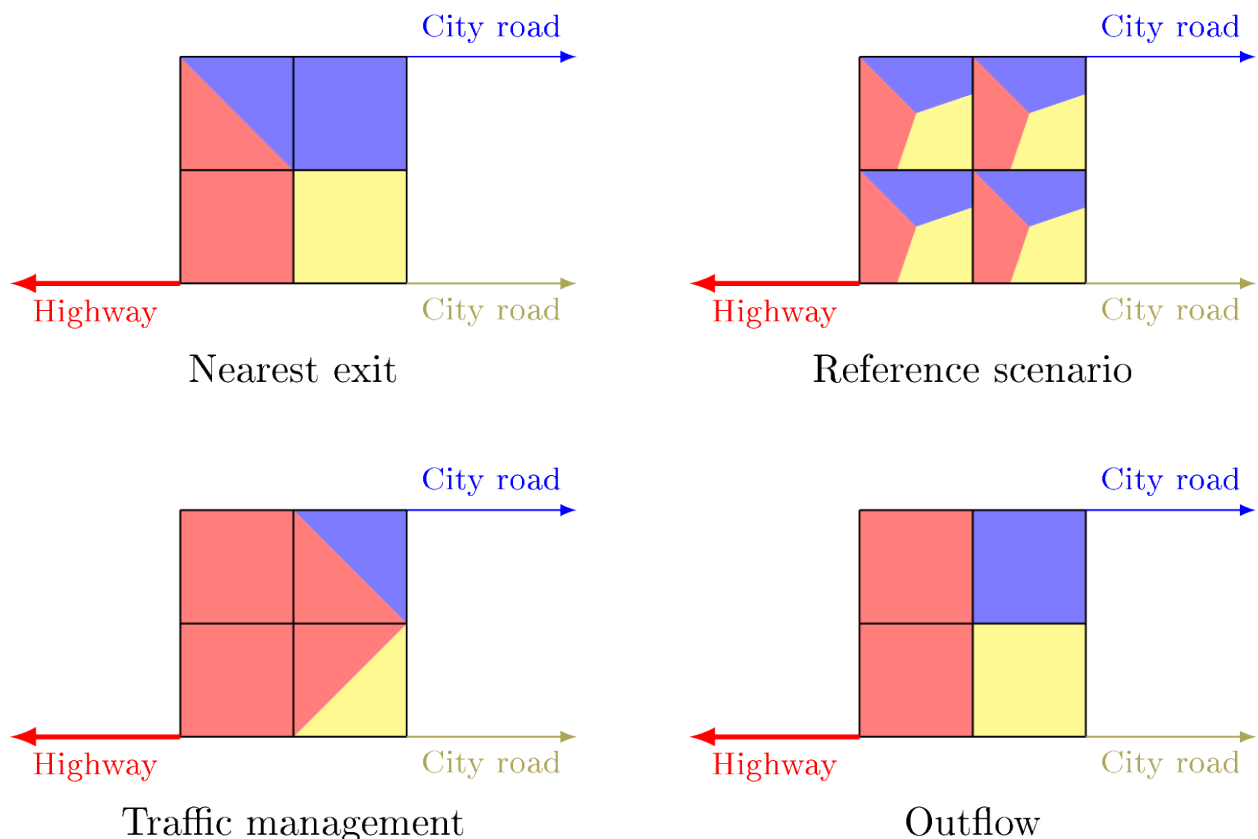


Figure 57: Traffic management strategies in the evacuation calculator

Alternatively, given the time available between the evacuation order and the start of the event when roads are not safe enough any longer to allow for people using them, one can calculate the number of people still in the city and who will suffer the consequences of the flood. Then in the DSS, another model evaluated a number of dead people by looking at the characteristics of the flood over a certain level of danger.

By comparing the outputs of the model, the decision maker is able to choose the best evacuation strategy and to fine-tune it according to his own knowledge and experience.

However, using a model like Evacuation calculator to calculate the time needed for the population to evacuate, one has to keep in mind that the results are based on strong assumptions about the way people the evacuation actually occurs which may differ a lot accross countries. Moreover, no result is more accurate than the original factors. Thus, this tool should only be used for comparison between different strategies, or for a rough calculation of the evacuation time.

Assumptions and principles

Figure 58 describes the main approach of the EC in three steps.

