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Partnership for Risk Reduction

ENHANCE

Enhancing Risk Management Partnerships
for Catastrophic Natural Disasters in Europe

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Deliverable 2.4: CONCEPTUAL GUIDELINES FOR CASE STUDIES - FRAMEWORK REPORT

Authors: Laurence McLean (UCL), Peter Heudtlass (UCL), Debby Sapir (UCL), María Máñez Costa (HZG), María Carmona (HZG), Kira Gee (HZG), Birgit Gerkensmeier (HZG), Beate M.W. Ratter (HZG), Wouter Botzen (IVM), Jeroen Aerts (IVM), Paul Hudson (IVM), Ted Veldkamp (IVM), Reinhard Mechler (IIASA), Anna Timonina (IIASA) Keith Willeges (IIASA), Swenja Surminski (LSE)

SEVENTH FRAMEWORK PROGRAMME

Title	**FRAMEWORK REPORT AS GUIDANCE FOR CASE STUDIES**
Author(s)	LAURENCE MCLEAN (UCL), PETER HEUDTLASS (UCL), DEBBY SAPIR (UCL), MARIA MANEZ COSTA (HZG), MARIA CARMONA (HZG),KIRA GEE (HZG), BIRGIT GERKENSMEIER (HZG), BEATE M.W. RATTER (HZG), WOUTER BOTZEN (IVM), JEROEN AERTS (IVM), RALPH LASAGE (IVM), REINHARD MECHLER (IIASA), ANNA TIMONINA (IIASA) KEITH WILLEGES (IIASA), JAROSLAV MYSIAK (FEEM)
Organization	UNIVERSITE CATHOLIQUE DE LOUVAIN (UCL); HELMHOLTZ-ZENTRUM GEESTHACHT (HZG), CENTRE FOR MATERIALS AND COASTAL RESEARCH, GERMANY; INSTITUTE FOR ENVIRONMENTAL STUDIES (IVM), VU UNIVERSITY, AMSTERDAM; INTERNATIONALES INSTITUT FUER ANGEWANDTE SYSTEMANALYSE (IIASA)
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1 Introduction

1.1 Multi-sector partnerships (MSPs)

The main goal of the ENHANCE project is to develop and analyse new ways to enhance society's resilience to catastrophic natural hazard impacts. Key for achieving this goal is to analyse new multi-sector partnerships (MSPs) that aim at reduce or redistribute risk, and increase resilience. This document introduces a working definition of partnership, where MSPs are understood as (Rhodes, 1997):

voluntary but enforceable commitments between partners from different sectors (public authorities, private services/enterprise and civil society), which can be temporary or long-lasting. They are founded on sharing the same goal in order to gain mutual benefit, reduce risk and increase resilience.

New forms of MSPs are needed, since it appears that existing partnerships are often not effective in managing risk from natural hazards (e.g. Evans, 2012). For example, the different responses to heat-waves and floods in Europe demonstrate that the roles of public, private, and civil society actors (including individuals) in preparing for and responding to catastrophic impacts are often neither clear nor effective. Moreover, actors must often base their risk management strategies on scarce, limited, or inaccurate risk information. Together, these factors can lead to the development of ineffective (prevention and mitigation) and unacceptable measures and unexpectedly large impacts of natural disasters (financial, ecological, health, and social). Moreover, in preparing for and responding to natural hazard impacts, there is also often a lack of clarity on financial responsibilities about who pays what, how much, and when.

Hence, knowing the challenge of managing risks resulting from natural hazards has increased, it becomes clear that these risks cannot be handled by either private sector of the government as single actors, and strategies to increase resilience should therefore incorporate all sectors of society (including closer cooperation between sectors).

1.2 Assessing healthiness of MSPs

In this first phase of the ENHANCE project, WP2 aims at bringing together different key concepts in order to analyse MSPs. These concepts are resilience, governance and risk assessment. This deliverable (2.4) is the final report of Work Package 2. It provides the 10 ENHANCE case studies with a conceptual framework for both, assessing on the healthiness of an existing MSPs, and provide a framework which can be used to assess whether MSPs can be improved, in order to better manage risk and increase resilience.

The framework encapsulate the key concepts extracted from three previous deliverables (D2.1, 2.2, 2.3). Resilience concepts and indicators in the context of MSP development are presented in D2.2. These have been merged with a framework for analysing (un)successful governance processes in MSPs, as presented in D2.3. Finally, D2.1 presents a catalogue of risk assessment and management tools, which can be used to assess current and future risks.

The presented framework is the product of iterative and collaborative process, which will continue throughout the project. Hence, the version therein does not represent a finalised version in so far as it accommodates the possibility for future changes to reflect partner inputs as context research progresses. Moreover, it should be highlighted that the purpose of this report, and the presented framework, is to serve as flexible and integrative tool within the project, not a representation of completeness or rigid prescription.

Applying the framework will support the cases drafting their first risk profiling report (D7.1). The Risk Profiling reports for each case study, will be presented during the Annual meeting of ENHANCE in Portugal, January 2014. The risk profiling report will provide the first important feedback on the applicability of the presented MSP framework.

Note: It is important to note that this framework is a concept, which will be further developed throughout the project. Each case study will likely delineate and unpack the terms used in framework in different ways. It also likely that partners will focus on parts of the framework as opposed to its entirety, this is a reflection of the framework as a thought process for situating case study work and not a complete conceptualisation of assessing resilience and role of MSPs.

2 Rationale: MSPs, governance and resilience

2.1 MSPs and building resilience to disaster risk

Report D2.3 presents an overview of the literature on resilience, which constitutes a broad realm of theories, methods and concepts. Building of resilience through MSPs is key to ENHANCE, which therefore seeks to operationalise concepts of resilience through case study analysis – for example, by producing resilience indicators and consequently measuring them.

While tentative first steps have been made in generating indicators or criteria to begin measuring resilience (e.g. Twigg 2009), understanding on how to properly contextualise resilience indicators, and on the specific data needs required, remains challenging. However, D2.3. shows there is growing consensus of understanding the main components of resilience. For this, the EmBRACE (2012) project is a key source, which is dedicated to empirically investigating resilience and has systematically trawled the literature in an attempt to draw out its main components (Annex 1). Figure 1 shows the results of Bahadur et al. (2010) why summarized the main components of a resilient system.

