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ENSURE E-LERNING TOOL

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Structuring the relations between physical, social and economic vulnerabilities: an introduction

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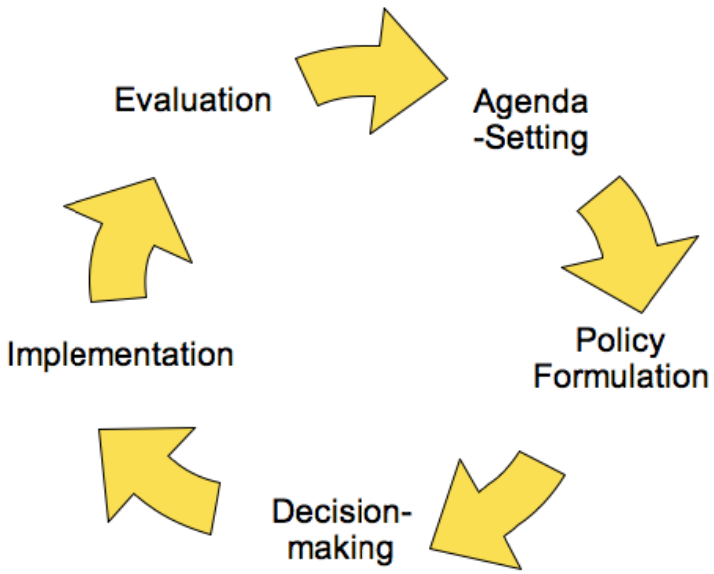
See References in ENSURE Deliverable 2.1.3

1 Methodological Framework

To discuss and analyse factors, vulnerabilities and interventions in the presented hazard cases a conceptual model has been adopted. This model is based on the policy cycle commonly applied in public administration to describe the policy process. The model consists of various stages, starting with agenda setting and concluding with the evaluation of a situation and/or process. After the evaluation, another process of policy-making may start again with agenda-setting. One of the most famous policy cycle models was developed by May and Wildavsky (1978).

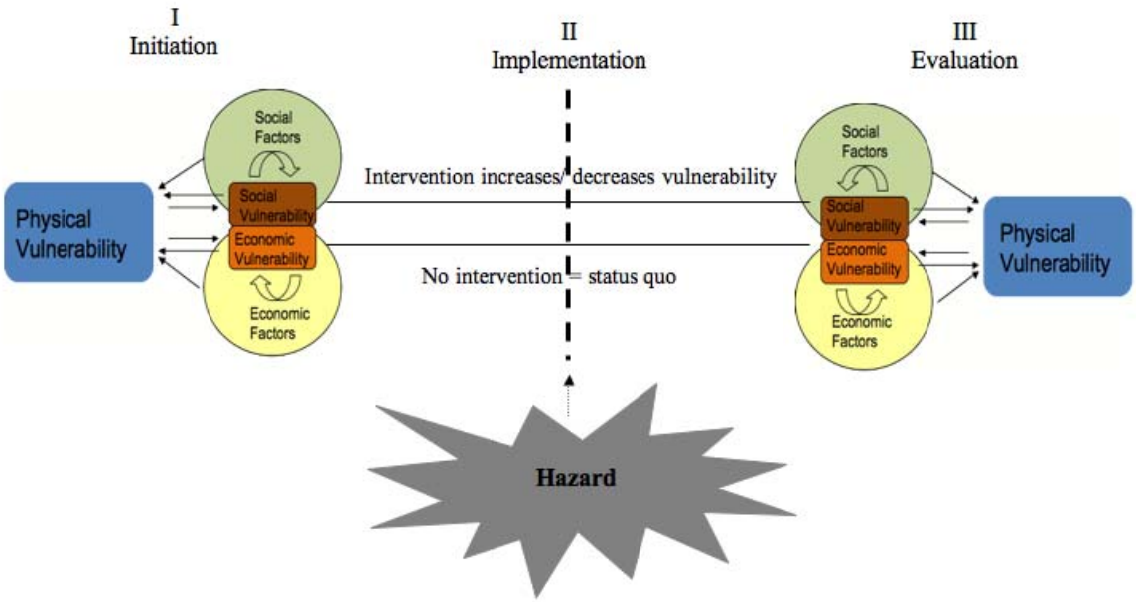
The model consists of the following steps: Agenda Setting, Issue Analysis, Service Delivery Systems, Implementation, Evaluation and Termination. The first two steps belong to the Initiation stage: a situation is perceived as a problem and decision-makers want to act on it. Step three and four belong to the Implementation stage: a policy is being designed. The final two steps are meant to evaluate the policy and to judge whether it should be prolonged; adapted or terminated, i.e. the Evaluation stage. Based on this cycle, more authors formulated their own definitions of the different steps. Jann and Wegrich (2005) defined agenda-setting, policy formulation, decision-making, implementation and evaluation (Figure 1).