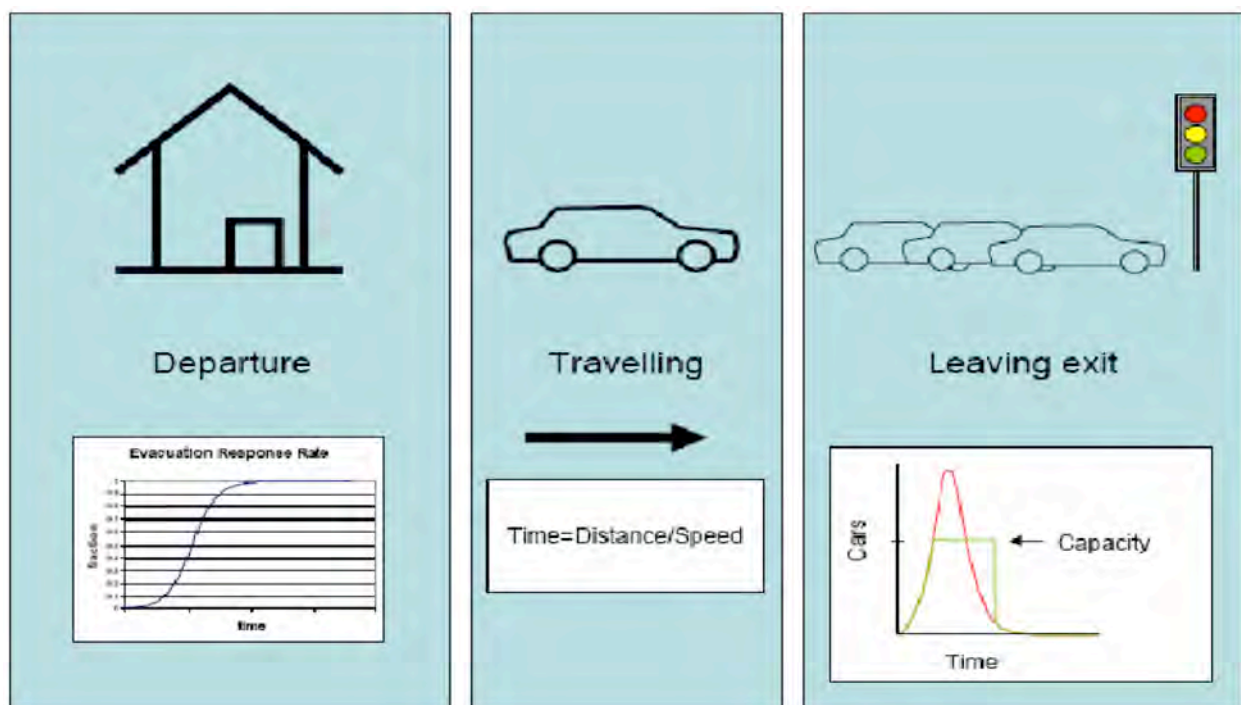


Figure 58: Main steps for the evacuation calculator

- Step 1: Departure of the people in the flood area. The inhabitants of the area that has to be evacuated are not leaving their home at the same time. Some people leave directly after the first warning, other people are not directly informed or take for other reasons more time to leave the area. By defining a departure distribution, the departure of people in time can be estimated.



- Step 2: The trip between home and the exit of the flood area. After leaving their home, people drive towards one of the available exits of the area. This travel time is estimated based on the distance and the expected speed at this trip.
- Step 3: Leaving the area. After arriving at the exit, people leave the flood area and arrive at a safe location. These exits have a restricted capacity. This can lead to congestion and (large) waiting times at the exit of the flood area.

Integration in the DSS

The evacuation calculator is used to calculate the consequences of a flood in terms of human casualties in the DSS, but can also help to evaluate the benefits of evacuation planning as a mitigation option. To this purpose, the user of the DSS has to define in which territory(ies) he wants to use this mitigation option. Then for each of them, he has to define the evacuation strategy.

The software does not assess the whole evacuation process but only one small part of it, namely how traffic is going on the transportation network. It doesn't rely on a full dynamic traffic model and some assumptions must be made in order to use it, so the result may not be very accurate.

The definition of the evacuation strategy in the DSS is made by providing an input file with the following elements, a subset of the full data required to prepare the evacuation plan:

- evacuation sectors with a population per category for each of them – this can usually be obtained from official national land use and population layers;
- exit points and their capacities – exit points are at the intersection between the exposed area and the transportation networks (roads, railways, or other transportation options);
- vehicles used by each category of population;
- rate of departures for each category of population – a set of predefined departure curves is provided in the software and the user may only choose the main parameters (for instance the time when 50% of the population left home and the time when 90% of the population left home);
- choice of exit points for each individual in the population, which is based on the traffic management strategy chosen in the evacuation plan.

After the simulation, the software returns two curves (or more detailed one by categories of population and exit points) telling the numbers of evacuated people with respect to the time elapsed since the evacuation order, as shown by the example on figure 59.

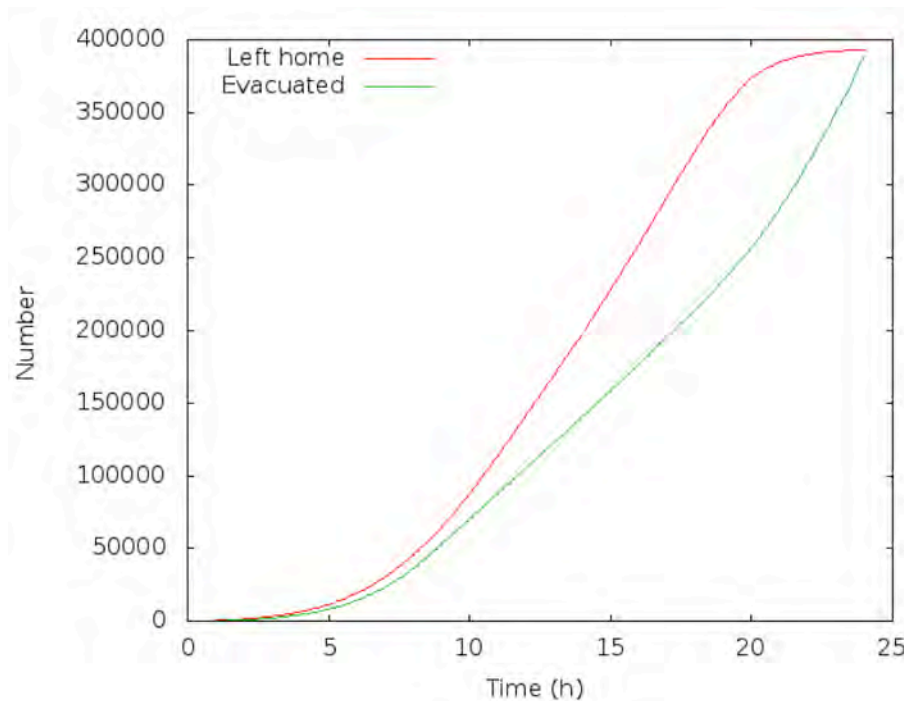


Figure 59: Example of output of the evacuation planner in the THESEUS DSS.