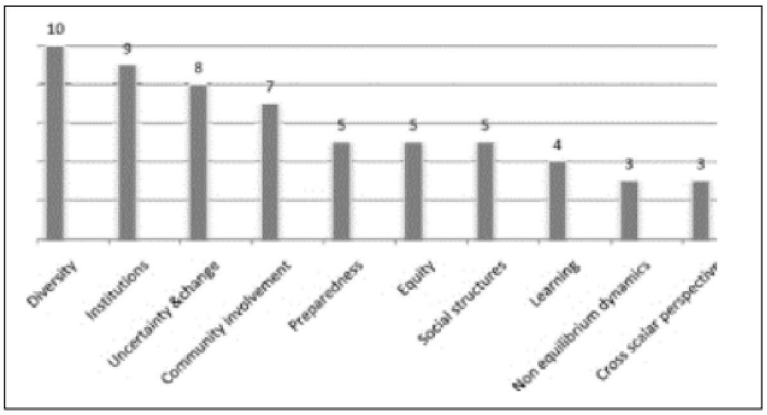

Figure 1. Higher level components of a resilient system taken from a robust literature review (Bahadur et al 2010).

These higher level components of resilience have been further analysed as to how they can be integrated into a framework for analyzing the effectiveness of MSPs for increasing resilience. The problem here is, that within social sciences, the issue of resilience is primarily concerned with studying highly integrated systems as a unit of analysis. However, since the ENHANCE project seeks for resilience indicators for analysing MSPs, a focus is needed where resilience is studied in the context of *how* partners cooperate in order to reduce risk. Therefore, reports 2.2 and 2.3 recommend focusing on (resilience-) indicators related to 'governance' as a cross-cutting theme for studying resilience and MSPs. An important source here is the research by Twigg (2009),

who emphasises the importance of stakeholder partnerships designed to increase resilience and reduce risk. Twigg describes 11 factors, which may provide a basis for identifying 'healthy' characteristics of an MSP for building resilience, or to shape new partnership development. The factors (See Section 3.2, table 1) are:
Integration of activities; shared vision; consensus; negotiation, participation, collective action, representation, inclusion, accountability, volunteerism; trust.

2.2 Capital approach: analysing the 'healthiness' of MSPs to manage risk

However, it remains quite challenging to convert these 11 resilience –governance- factors into measurable indicators, which would allow cases to evaluate whether an MSP is effective in producing measures that increase resilience. Report 2.3, therefore, introduces the "capital approach', which aims at studying governance processes of MSPs.

The Capital approach has its origin in the concept of sustainable development. The aim of the five capitals, being stocks or assets to e.g. MSPs, is their capacity to produce flows of economically desirable outputs (Goodwin, 2003). In the case of risk management, capitals are not only limited to economic characteristics. They provide partnerships with the capacity of being able to react to natural hazards.

Capital is then understood as the assets, capabilities, properties or other valuables which collectively will represent the good functioning of a partnership. The capital approach differentiate between five capitals: *financial, social, human, natural (environmental)* and *political capital* --the latter has been added in this project and refers to the capability of institutions to enact rules, laws or frameworks that might change the course of actions. Each of the 11 resilience indicators as described in Section 2.1, can be allocated within a capital. This is done in Chapter 3. The 5 capitals can be described as:

- **Social capital:** the relations (ships), networks and shared norms and values that qualify and quantify social interactions, which have an effect on the partnership productivity and well-being.
- **Human capital** is focused on individual skills and knowledge. It includes social and personal competencies, knowledge to be gathered from formal or informal learning, the ability to increase personal well-being and to produce economic value. In the case of partnership the human capital will be the addition of its individual skills and knowledge
- **Political capital** focus on the governmental processes, which are done/performed by politicians who have a political mandate (voted by the public)

to enact policy. It also includes laws, rules and norms which are juristic outcome from policy work.

- **Financial capital** involves all types of wealth (funds, substitutions etc.) that are provided , as well as financial resources that are bounded in economic systems, production infrastructure as well as banking industries. Financial capital allows fast reactions in disasters.
- **Environmental capital** comprehends goods and values, which are distinct from land, environment or natural resources.

The capital approach can be used to analyze (un)successful partnerships by looking in detail at these five capitals of a partnership. The rationale behind this approach is that the maintenance or enlargement of the five capitals will assure the capability of a partnership to react to environmental hazards. In an ideal situation a sustainable MSP will focus on maintaining and/or enhancing its capitals. The quality of these 5 capitals is contingent upon existing development and health baselines, as well as the legacy of past disaster impacts.

2.3 The Enhance Framework

The relation between resilience, good governance of MSPs and the capital approach is illustrated in Figure 2. The Figure shows the key components that determine the level of resilience (likelihood of it increasing) of an exposed population or community (present at multiple scales) to disaster risk.

Central in the ENHANCE project are the MSPs, which are envisaged as important resilience mechanism. MSPs can reduce risk and increase **resilience** through taking disaster risk management (**DRM**-) **actions**. The healthiness of MSPs determines the capability to take action. Healthiness of MSPs and likelihood an MSP to successfully increase resilience, is determined by the 5 **capitals:** human, social, financial, environmental, and political.

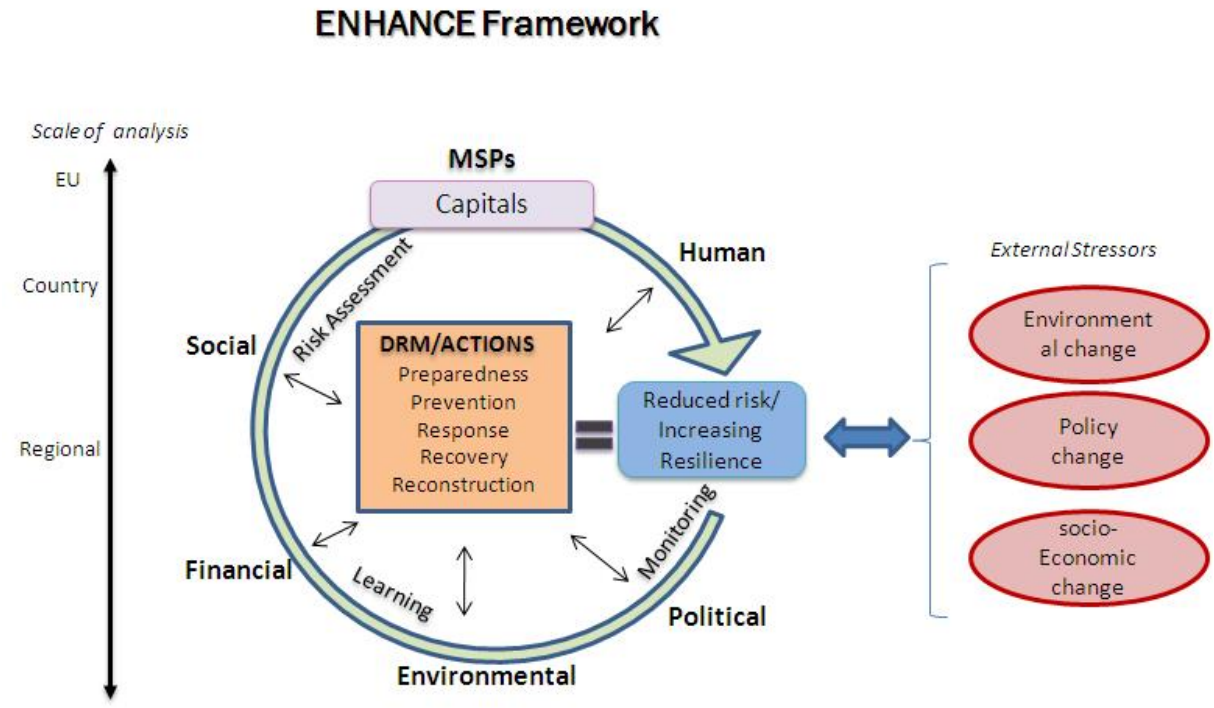

Figure 2. Setup of the ENHANCE framework for assessing the healthiness of MSPs to reduce risk or increase resilience.