Figure 1: Policy Cycle based on Jann and Wegrich, 2005



To analyse our hazard cases, the policy cycle has been simplified into three general stages: Initiation, Implementation and Evaluation. During the Initiation stage the analysis focuses on the different factors and vulnerabilities that influence or are influenced by the hazardous environment. During the Implementation stage the interventions formulated and adopted are investigated. These interventions can be activated by public, private or civil societal (groups of citizens acting apart from public and private sector) actors. During the final stage, the Evaluation, the key factors and blind spots of a case will be identified and discussed, which form the basis for further recommendations to decision-makers. The three stages are shown in the analytical framework in Figure 2.

Figure 2: Analytical Framework of Vulnerabilities in a Policy Cycle (authors)



While formulating the analytical framework, the following assumptions were made. These assumptions are theoretical at first instance.

Assumptions Stage I: Initiation:

- Physical vulnerability influences social and economic vulnerability
- Social and economic vulnerability influence physical vulnerability
- Social and economic factors influence physical vulnerability
- Economic and social vulnerability results from economic and social factors

- Interventions attempt to influence one or more vulnerabilities
- All vulnerabilities need to be considered to increase coping capacity and resilience and to make interventions effective

Assumptions Stage II: Implementation:

- New policies are supposed to reduce vulnerabilities
- Effectiveness depends on
    - Awareness
    - Acceptance
    - Priorities
    - Implementation mechanisms
    - Who sets the agenda
- Intervention can be implemented by
    - Public sector
    - Private sector
    - Civil-society (groups of citizens acting apart from public and private sector)

Assumptions Stage III: Evaluation

- Social and economic factors remain constant (in a social system variables are supposed to be stable, except for the relations between the vulnerabilities)
    - Relations among vulnerability types may change

2 Definitions

The overall definition of 'vulnerability' that is adhered to in this task is "*the susceptibility to loss and the capacity to recover*". This definition could be further extended to the different types of vulnerability, i.e.:

- Physical vulnerability is the susceptibility to physical loss and the capacity to recover
- Social vulnerability is the susceptibility to social loss and the capacity to recover
- Economic vulnerability is the susceptibility to economic loss and the capacity to recover.

The **physical vulnerability** concept can be further specified and elaborated for the different types of hazards, as can be seen in Table 1. Physical vulnerability clearly depends on the type of physical stress that arises from different *hazards*. This vulnerability type thus

cannot be generalized to all hazards, but is an intrinsic quality of any given object that depends on its resilience capacity to any given external shock.