LAND USE PLANNING AS A RESILIENCY ENHANCEMENT LEVER

In their article [24], Wardekker et al. define an operational framework to address the issue of defining urban resilience in connection with natural hazards. This paper gives also clues about how this resilience can be strengthened by improving the way its principles are taken into account on the field, thus paving the way for new and more efficient adaptation strategies. The authors' proposal is based on discussions with key players of the emergency management and planning in workshops organized near Rotterdam. Resilience is defined here as the “capacity of a system to absorb disturbance and reorganise while undergoing change so as still to retain essentially the same function, structure, identity and feedbacks”[23].

The principles of resilience that are defined by the authors include all the components of a well-prepared evacuation plan.

- Homeostasis** : a resilient system includes feedbacks loops that help to stabilize it in case of external perturbations. This is the main principle which is addressed by the preparation of mass evacuation plans. Well informed inhabitants who know the future risk, which consequences it can have on their own life and how they should react to it are able to carry out necessary actions to protect themselves from the coming event, thus decentralizing the crisis management and making it more efficient. Of course one can't expect every citizen to be warned in time and to do exactly what he was told, but this preparation removes a real burden on the authorities who then only have to manage unforeseen events or dependent people. The homeostasis principle emphasizes the need of three components in an evacuation plan :



- Evacuation-aware urban planning. First of all residential zones should obviously be built as far as possible from places at risk. This is an evidence but one has to notice that it was not applied in the past years. Of course coastal zones are subject to a lot of pressure and decision makers have to deal with different possible uses of the territory. Sometimes nothing can be done and they only have to cope with a given situation. But for new urban zones, the road networks, the location of public buildings which can be used as refuges, the position of public services involved in crisis management (firemen, policemen, technical services of municipalities), the public transportation should be thought about not only in a usual situation but also as means to allow for a better evacuation of people in crisis times.
- Preventive information of the population of the risks they are faced with and wide dissemination of the evacuation plan before the event. Most of the European countries already have regulations to make municipalities assess the risks on their own territories and prepare for it. The evacuation plans should therefore be included as a part of these emergency plans.
- Communication of forecasts in an understandable way for an impending event. This component can make the best use of classical media (TV, radio, alert bells) as well as new information technologies (sending of an area-wide phone message, GPS).
- Clear responsibilities of the different parties involved in emergency management and good communication procedures during the crisis. This is a crucial point, not only for the implementation of an evacuation plan, but for the whole policy of crisis management.
- Social cohesion. This may be the most difficult part to implement but can have a really positive feedback on the way the evacuation is realized. This factor can help replace an individual and sometimes unstructured response with a collective effort to proceed with the evacuation. In this field, one could for example organize carpooling for people who can't drive themselves. In some places, a "responsible person" is given the task to make sure everybody has been warned of the impending event and has left his house. Unfortunately, the level of social cohesion and the voluntary involvement for the civil protection varies a lot across the different countries and in some places it may still be an unreachable option.
- **Omnivory** : this property states that a resilient system should have different ways of fulfilling its purposes. In this configuration, the structure can keep on working even if one of its component does not function any longer. For the evacuation plan process, the main goal is to bring people at a safe place. Therefore the fulfilling of this requirement calls for different items:
 - Different kind of refuges available. The authorities should anticipate the evacuation by selecting safe and equipped refuges. These refuges must have a sufficient capacity. They have to be located at different places so that if one place is threatened by the event due to a worsening not foreseen like a dike breach, people can be sent to another place in a reasonable amount of time. Also, selecting different types of refuges (high buildings near the flooded zone, large halls farther, small rooms in different hotels) might be appropriate: the whole evacuation plan



will then be less subject to unpredictable harmful events such as the collapse of a building, a power cut, or an unexpected rate occupation rate of hotels at the time of the event.