The 5 capitals themselves can be upgraded through **learning** processes. For example, innovation, and lessons from recent disasters, provide novel information and experiences to MSPs who can alter their actions according to this information. **Risk Assessment (RA)** is an important anticipatory form of learning to provide MSPs with information on whether their actions increase resilience (e.g. Williges and Mechler, 2013). And finally, the whole system of MSPs, governed by their capitals is influenced by **external stressors** such as climate trends or political change.

A movement towards resilience will generally occur when various capacities, risk management activities, and learning processes are combined, and realised in co-ordinated actions, programmes and investments. When such approaches reduce risk to a community or population, simultaneously, the level of resilience will start to increase as they move along a new development trajectory.

We briefly elaborate on a few of these elements in the framework, to clarify their meaning:

Actions

Resilience of a community or system (at all scales), and likelihood of increasing resilience by an MSP will be significantly shaped via the quality of disaster risk management (DRM)

actions conducted by an MSP. The Figure 2 uses the five DRM actions from the iterative disaster management cycle (see report D2.1): *preparedness, prevention, response, recovery and reconstruction).*

Scale

A ranging scale bar eludes to the variety of cases, and the differences in their –geographical- scales in work package 7. This is in acknowledgment that resilience and the systems in which MSPs operate at different scales, from the local, national to regional (in this case European) and finally global. Hence, we define a unit of analysis in a flexible manner. For example, an MSP at city wide level (e.g. London) will incorporate multiple actors from different sectors. These will include local government, health services, operators of infrastructures, social services, community based NGO's etc. Moreover, EU, global and national actors will be important to some case studies concerning the EU solidarity fund. For ENHANCE, these actors in MSPs are of interest because they shape levels of resilience by taking action --or no action, which MSPs are not yet developed.

Learning

In the ENHANCE framework (Figure 2), learning is defined as the –iterative- driving force for upgrading the 5 capitals, and hence the capacity for MSPs to manage risk and reduce resilience. With learning we refer, for example, to experience with historical events, how this shaped a culture of risk, and this provided incentives for innovation and experimentation (e.g. Folke 2006). This may include the transfer of knowledge from different actors, policy and sectors based on new information, or better dissemination of current knowledge. MSPs can *learn*, both retrospectively (lessons of past) and anticipatory learning in relation to current and future risk. This learning process of MSPs can be facilitated by iterative policy processes, promoting risk awareness and co-and adaptive management (co-operation and / or exchange with other MSPs), and reflective practice between actors from a variety of sectors.

An important element of learning is *Risk perception.* This may represent a capacity or ability of actors (institutions and individuals) to have a risk awareness of future disaster risk and/or better understand the likelihood of current impacts. Knowledge from Climate prediction models, for example, could be a source of this awareness.

Risk assessment (RA) and learning

Risk assessment (anticipatory learning) looks to understand future permutations, constantly updating projections on risk scenarios through risk assessment and reflection (e.g. Tschakert and Dietrich, 2010). Risk assessment is not only needed to enhance resilience, but can play an important part in measuring the relative influence of MSP on

risk reduction through its actions. Evaluation and monitoring plays an important role, as it drives assessing the appropriateness of risk management activities/strategies within both current levels risk, and also in anticipation of future conditions.

External stressors

Each of the described MSP system (represented as a circular loop), interact with external stressors such as: *natural hazards, environmental change (e.g. climate change), social economic* and *policy change.* Such changes have the ability to distort, block or facilitate resilience processes represented along the circles.

Culture of Risk

Risk culture relates to the behaviour of the people within an organization in relation to risk management. Every culture constructs their risk and their response to risk depending on their cognition – a network of experience, knowledge, and culturally framed perception (e.g. Ratter, 2013).

3 Assessing healthiness of MSPs: Factors and indicators

Having the 5 capitals as key assets for ensuring 'healthy' MSPs, the next step is to develop a framework which facilitates a practical implementation of the capital approach in Case studies. This step in detail has been worked out as well in the task 2.3 of WP2. These detailed analysis have been done by developing measurable indicators for analyzing good governance processes in each capital. This is done in two steps (Figure 3): first, each capital is divided into factors. Second, each factor is sub-divided into measurable indicators.

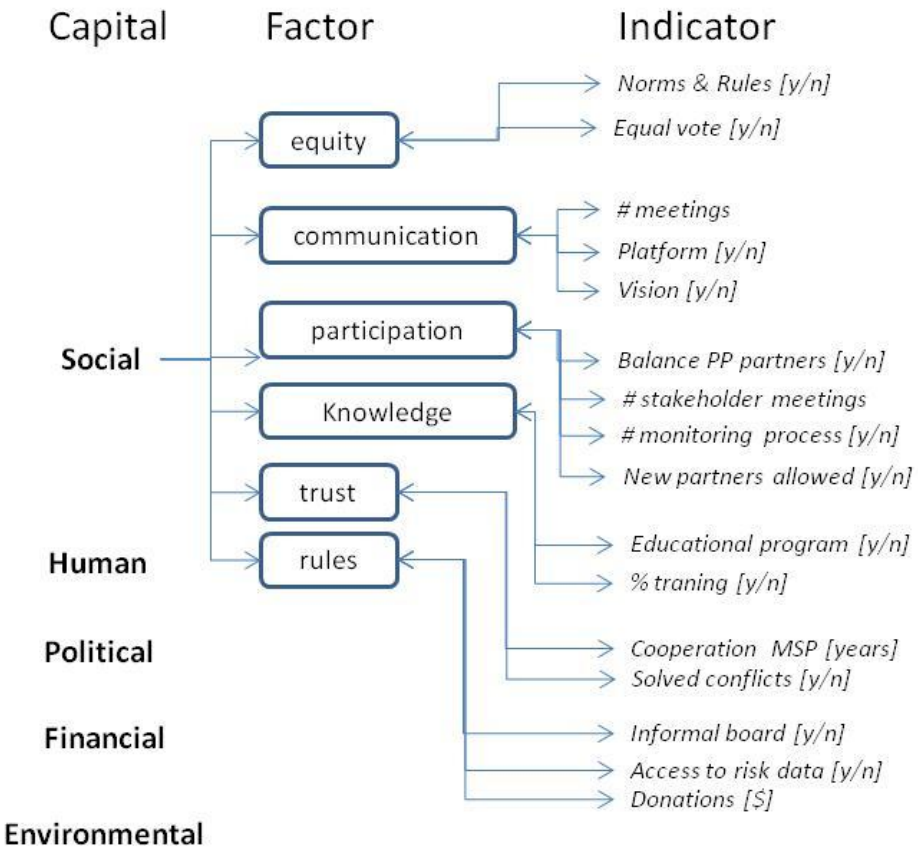

Figure 3. Example for breaking down capitals into factors, and factors into measurable indicator. The example here is given for social capital only. Each indicator should provide information on the healthiness of an MSP to reduce risk or increase resilience. Note that indicators and factors differ for each case study, and this example is based on the Waddensea case study in the ENHANCE project.