Table 1: Physical Vulnerability for Different Hazards

	Physical Vulnerability Elements
Drought	Areas, soil, vegetation, crops and livestock affected by drought
Earthquakes	Areas, built-up structures and infrastructure affected by earthquakes
Flooding	Areas of development (urban, rural), physical layouts of developments; built structures; infrastructure (above ground, below ground) affected by water level rise. Physical vulnerability will occur in the area directly affected by floodwater, but may also extend beyond this area to surrounding areas.
Forest fires	Areas (incl. air quality), built-up structures and infrastructure affected by forest fires, forest ecosystems and other vegetated areas, enhancement of soil erosion processes, flooding risk downstream.
Landslides	Areas, built-up structures and infrastructure affected by landslides
Volcanoes	Areas (incl. quality of air, water and vegetation), built-up structures and infrastructure affected directly or indirectly by volcanoes

The concept of **social vulnerability**, has been addressed quite extensively in work package 2.1. Social vulnerability was defined as being comprised of elements of human capital (i.e. skills, dexterity and judgment) as well as social capital (i.e. the value of social networks which affects the productivity of individuals and groups).

Economic vulnerability, then, is seen as a territorial area's susceptibility to exogenous shocks, which can be dampened by actors' choices that enable a given community to recover from or withstand the negative effects of such shocks. Economic resilience subsequently is defined as the policy-induced ability to recover from the effects of such shocks.

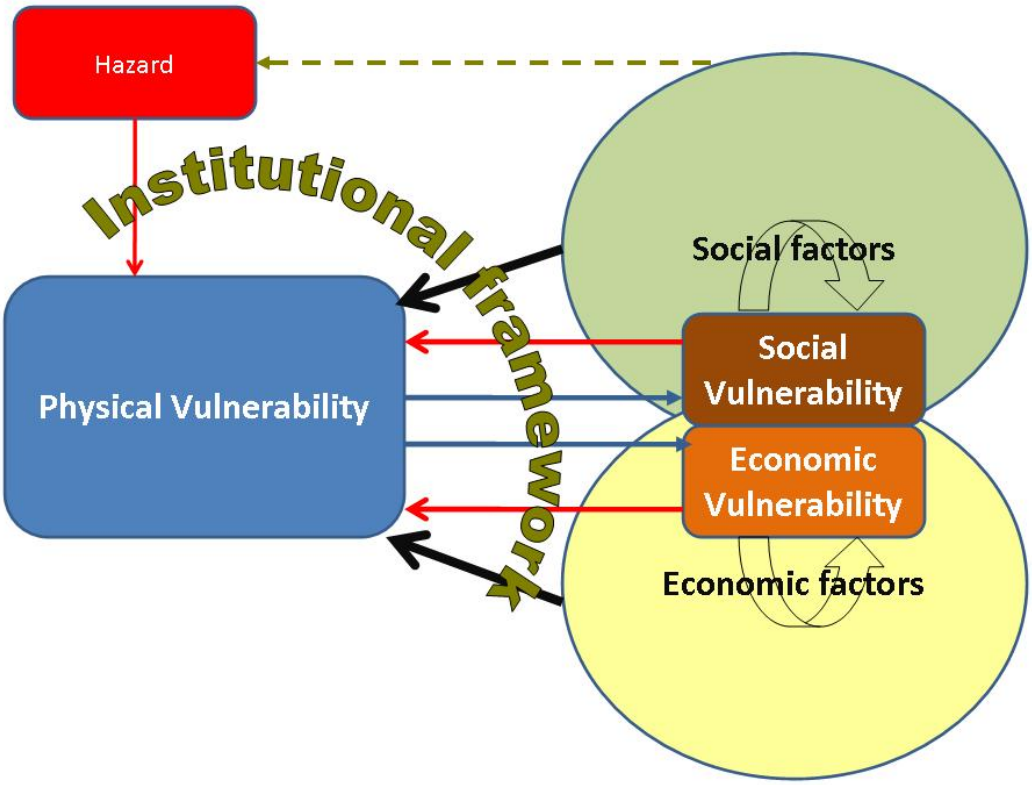
3 Relations and causal links in the vulnerability framework

The vulnerability framework and its various concepts (vulnerability of different types, coping mechanisms and resilience) are very much interconnected. Below we have attempted to unravel these intrinsically related concepts to enable a better analysis and understanding of the various relationships.