- Different pathways from the threatened zone to the refuges. A refuge with only one access point is not a fully reliable safe place. If the access point – for instance a road – is cut because of the flood, a truck overturned across it, or a car fire, the people will not be able to reach it any longer. If the immediate surroundings of the refuge is also at risk, then the situation is really serious and may lead to numerous casualties.
- Different modes of transport. This is a crucial issue for the preparation of an evacuation plan. One should combine several alternatives to allow for a faster and more secure departure from the threatened zone. Road is of course the first choice. Public transportation can reduce the traffic on the roads. Before the flooding, rail is an efficient and fast way of moving a lot of people. When the flooding starts, one can consider using airborne vehicles for special regions where the usual road transportation might be too dangerous.
- Different sources of energy. Power supply is a vital need for crisis management and power shortage in a refuge may worsen the situation of people. However floods often damage the distribution network of even the power plants. Localized sources of power like solar plants on the roofs of a building or simply personal electricity generators can compensate for a lack of power during a small amount of time.
- **High flux** : this property is associated with a quick response to the threats and changes. Whether the changes are fast or on long-term, the property can lead to different expectations:
 - High flux of data for a quick information of the citizens. The sooner residents and authorities are aware of the impending risk, the more time they will have to get prepared and the better the response will be. Therefore alert systems should be as accurate and fast as possible.
 - High flux of organizations to keep a high level of wakefulness. Littorals are subject to changes along the years, with the sea rising, the climate being altered, industrial zones growing, and more population gathering on the sea side. An evacuation plan should also therefore take into account these changes, by being updated every once and then. No plan can remain valid for more than ten years. Land use planning and protection structures have to be adapted in the same time.
- **Flatness** : this contributes to a quicker answer in case of an event. Flatness is a characteristic of an organization which is not overly hierarchical and heavy. With limited number of actors and levels of administration, information about the state of the event and decisions will move faster along the hierarchical levels and operational actions can be carried out earlier.
 - Local response. One way to fulfill this requirement is to make local decision-makers and technicians responsible for the local management of the event. Higher levels should only be involved when a large-scale coordination is required. With this approach it is also possible to provide responses tailored to the local situation.
 - Involvement of the public. Already stated earlier, the involvement of the public is an essential issue of crisis management. One notices that many citizens are willing to



help the authorities when an event occurs, but they do not know how to be useful. A well-informed public whose task force is channelled to priority stakes through preventive information and planning can prove more useful than referent operational services to ensure safety at a local scale. This concept is referred to as “holistic governance”, which aims at “creating a clearly communicable safety-culture in which professionals and residents participate”.

- **Buffering** : this property of a resilient territory describes the ability of the region to absorb damages until a certain extent. This helps to manage the event by giving more time to face it.
 - Making water retention fields. This measure is commonly adopted, not only for the emergency management but also to protect territories: fields are marked as reserved and can not be built upon, so that they will store a part of the water when the flood occurs. Water retention zones can also be managed real-time in a dynamic process.
 - Elevating vital functions. The refuges and transportation networks, as center parts of the evacuation process, should be protected against the water rise by being elevated above the level of adjacent ground. In the same time, one should as much as possible concentrate non essential functions or flood-resistant infrastructures on the ground level in the flood-prone zones, while living quarters have to be elevated above the expected level of water. Of course this might not be always possible, but one should keep this principle in mind when designing new urban quarters.
- **Redundancy** : this property states that each vital element of the emergency management should have multiple available instances, so that there is a falloff solution in case of failure. It is not exactly the same definition as omnivory for which the function must be assumed by different means whereas in the case of redundancy there has to be several instances of the same kind of resources. Making the system redundant thus means that there are several refuges available, several safe locations inside or outside the city, several sources of primary needs (food, water) secured by contracts with suppliers.

These properties give a first insight of the quality criteria an evacuation plan has to honor. A methodology should lead to such an evacuation plan and each part of it has to deal with one of those aspects.

SYNTHESIS : GUIDELINES FOR IMPLEMENTATION

This part is only a summary of the main guidelines to implement an evacuation plan. For the full methodology including relations between the main topics of the preparation of the actions plan and how data is used in the process, the reader should look at Theseus OD 4.1. The following paragraph is only a synthesis of the most important recommendations of the methodology. The advices are presented by thematics of the action plans. Most of those recommendations stem from the returns of experience from other past events [12,21,26], and from national guidelines from other countries [1,5,11,15].

PLANNING



The main things to remember when preparing an evacuation plan is that evacuation is NOT the primary solution to protect the population from the consequences of a coastal flood. The first option to look at is shelter-in-place, then if not possible relocate people in their neighbourhood, then only evacuate if no other option could be considered. If an evacuation is decided, authorities must still try to evacuate people as close as possible to their homes. In this approach, a “mass evacuation” is never a good idea and can lead to a man-made disaster [26].

In order for an evacuation to be considered as successful, ten major issues have been identified as described in Theseus OD 4.1 and should be solved during the stage of preparation of the actions plans:

1. know and anticipate the hazard in an uncertain environment;
2. define and implement efficient strategies by activating so-called “levers of actions” and make sure that all necessary actions are taken in the required delays;
3. make sure all required financial, human and material resources are available at the time of the evacuation;
4. coordinate the actions of different role players and decision makers involved in the emergency management (state institutions, local elected representatives, army,...)
5. integrate human, political and technical considerations in all the stages of the decision process;

This first group of topics has to be dealt with before the actual event, during the preparation stage. The following ones must be considered later when the evacuation decision has been taken:

6. organize the alert of the population beforehand and try to convince most of the inhabitants to go out of the exposed zone;
7. anticipate unpredictable events and be able to manage them. These events indeed tend to happen quite a lot during a crisis, with chain reactions worsening the already serious disaster: power shortage, traffic jams because of too many people trying to flee from the city at the same time, panic,...;
8. control the flow of people and goods during horizontal evacuation in order to avoid traffic jam and accidents;
9. assist dependent people (prisoners, patients in hospitals, old and sick people, pupils...);
10. manage the post-evacuation stage: ensure safety in evacuated zones, assist people in the shelters.