3.1 Factors per capital

The five capitals are further shaped according to the following factors:

Social capital

Equitable treatment of all partners includes an open process for all stakeholders during all stages of the process (in design, realization and assessment), also providing opportunity for the civil and economic sector to participate in decision-making processes.

Communication and information: Communication processes between all partners are essential for a successful governance process. Open access for all partners/actors within a collaborative process to all information that is used, applied and created in this collaboration is an important key element.

Participation is the ability to join a governance process and to act within it. For MSPs it is important to integrate partners from all different sectors that deal with (effects of) a risk in a specific risk area. A balanced share of partners from different sectors is the basis of a comprehensive participation process.

Knowledge is based on experiences as well as on cultural and historical contexts. Improved knowledge about risks can allow individuals as much as society to increase their resilience.

Trust (in stakeholder, other partners): Trust helps to sustain a co-operative social climate, to facilitate collective behaviour and to encourage a regard for the public interest. "The acknowledgment that trust and relationships underpin social learning" (Pelling and High, 2005)

Rules and norms of society: Formal and informal rules and norms in a society depend on the historical and cultural context. The extents to which actors have confidence in and abide by these formal and informal rules and norms are important key elements for successful cooperation processes.

Human capital

Skills and competencies: Skills, Health, knowledge and experiences are closely connected to factors like risk awareness and preparedness. Preparedness includes knowledge about practical measures and how to act in the face of risk events. Indicators may include level of education attainment or good health (Mayunga, 2007).

Political capital

Transparency and trust in political actions: Trust and transparency in interaction processes between civil society/stakeholders and government is important for productive partnerships. Clear and comprehensive communication of aims and interests between the stakeholders implement trustful and democratic cooperation improving a successful participation process. Therefore, independence of media institutions from governmental structures is important to guarantee freedom of information.

Regulatory framework: formal rules and norms: Presence of qualitative regulatory framework(s), which attests the government's ability to implement sound policies with respect to permit and promote development especially in the private sector.

Consensus: Between partners about the (main) goal, method and strategy of operation etc in order to create good working relations within a partnership. This factor is closely related to trust, equitable treatment and open communication processes between all partners.

Financial capital

Disaster funds: Existence of disaster funds that provide short-time as well as long-term financial support to affected populations, industries and service providers. These funds help to keep up basic services as well as provide resources for reconstruction processes. An an important example is insurance systems. They are based on the principle of risk transfer and its related losses/damages from one entity to another in exchange for payment.

Risk of impoverishment: Losses and damages resulting from natural risk and hazards. Including losses of personal assets and economic losses (industry or tertiary sector) can have negative influences on the economic power as well as social structures of an area. In order to cope with these problems, adequate measures have to be implemented (e.g. insurance).

Environmental capital

Regeneration of environment: Actions taking by the society on regeneration of the environment, which has been affected by a natural hazard, could support the recreation process of the environment to recover the ecological status before the hazard event happens. Both, the environment as well as the society may benefit from these actions.

Management strategies and planning processes: Planning processes are important in implementing protection as well as management strategies from legal framework to action. The amount and quality of planning processes in risk management can provide an impression of the practical efforts.

3.2 Governance indicators for ENHANCE

These factors, mentioned above can be characterised and measured by different indicators, which are presented in table 1. These indicators are given in order to present information on the healthiness of an MSP to reduce risk or increase resilience. These indicators represent a first theoretical framework for governance indicators to analyze successful governance processes in MSPs. Based on the characteristic of this document as a living document, suggestions from all case studies with regard to hazard specific indicators are welcomed. Based on these feedbacks and suggestions, the theoretical

framework will be enhanced in order to work out an analytical framework to analyze successful governance processes as one result of the ENHANCE project.

Motivations for risk partnerships are inevitably contingent upon specific context, type of disaster risk, etc. Therefore the case study feedback should be in context of the hazard. Other considerations should be focused on does an indicator exists in practice, is yet to be achieved, or has meet a certain part of a criteria which perhaps suggests progress but further efforts are needed. Additionally, the last column “Information by case studies” can be used to further describe specific situations and experiences related to the indicator. It should be noted that indicators are only examples and case study leads should assess whether they are relevant to their needs, so future refinement can be made.

Table 1: Factors (un)successful risk governance processes in MSPs.

		Capitals, Factors and indicators of (un)successful risk governance processes to improve resilience through MSPs		
Capitals	**Factor**	**Indicators related to factors**	**Unit**	**Case Studies: Are indictors 1. observable or relevant: yes, no? 2. At what scale are indicators analysed?**
Social capital	Equitable treatment of all partners	- There exist formal norms and rules to foster the democratic process. All members have an equal say in decision-making processes.	Y /n	
		- (Equal) vote of all partnerships members in processes of formal voting	Y /n	
	Communication and information	- Extent of a transparent and established communication processes like periodic reports, meetings, etc. guaranties the flow of information	Y /n	
		- Existence of platforms, committees and networks where all representatives can join the process of information exchange	Y /n	
		- Information available on both risk governance and management structures e.g. presented on different information channels? Available in different languages?	y/ /n	
		Evidence of a shared vision and objective within a partnership (e.g. written in documentation)	y/n	
	Participation	- Amount or balance of partners from each sectors (public, private, civil) within a collaboration	y/n	
		- Amount of periodic formal meetings of stakeholders who are involved in continuous networking processes	# number	
		- Implementation of monitoring processes (e.g. internal or external audits)	y/n	
		- flexibility to accommodate new partners (e.g. is it possible without causing significant to MSP implementation)	y/n	
	Knowledge	- Existence of educational programs for participating representatives and/or awareness campaigns for society at large	y/n	
		- Percentage of trained individuals /institutions in relation to the target group of the specific program	% in MSP	