The most important relationships and causal links that are being considered in the analysis of the interrelationships between physical, social and economic vulnerability are visualized in Figure 3. Not one single root cause or main cause-effect relationship can be identified. What

follows is an attempt to enhance the understanding of the web and chains of relationships within the vulnerability framework.

Figure 3: Vulnerability Framework



The meaning of 'hazards' in this delivery is not confined to 'natural hazards'. Volcanic eruptions and earthquakes are surely the result of natural processes, whereas for example floods do not necessarily occur solely naturally. Especially when putting a flood event into a wider time and spatial context, anthropogenic inferences such as deforestation or climate change have a clear impact on the 'natural' hazard. It is thus necessary to look for social and economic factors and their influence on such events. In this document hazards are not linked to social vulnerability through fatalities. Instead, physical vulnerability is perceived as a mediating variable, being intrinsically linked with economic and social vulnerability.

If the vulnerability of social groups and the economy is not at stake, i.e. if there is no evidence for social and economic vulnerabilities, physical vulnerability is irrelevant. Should that be the case, purely natural hazards are assumed. The impact physical vulnerability has on eco-systems and institutions could be added to this picture. But as eco-system vulnerability will not be considered here, and institutional vulnerability is thought to be an element of social vulnerability, this impact will not be discussed explicitly.

The direction of influence plays an important role. On the one hand, it could be physical vulnerability that influences social and economic vulnerabilities, e.g. when comparing the differential impact of a flooding event on small and medium-sized enterprises as compared to large companies. Or on the other hand, social and economic vulnerabilities may have an impact on and influence physical vulnerability. It is the latter direction, which will be the main focus of attention in this document.

The interest thus lies in the evaluation of social and economic factors and processes that do often determine who is most at risk and enhance physical vulnerabilities. For example factors that provoke somebody to settle in risky areas or to undertake economic activities in hazardous areas are considered.

A feedback loop is assumed to become evident when looking at the relationships between vulnerabilities. This is because the increased physical vulnerability that results from the various social and economic factors (black arrows) is expected to have an effect on the social and economic vulnerability of society as a whole, groups in society as well as on individuals (blue arrows).

A list with exemplary social and economic factors can be found at the end of this section. In this regard it has to be remembered that not all social and economic factors are equal to social and economic vulnerability factors and that it will be an important task here to identify those factors that should be considered as social and economic vulnerability factors. These could be factors such as low income causing families to settle in landslide hazardous areas because of low land prices.

Finally, intervention mechanisms have to be taken into account. Such interventions refer to mechanisms to cope with the enhanced physical vulnerability, i.e. mechanisms of coping capacity and resilience. Even though the definition already states that "vulnerability is the susceptibility to loss and the capacity to recover", intervention mechanisms are disentangled here from the vulnerability concept in order to be able to discuss and analyze them separately.

Intervention mechanisms can be found at four levels: in the public sector, in the private sector, and among groups as well as individuals acting in civil society.

Generally, a distinction between structural and non-structural mechanisms can be made, the latter of which refers to direct changes of behavior. Even though this differentiation is possible, in reality often a combination of both applies.

Consequently, the central aim with regard to interventions seeking to decrease the vulnerability to natural hazards is to:

a. Find out which social and economic factors are at stake (Initiation stage),
b. Examine the typical interventions to decrease vulnerability to specific hazards and their effectiveness (Implementation stage), and
c. Develop further insight about the relationship between physical vulnerability on the one and social as well as economic vulnerabilities on the other side (Evaluation), where the main focus in on the impact of social and economic vulnerability on physical vulnerability.

Influencing factors

Based on theory, a list of potential influencing social and economic factors was formulated. The list is used to get a general overview on how which factors can influence different types of vulnerabilities. Later, in the hazard cases, some factors will come back and will be complemented with others.