A successful planning of an evacuation analyses all those topics by going through the following steps [26]:

- do a risk assessment: “why do we have to evacuate?”
- evaluate the vulnerability: “who do we have to evacuate? What is at risk?”



- assess the behaviour: understand the potential reactions of the population and define a common and well-understood terminology
- develop evacuation zones
- perform a transportation analysis
- calculate the clearance times: “how long does it take to evacuate everybody?”
- perform a shelter analysis by evaluating the demand and checking that the capacities of all foreseen shelters are high enough to accommodate everybody.

GENERAL ADVICES

Make the best possible use of voluntary and private organisations

Most often, public resources are not sufficient to ensure safety and provide assistance to every citizen in need. Some resources needed may also be available in private companies (vehicles, power generators, food...). Authorities in charge of planning should have recourse to private firms, provided an agreement with them is concluded during the preparation of the plan. This agreement may be a contract that describes a commitment of the company to provide resources in case of emergency, with accurate provisions regarding the amount of resources made available, the time needed to prepare them, and the financial counterparts that are expected from the authorities.

For extreme events, additional staff and resources may also be brought by other states or foreign countries, and by non-governmental associations. They can be of great help for local authorities if their action is well coordinated. Local organisms in charge of managing the emergency are responsible for following the amount of resources involved on the field from different institutions and coordinating their assignments.

Be aware that people will help each other spontaneously

As shown during the Katrina event [12], people are usually willing to help each other during a major event. Thus during Katrina, Christian clergy assisted in disseminating the evacuation order and four congregations implemented a program to help evacuate people without any transportation means. Many churches also accommodated people during the first hours of the disaster.

This huge task force must be taken into account in the evacuation plan. Preventive and real-time information and communication about major issues can help them choose where they can focus their action.

Ensure an effective law enforcement response in evacuated areas

One of the main concerns of people when asked to evacuate is the safety of their homes and goods. Indeed previous experiences showed that theft and crime are very likely to happen in evacuated sectors while authorities are too busy with the protection of the



citizens. Therefore ensuring law enforcement in those sectors can greatly improve the efficiency of the evacuation order. An operational plan for law enforcement must be included in the evacuation plan.

Exercise the evacuation plan

Exercising is a key element of the planning. For evacuation, full-scale exercises may be very difficult to implement, but some components can be tested. A range of organizations as wide as possible should be involved in those exercises. They should over time address the full range of capacities and responders who might be involved in the process. The overall purpose of the exercises is to make sure the evacuation plan works well and that is well understood and applied by the population and the emergency services. If there is not enough population on site, one can hire extra players for the occasion.

Of course, when an exercise is organized, all its results and the actual events should be recorded through a standardized review process for further return of experience. Each individual organization involved in evacuation management, and especially those who will sign a contract with the local authorities, are responsible for the training and preparation of their own staff.

An exercise should at least be organized at the very beginning when the evacuation plan has been validated and signed and when the population has been informed of its existence. Afterwards, regular exercises are useful to maintain a high level of risk awareness in the population: one exercise each year or each two years is generally a good rhythm. More frequent exercises can also be organized in public establishments and firms to test their reaction to the event.



TRANSPORTATION

Plan evacuation routes for private vehicles and public transportation

Itineraries dedicated to evacuations help to share the traffic load on the network by assigning directions to drivers based on their origins, their destinations and the current traffic of the network. The purpose is to use the network in a nearly-optimal way. Two options are available:

- A static planning, where inhabitants from different districts are assigned different exit points and routes during the planning phase. This approach requires the least amount of work during the crisis but a significant communication work should be done beforehand so that most people are aware of the itinerary they are assigned, and it is in everyone's interest to observe the instructions. Targeted communication may also help to remind people of those instructions during the crisis.
- A dynamic planning, in which policemen direct people at crossovers and control traffic flows. The officers are able to communicate with their headquarters which provide them with new instructions regularly based on the current state of traffic in the whole town. This approach is the most efficient but requires more people to implement it and a previous installation of some systems to monitor traffic in the town (cameras, counting devices...).

The use of public transportation is a major action lever for authorities because it can drastically reduce the traffic load on the road networks. Busses, trolley busses, subways, trains can be used provided that the resources available during the crisis are well known and that contracts have been signed with their owners during the planning stage. Public transportation will at least be the only option for assisted evacuees.

Setting up contra-flow may help evacuate faster but has also lots of drawbacks

This consists in reversing the directions of some roads or even fully closing roads to make the road network as effective as possible to let people leave the threatened area. The rhythms of traffic lights should of course be altered accordingly. Yet one should not forget that opening new lanes for the outgoing traffic will not magically increase the network's capacity and speed up the evacuation process. An unconditional reverse of all roads in favor of the outgoing traffic is even likely to raise more issues than it solves, with unexpected congestions occurring at crossroads where several outgoing roads are crossing and the priorities of the traffic do not match the actual discharge of roads. Furthermore, changing the whole transport plan will puzzle people who are used to their common itinerary and cause many accidents. This method is also quite difficult to implement because contraflow lanes usually lack signage, signals and traffic control devices. The logistics of setting up road blocks, diversions, signage, and ensuring the inbound lanes are free of traffic is extremely time-consuming and requires a lot of people. Therefore, contraflow lanes will only seldom be set up in urban areas.