		- Existence of subjects in the curricula dealing with regional risk		
	Trust (in stakeholder, other partners)	- Existence/knowledge about influences on trust/beliefs resulting from historic events or cultural behaviour existing in a risk area	??	
		- Existence of longstanding cooperation between the same representatives which create trust between them – (medium duration of participation)	# years	
		- Experiences of mutual (successful) conflicts and problem solution	y/n	
	Rules and norms of society	- Existence of informal boards/groups resulting from cultural-historic development	y/n	
		- Monitoring tools to register pas events in the risk area and provide /access to these registrations for all actors	y/n	
		- Solidarity in society, e.g: - Amount of donations given from the society to a specific hazard event - Mobilisation of volunteers in the face of risk	$ donation to MSP y/n	
Human capital	Skills and competencies	- Level of education (could be given for example by PISA inform)	[#PISA]	
		- Are practical DRM measures taken in private households?	y/n	
		- Percentage of membership organised in non-governmental and governmental technical aid organisations (fire brigade, red cross, THW, etc) amount of Voluntary work -	%	
Political capital	Transparency and trust in political actions	-Periodic submission of new laws or decrees in a public document	# of new laws	
		- Percentage of population taking part in elections - Periodic statistical surveys published - reflecting the opinions of the population in regards to governmental work	% elections	
		- Existence of comprehensive anti-corruption policy	y/n	
		- Existence of laws/declarations, etc. in order to provide legal basis for the freedom of media	y/n	
	Regulatory framework: formal rules and norms	- Permanency of risk related laws/regulations (time period)	y/n	
		-Periodic revision and updates of laws and regulations concerning the protection against hazards and the management of disasters	y/n	
		-Existence of emergency plans (level of detail)	y/n	

		-Existence of obligation to obtain insurance	y/n	
		-Existence of risk maps	y/n	
	Consensus	- Consensus of all partners regarding their role, including how to achieve specified aims - is there consensus on any formal/informal rules (including contracts) that guide partnership characteristics and collective action	y/n	
Financial capital	Disaster financing (see table 2 which goes into greater detail, focusing indicators of PP's in insurance)	- Amount of disaster expenses of the total environmental budget	$ or [%GDP]	
		-Amount of existing disaster funds related to goods and values that exist/are stored in the risk area	$	
		- Ratio of public and private investments on disaster funding	P/P ratio	
		- Percentage of households/institutions that have insurance related to a specific risk area	% insurance	
		Are funds (e.g. insurance) equitable to all actors involved? (e.g. government, private companies, individuals)		
		- Percentage of damages that were covered by insurances during the last events.	%	
	Risk of impoverishment	- Number of enterprises with insurance related to the specific threat in risk areas	%	
		- Existence of rights of compensation (offered by the government); amount of these compensations	y/n	
		- Quality of supply of public goods in general is e.g. HDI	HDI	
Environmental capital	Regeneration of environment	- Percentage of ecologic compensation area per total area	%	
		- Number of post disaster local actions taken for environmental regeneration	#	
	Management strategies and planning processes	- binding force of legal frameworks/regulation	y/n	
		- Binding deadlines/schedules for implementation processes		
		- Amount of public investment in protection strategies	$	
		- Percentage and share of different land use types within the risk area (in order to implement targeted strategies/actions)	%	
		- Amount of protected area within the total risk area	#ha's	

4 Indicators for Public-Private Insurance partnerships

A special case of MSPs in the ENHANCE case studies are insurance partnerships. Like in other sectors, the rapid increase in global economic losses in recent years from natural hazards has initiated a discussion among insurers and governments within risk zones about whether (extreme) risks from natural hazards are still insurable in the future with current insurance partnerships (Botzen and van den Bergh, 2008).

Although in some countries, or for some specific hazards, natural disaster insurances are mainly offered by private insurance companies, in other cases they are set up in varying forms of collaborations between the government and the private insurance sector (Public-Private partnerships, PP). In PP insurance systems, the government and the private sector cooperate in sharing risks or selling insurance policies with the aim to achieve a high market share and to make optimal use of the expertise and capacity to carry risks of both sectors, while the government role in a fully private system is very limited, such as only a regulatory role.

We here present two sets of factors and indicators which can be sued by cases having insurance partnerships for assessing the effectiveness of managing, or sharing risk as well as how they provide incentives to DRM; One focusing on technical details (section 4.2) and a more general approach to partnership and DRM characteristics (Section 4.1).

Note that WP5 of ENHANCE aims to further explore the economic dimension of MSPs For example, Task 5.3 in WP5 will develop a methodology to evaluate how existing insurance schemes can contribute to risk reduction, which can then be applied to the insurance –related case studies. In addition, a special ENHANCE workshop will be organized around the topic of PP flood insurance in Munich 2013.

4.1 Technical indicators for assessing insurance MSPs

A first set of Indicators are developed that can be used by the ENHANCE (insurance-) case studies to analyse existing PP insurance partnerships, or how such partnerships should be developed to better manage risk. The indicators were developed in D2.3, and are derived using an international comparison for two major catastrophe risks: flooding and earthquake. Based on these indicators, the technical aspects of the reliability and the sustainability of PP insurance schemes can be studied. For example, what are the differences in premium pricing, coverage, funds management, and incentives for risk-reducing measures, and, how do they influence the overall performance of insurance systems in reducing or covering residual risk?

Table 2 provides the indicators and they are classified in 3 main components: (1) general characteristics; (2) funding conditions; and (3) achievement of disaster risk reduction (DRM).

General characteristics

The general characteristics describe the main features of a system, such as year of establishment, whether it is a voluntary or mandatory system and the main roles of stakeholders from the public and private sectors. Furthermore, the main characteristics of insurance arrangements are determined by the size of the catastrophe risk, which consists of the standard disaster return period, and the damage that can be expressed as a percentage of GDP. The damage and frequency of the hazard can influence the degree of responsibilities that each stakeholder takes on within the system. The market penetration rate of an insurance scheme indicates how many people are covered by the insurance. Sometimes insurance is compulsory in order to achieve a high market penetration rate. In PP systems, where the government covers part of the damage, indemnities may be paid, conditional on an official trigger in the form of an official declaration of a disaster.

Funding and coverage conditions

In terms of funding, coverage conditions on the hazards that the insurance covers are important indicators. Another important feature is whether or not an insurance scheme covers only direct- or also indirect damage, such as business interruption losses. The extent of coverage varies per system and is often set as a maximum compensation per policy for buildings or contents, or an overall maximum amount of damage covered per event, or a combination of these two (Michel-Kerjan and Pedell, 2005). Another limit on the indemnity paid can be set by a deductible, which is the portion of damage that the policyholder must pay before the insurer covers expenses. The main sources of funding for an insurance system are earnings from premiums, reinsurance coverage, reserves, or financial contributions from the government in the form of either direct compensation or as a state guarantee. Premiums can be either risk-based or flat, and are determined by insurers, the government or by representatives of both. Insurers can be stimulated to build up sufficient financial reserves by special tax benefits.