Public Sector

- Structure of the Policy-Making Environment
  - Spatial Planning Approach; systematic versus diverse, as described by Fleischhauer (2006)
  - Stakeholder involvement: involvement of spatial planning authorities at different administrative levels,
  - Power relations: Influence of certain economic sectors on decision-making; e.g. possibility of the building sector to influence the granting of building permits
- Capacity of public sector
  - Experience with risk assessment and management
  - Capacity of local authorities to evacuate/ enforce/ protect/ guide rebuilding
  - Coordination between different governmental levels: lack of coordination may cause overlapping or vague responsibilities resulting in an ineffective emergency response (Wanczura , 2006)
- Common Practices:
  - Policy-decision on how to (re)construct buildings. As an example, in Greece (after the Mt. Parintha earthquake) buildings were reconstructed commonly in order to decrease the adversary effects of individual decisions on overall vulnerability (Sapountzaki & Dandoukali, 2006)

Private Sector

- Culture of the business and private sector
  - sustainable business
  - transparency
  - anti-corruption
- Structure of private sector
  - Degree of competition
  - Monopolistic behaviour
  - Market size
- Land market

- Land registration
- Distribution public-private land

o Know-how

- Research and development
- Access to technology

o Role and functioning of the insurance sector (type products)

- Possibility to insure against hazards
- Risk perception

Civil Society

o Characteristics of the General Public

- Awareness; possible unawareness due to infrequency of occurrence
- Acceptance; increased through participation
- Attitude towards participation; (Jarva & Virkki, 2006: 28f).
- Beliefs and attitudes with respect to risk
- Experience with hazards; enhances awareness; offers possibility for learning
- Knowledge/ Information
- Degree of organization though Non-governmental organizations of Community based organsations (CBOs)

o Characteristics of Individuals

- Age: The elderly and children are said to be more vulnerable
- Poverty:
  a. Insufficient financial reserves lead to higher mortality rate and more housing damage
  b. Poverty slows down recovery, and thus leaves the persons concerned more vulnerable to future hazards
  c. Extreme poverty may encourage the development of illegal housing in hazardous areas
- Employment and location
  a. Living in hazardous areas because of possibilities to work; e.g. living in floodplains due to work opportunities
- Gender: Women more vulnerable than men; women are easier at risk of poverty; women more often have to take care of vulnerable groups

- Embeddedness: Tourists and minority groups more vulnerable due to lacking institutional and kinship embeddedness
- Owner/ tenant: owner more interested in hazard-fitting of houses as it is their own capital; tenants dependent on initiative of owners; owners possibly against awareness-raising methods as they fear a decrease in real-estate values

4 Public, Private and Civil Society Interventions

An overview is provided of different intervention mechanisms that are in place and are applied to deal with physical vulnerability. This knowledge will help to enhance better understanding of 'what works' and 'what does not work', and subsequently to understand which social and economic factors are at stake when dealing with physical vulnerability.

As mentioned in the Introduction the leading questions for the contributions are:

1. What are typical mechanisms/interventions (public sector, private sector and civil society) to deal with the physical vulnerability of the hazard type concerned?
2. What are 'blind spots' regarding social and economic factors/processes in the successful development and implementation of these typical interventions?

In Table 2 an overview is given of the various hazards and the possible interventions. Some interventions are more relevant for one hazard than for another. Intervention for hazard might differ according to temporal dimension (e.g. drought: prolonged periods, no shock, high frequency).

Intervention mechanisms could refer to prevention, preparedness, response as well as to information provision.

Examples of public intervention mechanisms are:

i. physical structures
ii. land use planning
iii. building codes
iv. building permissions
v. other regulations
vi. economic incentives
vii. information dissemination and awareness mechanisms
viii. response measures (incl. evacuation plans).

Table 2: Interventions Dealing with Physical Vulnerability by Hazard

	Physical structures	Land use planning	Building codes	Building permissions	Other regulations
Drought	√	√			√
Earthquakes		√	√	√	
Flooding	√	√	√	√	
Forest fire	√	√		√	√
Landslides	√	√	√	√	
Volcanoes	√	√	√	√	

	Economic incentives	Information and awareness mechanisms	Response measures	Private institutions	Civil Society Initiatives
Drought	√	√		√	√
Earthquakes		√	√	√	√
Flooding	√	√	√	√	√
Forest fire	√	√	√	√	√
Landslides		√		√	√
Volcanoes	√	√	√	√	√

Examples of private intervention mechanisms can be found in the insurance sector and in technological interventions.