If the authorities do still want to implement this option, the location of contraflow lanes, the duration of the altered transport plan, and the accompanying measures have to be carefully planned long before the disaster, when the evacuation plan is being written. A traffic flow model can help assess the impacts of the contraflow lanes on the times needed to evacuate the threatened area. The evacuation plan has to describe accurately the following elements:

- the location of contraflow lanes and especially the points where they will join normal lanes,
- traffic diversions that are induced by those contraflow lanes,
- the number of persons needed to make sure the new transport plan is respected and to help and direct people in their cars to the right direction (some people are needed at every entrance, exit and crossover of a contraflow lane),
- the additional equipment that has to be prepared (signage, road blocks),
- the time needed to prepare the change in the traffic plan,
- the benefits of the measure in terms of time to evacuate and security of people.

Take into account shadow evacuees

Shadow evacuees are people deciding on their own to leave their home even if it is located outside the threatened area. Shadow evacuees have an influence on the implementation of the evacuation plan because they require assistance even if they were not registered in the plan, and therefore put an additional burden on the authorities.

Evacuation plans must have sufficient safety margins in the calculation of capacities of shelters and transportation network to deal with the shadow evacuees.

Consider dependent communities

Some types of people are more vulnerable to a coastal flood. Ethnic minorities may not fully understand the evacuation orders because they do not speak the same language and therefore won't know where to go in case of a disaster. Tourists may understand the evacuation order but their knowledge of the city is not good enough to know where the meeting points are located or which route they have to take to leave the city. Vulnerable groups are also made of poor people and homeless who do not own or have access to a car, or who can't seek shelter in second homes, hotels or relatives and therefore rely on public shelters. Finally dependants are people whose age, medical state or legal status make them require continuous assistance from a third party.

Among the dependant people, prisoners must not be forgotten and they also need to be moved early in case of evacuation. Finally, one of the most vulnerable groups is childrens, found in schools and child care centres. Due to their vulnerability to psychological stress, evacuation planning has to be particularly mindful of the welfare needs of children. Moreover, those actions have a major influence on reducing the distress of their parents.



All those groups must be taken care of when planning evacuation routes and assigning evacuation vehicles to them. Some will require public transportation and other special vehicles. Authorities must make sure each of those people is assigned to a transportation option which fulfills its needs.

Evacuate as close as possible to the original location

The best option to make the evacuation happen faster is to limit the number of people on the roads. That is done by promoting in-place sheltering as much as possible, then relocation to close buildings, and only if all options were discarded, evacuation. People should then be brought to a shelter as close as possible to their homes which is not flooded itself.

Always prevent evacuation routes from intersecting. Keep an inbound road free for access by emergency vehicles. Stop inbound traffic as soon as possible.

The aim of the traffic management plan is to make people leave the threatened area as fast as possible.

To this purpose, one should also prevent inhabitants from going back to the area as soon as possible, since this would increase the demand of outgoing traffic and the burden on outbound roads. When the evacuation order is issued however, one must expect that many people will try to first come back home and pick up their relatives or even personal belongings before leaving. It is very hard to avoid this movement, so it is better to allow it for several hours, which has to be clearly explained in the warning message.

When evacuation sectors have been defined with routes to the shelters, one has to make sure some inbound roads are kept free of traffic, in order to allow emergency vehicles reach the inhabitants.

Finally, it is strongly recommended to avoid intersections of evacuation routes, which could lead to confusion for the evacuees who will not know which road they have to follow to go to their shelters. Furthermore, crossing roads increase a lot the probability of accidents.

Test particular evacuation plans (like the hospital ones)

The methodology for planning an evacuation advises institutions which accommodate dependant people (hospitals, schools, prisons, nursing homes) to prepare their own evacuation plans, because they are the only ones able to evaluate the needs of their patients and to determine the best way to transport them. However, past experience showed that the plans made by those institutions were not always realistic in terms of time needed to prepare the evacuation or facilities able to accommodate people. Moreover they were not coordinated with the general evacuation plan. So particular evacuation plans must be tested the same way as the general evacuation plan.



Ensure the availability of drivers and fuel in case of emergency

If the evacuation plan includes public transportation as an option to speed up the process, one has to make sure all vehicles are ready to depart in a reasonable amount of time. This requires the availability of drivers and fuel. For drivers, a successful planning should make provisions to make sure they can come to the depot and start working quite fast. This may be done by including special clauses in case of emergency in their work contracts if they work for the public authority, or in the contracts signed with third-party private organisations involved in disaster management.

Fuel is also a major issue because stations may not be supplied during the disaster and therefore public transportation vehicles won't be able to gas up. Thus there should be emergency stocks of fuel placed at strategic locations or in the depots to allow for the evacuation of all people who will use public transportation.

COMMUNICATION AND WARNING

Take into account tourists who may be the least prepared for the evacuation

Tourists are a recurrent problem of disaster management. Not only don't they know the city as well as its inhabitants which makes them less aware of the risks and less likely to know how to behave in this case, but they also sometimes don't understand the official language and the evacuation orders.

First their number should be evaluated, depending on the season and the day of the week. Tourist offices may have estimations about that. Otherwise, a survey among hotels and holiday homes can give additional information. Tourist offices should provide guidances for them in case of disaster, in different languages.

