Institutional challenges for multi risk management: comparative analysis of Naples, Italy, and Guadeloupe, France, case studies

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1. Introduction

A variety of natural extreme events, including earthquakes, landslides, volcano eruptions, tsunamis, river floods, winter storms, wildfire, and coastal phenomena, threaten different regions in the world. European planners and policymakers, as well as scientists who inform their judgment, usually treat the hazards and risks related to such events separately from each other, without consideration of interdependencies between the different types of phenomena, as well as the importance of risk comparability.

This often ignores the frequent causal, spatial and temporal relationships between risks. Also it fails to recognise the cascading and conjoint effects of different hazards, which may worsen already difficult situations. By conjoint effects we mean a series of parallel adverse events generated by different sources, for example, cyclone and marine and continental floods generated by it. This happens when an adverse event, located inside or outside the site, triggers one or more sequential events, such as heavy rains and landslides (Marzocchi et al, 2009). For example, the occurrence of a given hazard may not only cause additional events via cascade or domino effects, such as earthquakes triggering tsunamis, or volcanic eruptions triggering earthquakes, but the initial event may increase vulnerability of the region or the country to hazards in the future, such as earthquakes, that for example could damage flood defences. The conjoint and cascade hazards can be approached by the multi risk assessment, which should improve the ability to take risk reduction measures in a cost-effective way and to lower the consequences of these types of events.

In this paper we focus on the institutional aspects of the management of multiple hazards. The benefits anticipated by the adoption of this approach are numerous, such as:
1. Multi-hazard risk assessment may have relevant policy implications and could emphasize, for example that efficient mitigation actions do not necessary need to be focused on reduction of the highest risk but on the risks that could be mostly reduced;
2. Addressing multiple hazards may lead to significant costs reductions and improvement in the efficiency of risk mitigation and management measures, comparatively to cases when hazards are treated separately from each other;
3. This approach may help to develop a better coordination and interfacing between different specialized authorities and agencies which each deal with specific hazards or risks without developing an overview of the knock-on, domino and cascading effects (EN 2009:28).

Besides these theoretical benefits, the challenges posed by the adoption of such an approach can be also numerous. The key objective of our study was just to identify the social and institutional barriers to effective assessment in the case of multiple hazards and propose solutions to overcoming them. We assumed that policies and decisions for risk management are influenced by the institutional context of a country, which can be marked for example by the division of responsibilities among stakeholders, poor communication pathways and at times conflicting objectives.

The identification of the major barriers to multi-hazard risk treatment was based on analysis of existing institutional landscapes for risk management in frames of two case studies, Guadeloupe, in France, and Naples, in Italy. The results can provide recommendations to public administrators going beyond the question for priority of treatment of higher-impact lower-probability hazards or lower-impact higher-probability hazards and also how to improve mitigation and management of both by applying synergies in measures and avoiding conflicts.

2. Background

Methodologies for multi-type hazard and risk assessment are becoming a new research field and represent a “Copernican revolution” in risk assessment and management because they allow taking into account dependencies between different risks by using homogeneous procedures. In this way the comparison of different risks becomes feasible because these methodologies use a single metrics.

From the scientific viewpoint, these methodologies focus on comparability between different types of risks, cascading hazards, and time dependent vulnerability in the frame of conjoint or successive hazards. Currently, the evaluations of risks related to different sources are mainly conducted on the basis of single risk analysis and, the multi-risk analysis is provided as a sum of single risk

assessments; this may lead to severe underestimation of the real risk because of two reasons. First, the single risk assessments are not always adapted for inter-comparison because they deal with different spatial and temporal resolutions and use different approaches to vulnerability. Second, the single risks sources are rarely strictly independents. Single risk approaches make it difficult to compare risks with such implicit assumption of independence of the risk sources. Also it leads to the neglect of possible interactions among the risks and "cascade" effects, when risk and vulnerability of exposed elements may change significantly after the occurrence of an event (Gasparini and Marzocchi, 2010).

Recently two new scientific works were published on assessment of multiple risks. These two projects are examples of successful development of quantitative methods of analysis for multi-hazard situations, allowing quantitative assessments of and enabling their comparison on the bases of risk indicators. These risk indicators provide estimations of annual damages caused by more frequent events as well as estimations of potential damages that might be caused by extreme events with low probability. They also provide multi-hazard risk figures that allow evaluation of different disaster types, to raise awareness for different aspects of disaster mitigation and to develop tailor-made mitigation strategies.