4.2 Insurance Partnerships and DRM

In order to achieve long-term sustainability of an insurance arrangement, the partners in an insurance MSP need to integrate adequate incentives and policies that encourage disaster risk management (DRM) (Botzen and van den Bergh, 2008). In-depth studies of

hazard-prone areas and risk-zoning are essential to manage different catastrophe risks, to adopt appropriate mitigation measures in high-risk areas, and to set up post-disaster relief plans. In addition to risk reduction strategies implemented by the government and insurers, policyholders can often limit potential damage by taking risk-reducing measures. Insurers can reward policyholders who voluntarily reduce their risk by lowering the level of deductibles and premiums.

Within ENHANCE, most insurance cases are on flood risk and for the flood insurance debate it is important to consider how MSPs in flood insurance either support or possibly hampers flood risk management. Its effectiveness heavily relies on the underlying prevention and damage control. If risks are left unmanaged insurance may become invalid, particularly if provided by the private sector. In this context un-insurability or increasing costs of insurance can be seen as indicators of lack of risk management. Therefore design and operation of a flood insurance scheme should have good risk management behaviour in mind and be designed to avoid moral hazard.

A framework with factors to assess existing and planned insurance schemes and their incentives for DRM is proposed below. It is based on previous work from Crichton (2008), Paudel (2012), and Surminski & Oramas-Dorta (2013) and aims It aims at testing different ways of flood insurance supporting physical flood risk reduction:

1. Do flood insurance schemes increase risk awareness and knowledge about risks - such as the provision of risk-relevant information and knowledge transfer to educate policy-holders and the public?
2. Does flood insurance increase capacity for risk reduction by informing about the benefits of flood risk management and preventive measures?
3. Are there any explicit financial incentives that the insurance provides to policyholders to invest in mitigation;
4. Promotion of resilient reinstatement techniques after a flood loss;
5. Incentives for public policy;
6. Compulsory risk reduction, such as requiring policy holders to take certain preventive measures as a condition for cover;
7. Incentives for not developing in flood risk areas

A first attempt to convert these general factors into measurable indicators is illustrated in Table 2 under the category ‘DRM’

Table 2. The main components and indicators of public-private natural disaster insurance systems.

	Indicators	***Description***
General characteristics	*Programme name and year of establishment*	The official name of a private or an insurance scheme and the year of the establishment;
	Programme duration	The duration of a programme, which is either on a temporary or permanent basis
	Standard disaster return period	The reoccurrence probability, which is the return period in years for a specific disaster that is generally used to assess actuarial risk-based premiums and coverage
	Damage intensity	Estimated damage in absolute value and as a % of GDP, caused by a specific hazard within a given period
	Compulsory coverage	Whether participation in an insurance system is mandatory or voluntary for the insured
	Market penetration	The % of homeowners in a given region or in a country who have purchased insurance products against a specific catastrophe risk
	Official trigger	Whether an official disaster declaration is needed before the insurance takes into effect, and, if applicable, the predefined minimum damage level before the declaration is granted
	Responsibility public sector	The main responsibilities of the public sector in the insurance system
	Responsibility private sector	The main responsibilities of the private sector in the insurance system
Funding	*Hazard covered*	The covered catastrophic hazards e.g. earthquake, flood, storm, hail, volcanic eruption
	Damage covered	Type of damage covered; e.g. damage to residential or commercial property and contents, casualties, or business interruption damage
	Limit of indemnity	The overall and per policy limit of coverage in US$
	Individual policy deductibles	Amount of loss that a policyholder pays before the insurance starts paying
	Premium setting	By whom the premiums are determined, and whether they are risk-based or flat
	Premium level	The level of insurance premium for a specified risk for a specified period of time in US$ (numbers are indicative).
	Reinsurance	Whether a PP system uses reinsurance for hedging risk, and whether this is obtained from public or private reinsurance, with or without a state guarantee
	Reserves and special tax treatment	Whether, and how, a PP insurance system builds up financial reserves, with or without a tax exemption
DRM	*Integration of risk mitigation and preventive measures*	Whether, and how, the damage mitigation and prevention measures are integrated into the insurance programme
	Risk zoning and risk maps	Whether there are risk maps available that show hazard-prone areas

	Incentives based on premiums	Whether risk-based premiums provide policyholders with incentives to undertake mitigation measures
	Incentives based on deductibles	Whether risk-based deductibles provide policyholders with incentives to undertake mitigation measures

5 Risk Assessment

5.1 Inventory of existing risk assessment tools in case studies

We now discuss quantitative and qualitative risk analytical methods that are in use in the specific case studies to encourage risk assessment and anticipatory learning. The following Table 3, based on a review with the cases studies in the summer of 2013, provides an overview of the methods being used organised around the different stages of the iterative risk-management cycle. The disaster management cycle aims at the implementation of effective, efficient, equitable and acceptable risk management options by systematically conducting, (a) risk identification and analysis, (b) Evaluation of risk management options (c) Supporting the implementation of options (d) Monitoring the impacts of implemented risk management measures (see deliverable 2.1).

Based on the assessment of the current status quo of the usage of methods (which will be subject to change over the course of the project), we find that ENHANCE partners and cases employ a multitude of methods. All case studies base their analyses on empirical impact data, which if used continuously over time allows for monitoring risk. In terms of risk identification and analysis, qualitative approaches are as well decisive for identifying the risks as well as dominant drivers of risk. In terms of assessing risk, interestingly, analysis focussing on risk perception was only mentioned once. Risk modelling, employing among others, extreme value statistics would be used in most cases. Again of interest, according to this quick survey, these methods currently would employ frequency approaches only, and Bayesian techniques were not mentioned yet. Concerning decision-tools for evaluating risk management, all three key techniques (CEA, MCA and CBA) receive application. A number of cases currently plan to use stochastic simulation, and two stochastic optimization techniques.

Based on the described methods, Annex 2 provides additional tools that have been developed to assess and manage. A number of tools (EM-DAT, CATSIM, AquaCrop, AQUATOOL and the IWRM toolbox; entries in table marked in grey) listed are currently run or available with the ENHANCE project consortium. It is envisaged, that more and other tools will be employed in the course of the project.

Table 3. Summary of current usage of methods in ENHANCE case studies.