Keep on educating people to make them aware of the risk and how they should behave

Preventive communication is crucial: some instructions to citizens can't be delivered in real-time because they need some explanations and the communication media are not adapted to send them, or the bandwidth is not sufficient. For instance, it is difficult to deliver different evacuation procedures depending on the evacuation area, especially if those areas are not well defined. Furthermore, the sooner people know how to behave, the more time they have to prepare. There is also a direct link between risk awareness and the willingness to comply with the evacuation order, so that raising the awareness increases the proportion of people who accept to leave their homes.

Clearly order the evacuation when decided, and communicate with the same terms to everybody

An evacuation order should be as simple as possible. First it must sound like an order and not a recommendation or an advice. Then the evacuation order has to apply to everybody that gets it. Different messages for different people lead to confusion afterwards when people talk to each other. If some people have to adopt a specific behaviour, they should



be warned about it beforehand and the reason for this has to be clearly explained. There is no time to do so when the disaster has started.

Keep citizens informed about threats and evacuation zones during the whole event

During the evacuation stage, experiences from past events (especially the differences between Mississauga and New Orleans, see Theseus OD 4.1) show that regular communication to evacuees is vital to improve traffic on the roads and to avoid panic in shelters.

Communication has two main objectives: keep people informed about the state of the disaster, the measures that are taken by the authorities to protect citizens and the current capacity of transportation networks and shelters ; and tell them how their relatives are going. For the first objective, traditional media can be used as the message is unique for everyone. For the second aim, authorities have to put up call centers where people can phone to get information and they must register every evacuee who arrives at a shelter.

Make use of different media to communicate the warning and evacuation order, and to inform citizens about the state of the disaster

Using different media to communicate with evacuees is one of the component of resilience enhancement as described previously. This has two purposes: first using different media makes it less likely that all communication channels are disrupted by the event itself ; then more media should allow to tackle more people who are used to different kind of information sources.

Media that can be used during a disaster include door-knocking, television, automated phone calls and automated short messages, call centers, radio, official websites of authorities, social networks (this option is very effective has to be used with care since it was found after Sandy in New-York (2012) that social networks were also used by people to transfer false information or to exaggerate the seriousness of the event).

Deliver an accurate evacuation message

The evacuation order should hold all the instructions to direct people to shelters. A first warning message as soon as a potential risk is detected can be disseminated to help people get prepared to evacuate. This warning message should describe accurately the event, when it may happen and why it is a danger for the population.

The evacuation order itself must be clear, short and accurate. It must not leave any doubt about the disaster and the need to evacuate. The following elements should be in its content:

- state of the event and what are the threatened districts;
- tell that the decision to evacuate was taken by the official authorities and name those authorities (local mayor, state organisation...)



- the type of behaviour which is required: in-place sheltering, relocation to higher floors, horizontal evacuation;
- the time when the evacuation should start;
- the best routes to take to evacuate, and if some important roads are closed;
- the transportation option which can be used by non-autonomous people, and where they should meet;
- open shelters that can welcome evacuees;
- phone numbers of the call center in case of additional questions.

This message should be updated for the part regarding the state of the event and repeated every 15 minutes.

Take care of the decision to send people back to their homes

When the disaster is over and if the evacuated areas are not destroyed, people can be sent back home. This may be done in different steps like during the evacuation process. However, one has to inform people about the end of the crisis, and this can only be done once.

The decision maker must be very careful when choosing to allow people to get back home, because it will not be possible to evacuate again because of inbound traffic. Only when there is no way that the intensity of the event rises again can he decide it.

SHELTER MANAGEMENT

Carefully evaluate the shelter demand

During the crisis, most people will prefer alternative options instead of going to a shelter. They may go to relatives closeby or book a room in a hotel. Only a minor part of the population will have recourse to shelters, mostly people whose lower income and social network don't allow to find another option. Thus the shelter demand of a district is reversely correlated to its average income, and positively correlated to the number of tourists and isolated immigrants in it.

An accurate evaluation of the shelter demand is therefore needed to prepare accommodation in public buildings and make sure there is enough place to answer the needs. This evaluation should include the inventory of special needs.



Assist people in shelters

The assistance of people in shelters is a critical parameter of a well-applied evacuation plan[4]. The psychological impact of the evacuation depends widely on it. Furthermore, if a shelter is not well managed, it can even threaten the life of accommodated evacuees.

In a shelter, people should get access to food, water, medicines, a suitable place to sleep (at least 5 square meters), a sufficient number of toilets and sanitation rooms, and at least one communication medium to get instructions from the authorities and inform them about needs and specific problems. Another communication medium dedicated to the communication with other evacuees is also recommended. Finally, shelters should be accessible for the public, the suppliers and rescue services in safe conditions. There must not be any disruption of the supply, even for one day. Provisions may be made beforehand to avoid this situation.

Of course the authorities must make sure the shelters and the transportation and distribution networks which connect them with the rest of the town are not threatened by the disaster itself, and building health and safety regulations are followed.

Plan for the real population and not for a theoretical one

“People with special needs” may be considered as a minority of the population and therefore evacuation plans only give short provisions about how to deal with them. However, according to [26], more than 50% of the population has special needs. Those needs may consist in special dietary regime, medical treatment, psychological care, disablement, caring for a pet, or a restriction of individual freedom. Planning for a customized assistance is crucial. To this purpose, it is important to take an inventory of the special needs according to the geographical origins of evacuees. This will help to establish the required facilities to accommodate those people. Specialized facilities may also be set up in different places in order to fulfil those different needs.