The possible procedures for multi-hazard case study were developed in frames of the Principles of Multi-Risk Assessment, Interaction among Natural and Man-Induced Risks (NaRaS project for the Casalnuovo municipality). Casalnuovo, a municipality in southern Italy, is located just 13 km away from the crater of the mount Vesuvius volcano and is exposed to several kinds of hazards like Vesuvius volcano, the Irpinia tectonic earthquake source, a river passing through municipality as well as the presence of industrial landfills. The local government was interested in identification of the most dangerous hazard and the most effective way of financing the risk mitigation measures. The multi-risk assessment provided local decision-makers with new insights on mitigation of hazards. It showed that volcanic risks overwhelm significantly all other risks in mitigation measures and that interaction between volcanic, industrial and environmental risks are not taken into consideration, which led to underestimation of these risks. However, this project did not focus on barriers in the institutional structure, which would provide also operative guidelines for the implementation of multi-risk assessment (Marzocchi and Woo, 2009).

Another multi-risk assessment was conducted for the city of Cologne by the German Research Network Natural Disasters project. The vulnerability of Cologne is marked by huge accumulation of people as well as cultural, industrial and economic assets. The city is at hazard of windstorms, floods and earthquakes. The multi-risk assessment included vulnerability assessment and estimation of direct losses for such sectors as private housing, commerce and services, industry, energy and water supply. The project also developed a set of scenarios focusing on potentially damaging events from each of three above-mentioned types of hazards. Even though, this project conducted detailed assessment for multi-risk situations, it did not investigate the institutional

structure existing in the city of Cologne to mitigate and manage these hazards (European Commission, 2009).

For successful implementation of multi-risk mitigation and management policies, an analysis of institutional landscapes, including identification of roles, capacities and interactions of separate stakeholders and organizations, is also necessary. The analysis of institutional landscapes was identified by the GEO Disasters Societal Benefit Area as a target for 2015, which includes an increased communication and coordination between national, regional and global communities, in support of disaster risk reduction, based on clarification of roles and responsibilities of every involved institution and therefore improved resources management (Group on Earth Observations, 2009).

For example it is clear that that an institutional landscape marked by conflicts of interests of the stakeholders involved may create a particular burden on the implementation of multi-risk assessments especially if there is not cooperation among them. To analyse the institutional challenges for multi risk management, we will start with a description and analysis of the national risk management system in the two countries under study, i.e. Italy and France, focusing on the responsibilities and capacities of the major actors involved. This analysis will help to point out potentials and barriers in the existing national systems. After analysing key similarities and differences between the two systems, we will describe the two case studies of Napoli and Guadalupe. To better understand the institutional landscapes we will first focus on how single hazards are managed and then we will describe some possible multi-risk scenarios. The paper ends with an identification of the major barriers and bridges to multi-hazard risk treatment.

3. Methodology

Our research work is based to a large extent on the analysis of legal and regulatory documents on institutional and regulatory landscape in the two case countries. This allowed description of the risk management system and the mapping of stakeholders involved. According to definitions given in the scientific literature, we understand here the institutional framework as a set of governmental and non-governmental organizations or institutions, which have a recognized role in the risk mitigation and management, also including mechanisms for coordination among organizations and institutions. The institutional framework also includes networks of entities and organizations involved into planning, supporting and implementation of risk mitigation and management programmes and practices. It also includes linkages between and among organizations at the local, state, provincial and national levels as well as between governmental and non-governmental entities such as local communities and business leaders. The analysis of the institutional framework and the mapping of stakeholders allowed us to understand forces, responsibilities and interests of the organizations involved.

Our findings were supported by preliminary stakeholders' interviews in order to determine their positions regarding multi hazard and risk assessment in comparison to the single risk approach. Their opinions about gaps or existing synergies in the management of different single risks and their perceptions of existing barriers for implementation of a multi-risk approach were collected.

Finally, and the last step includes a comparative analysis of case studies in Europe and outside of it. This analysis allows a comparison of different methods for risk management and, more precisely, top-down and bottom-up interactions. This explains the choice of our case studies. One case study, the city of Naples, is in Italy, where the institutional landscape is marked by significant autonomy in decision-making processes from the side of the Italian regions for assessment of the majority of natural risks, excluding volcanic risk, which is treated at the national level. In case of emergency planning and management instead, Italy is characterised by a mixed top-down, bottom-up organizational system. The other case study is situated in the French West Indies, outside Europe, under governance of France, where the decision-making process is marked by a greater centralization in decision making associated to well-established state governance within regions and decentralised delegations of central ministries.

4. Natural risk management in the two case studies

4.1. Italy

In the period 1998-2009, Italy was mourning more than 20,000 fatalities due to natural catastrophes (EEA, 2011). In 2009 the earthquake in the Abruzzo region, central Italy, caused 309 fatalities and in 2012 another earthquake in central Italy, Emilia Romagna region, caused 17 victims. In terms of fatalities, all over Europe the country is second only to France. These figures immediately show how natural disasters represent a dramatic problem for the country. Up to 40% of the Italian population, that is about 24 million people, lives in highly seismic areas of the zones 1 and 2, where 60% of the buildings are not constructed according to anti-seismic rules. About two millions people are exposed to volcanic risk. Around 5 million people and 8 municipalities out of 10 are at hydro-geological risk, such as floods, landslides and debris flows.