	Risk monitoring	Risk identification and analysis				Evaluation of risk-management options				
	IA	QA	RP	RM	BA	CEA	MCA	CBA	SS	SO
Drought management in Jucar river basin district	x	x		x		x	x	x	x	x
Flood risk management for Rotterdam Port infrastructure	x	x		x				x		
Health preparedness and heat wave response plans	x	x		x		x				
Air industry response to volcanic eruptions	x	x								
Risk culture, perception & storm surge management (Wadden Sea)	x	x	x				x			
Climate variability & technological risk in the Po basin	x	x		x			x		x	
Flood risk and climate change implications for MSPs, London	x	x		x		x		x	x	
Building railway transport resilience to alpine hazards	x	x		x		x		x	x	
Insurance & forest fire resilience, Chamusca	x	x		x				x	x	
Testing the Solidarity Fund for Romania and Eastern Europe	x	x		x		x		x	x	x

Note: IA: Impact Analysis, QA: Qualitative analysis, RP: Risk Perception, RM: Risk modelling; BA: Bayesian analysis; CEA: Cost-effective analysis; MCA; Multi-criteria analysis; CBA; Cost Benefit Analysis; SS: Stochastic Simulation; SO: Stochastic Optimization

5.2 Definitions of Risk Assessment tools

Impact Analysis (IA) : Impact analysis empirically studies the consequences of natural hazards and climate change and gathers information needed to develop recovery options. Information in that regard can be taken from various sources, such as the EMDAT database, which is the most comprehensive disaster database and for a multitude of events covers disaster impacts, such as people affected, killed and monetary losses (CRED, 2013).

Qualitative analysis: Risk studied through a qualitative risk assessment is descriptive and/or categorical in nature and not directly tied to a quantifiable risk measure. Qualitative risk assessments are commonly used for screening risks to determine whether they merit further investigation, and can be useful in preliminary risk management activities. However, they very well may also provide the needed information and additional analysis to answer specific risk management questions

Analysis of risk perception: Risk perception is the judgment about the characteristics and severity of the natural hazards risk using mental, rather than numerical models (see IPCC 2012; for ENHANCE project details see Wadden Sea case study). Risk perception is shaped by cognitive, cultural and social factors (Slovic, 2010) and plays an essential role in judging if or if not to implement risk reduction measures.

Risk Modelling: Modelling disaster risk is a key tool to study potential impacts using numerical approaches. Four different types are worth noting. These are 1) Extreme value theory and frequency analysis 2) Scenario generation 3) Multi risk, dependences and cascading effect 4) Bayesian analysis (these techniques are elaborated on in Del.2.1)

Cost effective analysis: Cost benefit analysis is a decision-making assistance method that identifies the economically efficient way to fulfil an objective by comparing benefits and costs of two or more courses of action.

Stochastic simulation : Comparing and evaluating different risk management options are based on running a large set of scenarios using different simulation techniques, e.g. Monte-Carlo simulation or optimal quantization.

Stochastic Optimization: Stochastic optimization is a decision-making technique to maximize or to minimize objective functions in a stochastic context. In this case, the optimal decision can be derived using stochastic optimization methods (single-stage stochastic programming, multi-stage stochastic programming) using generated samples from the empirically estimated loss distribution

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7 References

Bahadur, A., Ibrahim, M. & Tanner, T. (2010). The resilience renaissance? Unpacking of resilience for tackling climate change and disasters. Available at: http://opendocs.ids.ac.uk/opendocs/handle/123456789/2368 [Accessed September 20, 2013].

Botzen, W.J.W. and van den Bergh, J.C.J.M. (2008). Insurance against climate change and floodingin the Netherlands: Present, future and comparison with other countries. Risk Analysis, 28(2): 413-426.

Embrace (2012) http://www.embrace-eu.org/

Evans, J.P. (2012) Environmental governance. London: Routledge.

Folke, C., 2006. Resilience: The emergence of a perspective for social–ecological systems analyses. Global environmental change. Available at: http://www.sciencedirect.com/science/article/pii/S0959378006000379 [Accessed September 10, 2013].

IPCC, Intergovernmental Panel on Climate Change (2012). Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation, Cambridge University Press, New York, USA.

Goodwin, N. (2003). Five Kinds of Capital: Useful Concepts for Sustainable Development. Global development and environment institute. Working paper 03/07, Tufts University.

Mayunga, J.S. (2007) 'Understanding and Applying the Concept of Community Disaster Resilience: A Capital-Based Approach', draft working paper prepared for the summer academy, Megacities as Hotspots of Risk: Social Vulnerability and Resilience Building, Munich, Germany, 22–28 July 2007

Michel-Kerjan, E.O. and Pedell, B. (2005). Terrorism risk coverage in the post-9/11 era: A comparison of new public-private partnerships in France, Germany and the US. Geneva Papers on Risk and Insurance−Issues and Practice, 30(1): 144-170.

Paudel, Y., Aerts, J., Botzen. (2012) W. Public private catastrophe insurance. Geneva Papers on Risk and Insurance, 37, 257-285

Pelling, M. and C. High. 2005. Understanding adaptation: What can social capital offer assessments of adaptive capacity? Global Environmental Change, Volume 15, Issue 4, pp. 308-319

Ratter, B.M.W (2012). Complexity and emergence. Key concepts in non-linear dynamic systems. In: Glaser M, Krause G, Beate M.W. Ratter, Martin Welp (ed): Human-nature interactions in the anthropocene. Potentials of social-ecological systems analysis. New York, 90–104.

Rhodes, R. A. W. (1997). Understanding governance: policy networks, governance, reflexivity and accountability. Buckingham.

Slovic, P. (ed.) (2010). The Feeling of Risk: New Perspectives on Risk Perception. Earthscan, London, UK.

Surminski, S., and Oramas-Dorta, D. July 2013. Do flood insurance schemes in developing countries provide incentives to reduce physical risks? Working paper, Grantham Research Institute, London, UK. Download PDF of paper| (433KB)

Tschakert, P., and K. A. Dietrich. 2010. Anticipatory learning for climate change adaptation and resilience. Ecology and Society 15(2): 11.

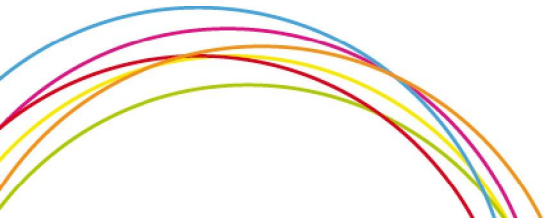
Twigg, J. (2009) Characteristics of a Disaster-Resilient Community. A Guidance Note. Version 2. November 2009. DFID Disaster Risk Reduction Interagency Coordination Group. UK Department for International Development: London

Williges, K. and Mechler, R. (2013). Iterative risk management. Insights from European case studies. Manuscript under submission.

Annex 1. Main Resilience components

(source: embrace project, 2012)

1) Governance (actors, institutional arrangements and organisations)
2) Education, Research, Awareness and Knowledge
3) Information and communication
4) Culture and Diversity
5) Preparedness
6) Response
7) Protection
8) Exposure, Experience and Impact Severity.
9) Resources
10) Health and well-being/Livelihood
11) Economic
12) Adaptive capacity
13) Coping Capacity
14) Innovation and Capital
15) Infrastructure and Technical.