Stockpile first-need resources in strategic places

During the first stages of the evacuation, the roads leading to shelters may well be encumbered by a constant flow of vehicles with evacuees. They will not be available to bring first-need resources like water and food to the shelters. Furthermore, at the same time, the authorities are usually too busy with urgent matters like traffic management, survey of protection structures, assistance of people in exposed areas, registration. Therefore, if a building is planned to accommodate people during the evacuation, to leave them more time to cope with the flow of arrivals, one should stockpile first-need resources for at least two days in it.

First-need resources are food, drinkable and not drinkable water (for individual hygien), fuel and common medicines. For specialized shelters, other resources may also be required



and stockpiled. It is needed to regularly check the state of those goods and replace them if they can't be used any longer.

Keep track of people registering in shelters in an integrated system to deliver assistance

The registration of all persons is absolutely necessary when they enter in a shelter. This allows the authorities to calibrate the supply needs for the shelter and to be aware of the fate of individuals in order to give information to their relatives. Pre-established agreed registration forms should be prepared and distributed to potential shelters and people should be instructed to help evacuees fill those forms.

ORGANISATION OF CRISIS MANAGEMENT

Clearly define the authorities in charge of managing the evacuation and all its stages

A successful evacuation requires a good coordination between different agencies. This process is particularly difficult because of the number of institutions that are involved. To facilitate the procedures, the crisis should first be managed locally, as close to the event as possible. Although the organisation of crisis management may already be described in rules and regulations, it is always useful to remind the roles of everyone in the evacuation plan itself. At least the plan should describe the organisation and functioning of the emergency response unit.

The emergency response unit gathers representatives from the main organisms involved in crisis management: police, fire and rescue services, ambulance services, local authorities, voluntary and community sector, health department, environment agency, highways agency, main transport and distribution companies. The composition of the emergency response unit is written in the evacuation plan. As soon as the event is known, it is called together. Its procedures of operating should be well defined and the staff trained before the event. More details about a possible organization of the unit can be found in Theseus OD4.8.

The representatives of third-party organisms involved in crisis management take also part in the emergency response unit. Their role is to facilitate the exchange of information between the authorities and their organism thanks to their good understanding of the assignments and organisation of it.

For each organism involved in the emergency response (public organism or private company under a contract with the authorities), the plan should define its role. The main roleplayers in a case of mass evacuation are^[1]: the city and metropolitan area services, other cities, the spatial planning agencies, the police department, the fire brigades, the highway agencies, public transport companies, national food and health departments, ambulance services, schools, hospitals and nursing homes, voluntary organizations, the armed forces.



Improve communication between jurisdictions

When the own human and material resources of an impacted city are not enough to provide assistance to the population, this city can have recourse to neighbouring cities, regional or national administrations. However, there must be only one person responsible for the coordination of the operations of all the involved parties. To facilitate the dissemination of its instructions and the feedback from the field, a good communication between all the jurisdictions is required. The principles of this communication shall also be described in the evacuation plan.

Make sure that the organisms that take part in the implementation of the actions plan know each other before the event

Having under hand the right contact point in an organization to manage a special aspect of the crisis can spare a lot of precious time when dealing with an emergency. To that purpose, the organizations and their employees involved in crisis management must know the basics of their ways of working. However, the process must be clearly framed so that responsible persons are not bypassed in the process and are kept informed of the situation and the measures taken.

Establish national leadership and common terminology

Even in the evacuation should be managed as close as possible to the location where it occurs, national authorities should establish guidances to help local authorities set up their evacuation plan[26]. A clear definition of all the terms should be used to facilitate communication between institutions. This facilitates greatly the assistance by other organizations which can provide reinforcements when needed.

Enact and enforce sound land use practices

An evacuation can be greatly sped up with prior evacuation-aware land use practices. Examples of such practices can be a good spatial distribution of public buildings able to accommodate people on the threatened areas, the redundancy of transportation networks in order to avoid the isolation of some areas or shelters during the disaster, the diversification of power sources...



Involve every roleplayer and citizen in the preparation of the emergency plan

The evacuation plan can only reach its full efficiency level if it is understood and applied by everyone. The best way to reach this is to associate every roleplayer and citizen in the process of establishing it.

For the third-party organizations which have a role in emergency management (transport companies, nursing homes...), contracts must be concluded with the authorities to clearly state the responsibility of everyone during the crisis and get guarantees about how they will be prepared to react the event. Those organizations can also be invited to meetings where the evacuation plan is discussed.

Citizens can't be involved in all the stages of the preparation as it would be too difficult to organize such participation. However, they should get the opportunity to comment on the plan when it is ready, and their comments should be taken into account to update the plan.

Finally, a successful evacuation plan must be exercised before the disaster on a regular basis.

Work on a common operating picture

During the disaster management, it is very important to make sure every roleplayer gets the same information in order to take coherent decisions. A common operating picture showing the state of the disaster with the level of danger as well as the protection measures which have been put up and the location of evacuees should be prepared by the emergency response unit and shared to everybody who needs this information. Recent events [26] have shown the benefits of new technologies for this purpose as they allow to work on the same system, but another fall-back solution should also be ready in case communication networks are disrupted or overwhelmed.

Develop a system for managing logistics and tracking resources

It is recommended to develop and share a common system for managing logistics and tracking resources so that the common operating picture is filled by information about available resources that can still be mobilized for disaster management. There should be enough details about those resources so that the users of the system can find out if they are adapted to their own situation.

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