In the last two decades (1990-2010) the overall costs for natural disasters in the country have been estimated to approximately 100 Euros billion (Monti and Chiaves, 2006). Every year the Italian Government spends on average 3.5-4 billion Euros to indemnify damages caused by catastrophic events (EEA, 2004). Recent statistics developed by the National association of insurance companies (Conforti, 2012) reveal that the exposed value in terms of houses is 3,903.67 billion Euros for earthquakes and 2,028.83 billion Euros for floods. At present Italy does not have a private insurance system for natural hazards, even if this is definitely a central topic of discussion at the national level and several attempts have been made in the last years to develop public-private

partnerships. However, some insurance companies offer a limited coverage for earthquakes and floods.

General framework

The risk management system is grounded on the administrative structure of the country. Italy is divided into 20 administrative regions, 110 provinces and 8,104 municipalities (ISTAT, 2012). For risk and emergency management, government services at different levels are structured to coordinate their operations and resources with non-governmental actors through a mixed top-down, bottom-up organizational system that strategically integrates different capabilities (OECD, 2009).

Many municipalities are remote, sparsely populated and possess very limited resources for public services, yet their locations are often highly exposed to natural hazards. For this reason, provinces and regions administrations often have to strongly support them in risk management activities. More specifically, regions play a crucial role due to their legislative competencies in risk management which is partially shared with the state.

Indeed the Italian Constitution of 1947 established a principle of decentralization of powers to Regions (art. 116). These were distinguished in Regioni a Statuto Speciale, also known as Regioni Autonome (Special Statute Regions or Autonomous Regions), and Regioni a Statuto Ordinario (Ordinary Statute Regions). The recent Constitutional Law 3/2001 lists the competences at national level, leaving the remaining ones - among which risk management and environmental protection - to the regions, which are even more extended in the five with a special statute of autonomy.

A key role for risk assessment is played by the "competence centres", i.e. institutions that provide scientific and technical expertise about the nature of hazards, vulnerability of population and assets, and the development of technical measures to reduce them (OECD, 2009): universities, national research centres, river basin authorities and local agencies are part of this broad network. The need of such a network of competence centres has been recently emphasised by its definition in a law decree (3593/2011) listing all the competent authorities and their responsibilities for the preparation and review of hazard, risk and vulnerability assessment. For example the river basin authorities prepare flood and landslide risk maps, the national and regional soil defence authorities prepare earthquakes maps, and the national institute of geophysics and volcanology (INGV) prepares -among others- volcanic risk studies. Technical offices, at municipal, provincial and regional level, collect the information for different hazards. There is not a unique risk assessment plan, as there is, in the contrary a unique emergency plan, which usually collects also the information available about hazard/risk assessment. . Information about risks has to be included in the urban planning tools (piano regolatore) at different scales, municipal, provincial and regional. There is not a municipal information document on major risks as it is the case for France.

It is important to emphasise here that there are relevant differences in the risk management depending on the hazard. For example volcanic risk management is more centralized than the hydro geological or seismic one. More precisely the key authorities for volcanic risk management are at the national level, whereas the key ones for hydrogeological risk are the river basin authorities and for seismic risk national and regional authorities, depending also in regional specificities.

With regard to emergency and crisis management, specificities of single hazards are less prominent. The mayor and the prefect, who is the State representative authority with responsibilities over public safety at the provincial level (L. 121/1981), are the key authorities designed to cope with all the risks that might occur in the municipality territory. Each municipality has to prepare an emergency plan including all operative indications needed, such as warning and evacuation procedures. Emergency planning follows the so-called Augustus method elaborated in NDCP guidelines. This method is an organic and systematic tool for producing civil protection plans in Italy and, though it is not mandatory, it is configured as an optional tool of governance. The guidelines provide a blueprint for flexible planning and have been created to define, elaborate, manage, verify and update emergency plans. Each municipality has also to set a Municipal Operations Centre (MOC), in which managers of authorities and of municipal operation units work together to define the intervention strategy, and an operations room organised by function.

A leading principle for emergency management is subsidiarity. When municipal government capacities are insufficient to manage the scale of event, they are supported by provinces and regions as well as by the central government administration. Moreover three different types of events foresee involvement of different levels of government in emergency management. Table1 summarises the operative organisation of the civil protection system depending on the type of event.