Examples of civil society intervention mechanisms include i) self-awareness; e.g. self-evacuation and ii) individual precaution; e.g. neighbourhood initiatives.

5 Public Intervention at the European level

Nowadays public intervention mechanisms are influenced by decisions taken on the European level, some examples of such decisions regarding natural hazards are given.

European regulation on Earthquakes

The European Committee for Standardization (CEN) is responsible for the issuing of Eurocodes; that are "common structural building and civil engineering structures" (CEN, 2009). With the introduction of Eurocode 8, by 2010 all national rules concerning the "Design of Structures for Earthquake Resistance" are replaced by a standardized European norm. The overarching aims of this norm are to protect human lives, to limit damages and to keep structures important for civil protection in operation.

European regulation on Floods

On the European level, Directive 2007/60/EC sets a framework for dealing with floods. In accordance to the subsidiarity principle (as set out in Article 5 EC), the Directive defines guidelines and overall goals but leaves their implementation to the different river basins as those are the management boards already involved in other European coordination attempts. The focus of the Directive is on the '3 P's' (Prevention, Protection and Preparedness; Recital 14 of the Preamble) and therefore a threefold path towards flood management is envisaged.

The first step is to undertake a Preliminary Flood Risk Assessment by December 22, 2011. This assessment includes mapping the river basin, reviewing its flooding history and giving an outlook to probable future events and their adverse consequences. The second step, to be finished by the end of 2013, is to draw Flood Hazard Maps showing the probabilities of floods and Flood Risk Maps depicting potential adverse consequences. Thirdly, by 2015 Flood Risk Management Plans shall be in place, which are to focus on the '3 P's' mentioned above.

Throughout the Directive the need for cross border coordination is highlighted, not only between Member States but also with third countries as natural hazards do not occur in accordance to national boundaries.

European regulation on Forest Fires

Also the natural hazard of forest fires is regulated on the European level. A basis was laid in 1992 with Council Regulation 2158/92/EEC on the protection of the Community's forests against fire. This Regulation has two main objectives: to reduce the number of forest fire outbreaks and to reduce the extent of areas burnt (Article 1(2)). In order to do so, information systems shall be better coordinated, measures shall be evaluated and new activities shall be concentrated on the elimination of causes. Especially areas in Portugal, Spain, France, Italy and Greece are recognized as areas of high risk. For those areas, Member States are obliged to provide forest-fire protection plans which include a description of the present state of affairs and of the most recent fires as well as a statement on the objectives of the planning period and the measures applied to achieve them. Any Community funding as regards forest fire protection projects and programs is subsequently dependent on those plans. The scheme thus laid out was scheduled for five years, and thus follow-up regulations were necessary.

Already in 1994, Regulation 804/94/EC followed. It formulated rules for the application of the '92 Regulation. It is rather short and stipulates a minimum common core of information on forest fires, comprised of such data as the dates of alert, intervention and extinguishing. Council Regulation 1727/99/EC has the same aim as its predecessor and adds specific instructions on the make-up of national programs and the possibilities of funding. In the latest amendment, Commission Regulation 2121/04/EC, the competent bodies were further specified. Those bodies need to be governed by the law of one Member State; they shall offer adequate financial guarantees, operate according to the requirements of sound financial management and operate transparently (Article 1(2)).

Others

For the hazards of droughts and volcanic eruptions no regulatory framework exists on the European level. For both, decisions have been taken on emergency response measures under specific circumstances. So for example Council Regulation 787/98/EC allowed for special measures for Portuguese farmers affected by the 1992/93 drought and through Decision 2003/785/EC money of the Solidarity Fund was made available for citizens affected by the eruption of Mount Etna.