Annex 2. Inventory of Risk Assessment tools

Table 4. Selected tools for the assessment and management of disaster risk, providing summaries of selected tools, classification within the IRM framework, and links for further information.

Name	Type	Institution	Purpose	Description
EM-DAT	IA	Centre for Research on the Epidemiology of Disasters	Disaster impact database: The main objective of the database is to serve the purposes of humanitarian action at national and international levels.	Extraction and consolidation of historical data on heat wave mortality from global EMDAT database and other sources (e.g. national and European mortality monitoring projects such as Be-MOMO and EUROMOMO).
Natural Disaster HotSpots	IA	World Bank	To present a global view of major natural disaster risk hotspots – areas at relatively high risk of loss from one or more natural hazards.	Data on six hazards are combined with state-of-the-art data on the subnational distribution of population and economic output and past disaster losses.
Desinventar	IA	Corporacion OSSO, La Red, UNISDR	Desinventar is a conceptual and methodological tool for the construction of databases of loss, damage, or effects caused by emergencies or disasters.	The Disaster Information Management System is a sustainable arrangement within an institution for the systematic collection, documentation and analysis of data about losses caused by disasters associated to natural hazards.
WorldRiskIndex	IA	UNU-EHS	The WorldRiskIndex presents a global view on risk, exposure and vulnerability.	The index is based on 28 indicators that are available worldwide. The selected indicators represent four components of risk, namely, exposure and vulnerability, whereas vulnerability is composed of susceptibility, coping capacities and adaptive capacities.
Disaster Loss Assessment Guidelines	IA	Emergency Management Australia	To provide an explanation of the process of loss assessment, and lead the reader through the steps required to carry out an economic assessment of	Disaster Loss Assessment Guidelines assist in the management and delivery of support services in a disaster context.

			disaster losses.	
Handbook for Estimating the Socioeconomic and Environmental Effects of Disasters	IA	Economic Commission for Latin America and the Caribbean	To describe the methods required to assess the social, economic and environmental effects of disasters, breaking them down into direct damage and indirect losses and into overall and macroeconomic effects.	The handbook incorporates new and significant developments while refining and improving the methodology for damage assessment contained in several sections included in the first version published in 1991.
HAZUS-MH (Hazards U.S. Multi-Hazard)	IA	Federal Emergency Management Agency	To analyse losses from floods, hurricanes and earthquakes.	HAZUS-MH applies geographic information systems (GIS) technology to produce estimates of hazard-related damage before or after a disaster occurs.
CATSIM	IA, RM, SG, SS, CEA	International Institute for Applied Systems Analysis	To help policymakers, particularly in developing countries, devise public financing options to be implemented in both the pre- and post-disaster context.	CATSIM uses Monte Carlo simulation of disaster risks in a country or region, and examines fiscal and economic risk based on an assessment of the ability of governments to finance relief and recovery.
CAPRA (Central American Probabilistic Risk Assessment)	RM, SG, SS	Consortium in Latin America	CAPRA is a Disaster Risk Information Platform for use in decision-making that is based on a unified methodology and tools for evaluating and expressing disaster risk. Building on—and strengthening—existing initiatives, CAPRA was developed by experts to consolidate hazard and risk assessment methodologies and raise risk management awareness.	The model is based on a GIS platform for risk assessment linked to selected hazards. The approach is to use probabilistic methods to analyse different natural hazards, including hurricanes and floods. For the risk assessment, hazard information is combined with exposure and vulnerability data. The GIS information system allows focusing on a single hazard risk and multi-hazard risks.
Vulnerability and capacity assessment (VCA)	QA	International Federation of Red Cross and Red Crescent	To identify the strengths and weaknesses of households, communities, institutions such as national societies	Vulnerability and Capacity Assessment (VCA) uses various participatory tools to gauge people's exposure to and capacity to resist natural hazards. It is an integral part

		Societies; CARE	and nations.	of disaster preparedness and contributes to the creation of community-based disaster preparedness programmes at the rural and urban grass-roots level.
Community based disaster risk management	QA	Asian Disaster Preparedness Center	To denote the application of measures in risk analysis, disaster prevention and mitigation and disaster preparedness by local actors as part of a national disaster risk management system. A key feature is multi-sectoral and multi-disciplinary cooperation with special responsibility borne by the municipal authority.	Community based disaster risk management (CBDRM) is a process, which leads to a locally appropriate and locally 'owned' strategy for disaster preparedness and risk reduction.
AquaCrop	IA	Food and Agriculture Organization (FAO) of the United Nations	The model estimates crop growth, given a set of climate and soil parameters, together with crop management. As the model was designed to assess crop response to water, it allows for the evaluation of climate impacts (reduced water availability) or environmental regulations (reduced water quotas) on crop yields.	AquaCrop is a crop-model to simulate yield response to water of several herbaceous crops. It is designed to balance simplicity, accuracy and robustness, and is particularly suited to address conditions where water is a key limiting factor in crop production. AquaCrop is a companion tool for a wide range of users and applications including yield prediction under climate change scenarios.
DIVA	IA, QA, SS		DIVA produces quantitative information on a range of ecological, social and economic coastal vulnerability indicators from sub-national to global scales, covering all coastal nations.	DIVA (Dynamic and Interactive Vulnerability Assessment) is an integrated model of coastal systems that was developed, together with its proper coastal database, within the EU-funded project DINAS-COAST.

AQUATOOL	IA, QA, SG, SS	David Haro, Joaquín Andreu, Manuel Pulido	AQUATOOL includes several utilities focused in water resources systems analysis, namely, quantitative simulation of water management and water quality (SIMGES and GESCAL), optimal water allocation (OPTIGES), definition of environmental flows (CAUDECO), stream flow series analysis and modeling (MASHWIN), drought risk assessment (SIMRISK methodology), and rainfall-runoff modeling for stream flow series generation (EVALHID).	AQUATOOL is a Decision Support System (DSS) for the management of the water resources in a river basin which integrates in a comprehensive way all relevant water elements and its interactions, in order to provide different scenarios that incorporate water offers and demands.
IWRM toolbox	IA, RM	Global Water Partnership	Adapting to climate change implies improving and adapting water management. IWRM is offering a base for climate change risk-management and has been recognized by both IPCC and UNFCCC as a way forward.	GWP developed tools to approach IWRM that deal with access to water and protecting the integrity of the ecosystem, thus safeguarding water quality for future generations. In this way IWRM can assist communities to adapt to changing climatic conditions that limit water availability or may lead to excessive floods and droughts.

Note: IA: Impact Analysis, QA: Qualitative analysis, RP: Risk Perception, RM: Risk modelling; CEA: Cost-effective analysis; SS: Stochastic Simulation; SO: Stochastic Optimization
Note: tools marked in grey are owned or run by ENHANCE project partners,