Table 1: Operative organization of the Italian civil protection system in case of emergencies

Type of event			**Level**	
			National	Operational committee Major risk commission National Operational room Di. COMA. C (national coordination on site in case of major events)
			Regional	Regional operational room Crisis Unit
			Provincial	Rescue coordination centre Inter-municipal operational centres
'C'	'B'	'A'	Municipal	Municipal operational centre (COC) Strategy area, decisional function; Operative room

- Type A: events that can be managed by municipal authorities as part of their routine duties;
- Type B: events that require coordinate intervention of more authorities at provincial and regional level, as part of routine duties;

- Type C: events of great intensity and extent that require coordination and intervention at national level.

The most serious events of the type C require a national level integration and the availability of emergency forces on the spot. These events also require coordinated work of emergency forces and other staff involved as well as provision of all necessary equipment to manage the risk in a most efficient way. More precisely, the Council of Ministers, on proposal from the President of the Council, deliberates on the state of emergency, determining its duration and extent strictly with respect to the quality and nature of the events. Emergency interventions are implemented following this declaration, also using appropriately motivated legal dispensations, including faster procedures for fund availability.

The National Civil Protection Service (NCPS) plays a relevant role in the emergency management. It is an umbrella institution, which guarantees national coordination of disaster management on the field and acts as an external organ of the Environment Ministry. Its main operational structures are the fire brigades, the army, the police forces, the forestry national service, the national technical services, some institutions and groups of scientific research, the Italian Red Cross, the structures of the National Health Service, and the national Alpine rescue service. Even civil society fully participates in the Civil Protection National Service, mainly through volunteer organizations. In 2010 the voluntary system included 27 national organizations, 3,667 local volunteer organizations and 1,200,000 volunteers, which made almost 2% of the national population (Renzulli, 2010).

As for the competence centres network for risk assessment, the network of functional centres connects the supporting organizations for the emergency management system (law decree 3593/2011). These centres have a function in forecasting and monitoring at the regional level, which is supplemented by a National Functional Centre in Roma, and are dedicated to prevision and surveillance of all natural phenomena, for the purpose to support the decisions of civil protection authorities with hard data. The National Functional centre in Roma is divided into three main branches: hydro-geological risk, volcanic risk and forest fires. Functional centres work closely together with Competence Centres. The link between them is based on contracts with the aim of supplying necessary services throughout the year.

Finally, in regard to the promotion of risk awareness and preparedness, provincial and municipal authorities are in charge of providing information to the population. Locally, it is the municipality that has to communicate appropriate behaviours to be enacted in case of an emergency. The national Civil Protection also provides activities of risk education that schools can include in their curricula.

Napoli case study

With its almost 1 million inhabitants (ISTAT, 2011), Napoli is the biggest municipality of southern Italy and probably also one of the most exposed to several natural hazards such as volcanic eruptions, earthquakes, hydro geological risks and fires. Risk assessments are up-to-now developed on a single risk approach and the complexity of hazards interactions and cascade effects is not reflected in these documents. Different organizations working from the national to the municipal level are in charge of hazard assessment and take part in generation of risk prevention documents.

Sources of volcanic risk are concentrated in the province of Napoli and consist of the volcanoes of Somma-Vesuvius, the Campi Flegrei and the island of Ischia. What makes volcanic risk high in the Naples area is the combination of a the high density of population and property exposed to an explosive eruptive hazard, which, in case of pyroclastic clouds, would have immense destructive power.

Three zones have been designed on and around Vesuvius based on the type and nature of hazards that might affect them. The Red Zone (200 km2), defined on the basis of distribution of deposits from the flow of Plinian and sub-Plinian eruptions, includes 18 municipalities, all in the province of Naples. The Yellow Zone (1100 km2) would be affected by thick coverings of ash and lapilli with loads on the soil exceeding 300 kg/m^2. It comprises 96 municipalities in all five provinces of Campania. The Blue Zone (100 km2) could be invaded by mud flows and be affected by flooding. This zone comprises 14 municipalities, all in the province of Napoli. The 3 zones cover a total population of about 600,000 inhabitants

The volcanic areas surrounding Napoli are currently monitored with modern instrumental networks by the Vesuvius Observatory, a division of the National Institute of Geophysics and Volcanology (INGV). The data are constantly updated and open access on the INGV website. The Action plan for Vesuvius risk mitigation consists of wide-ranging legislation and 12 integrated actions aimed at progressively reducing urbanisation in the most exposed area. An Emergency Plan for Vesuvius and basic elements for national emergency planning of the Phlegrean area are also available. Management of volcanic risk are conducted mostly at the national level: the National Institute for Geophysics and Volcanology (INGV) plays a crucial role not only for volcanic monitoring. It is also in charge of seismic monitoring and prepares research programmes to obtain a better knowledge of the scenarios for seismic and volcanic hazards.

In Napoli, seismic and volcanic risks are strongly linked: one can trigger the other, thus showing some domino effects typical of multi risk contexts. Seismic classification of Italy into four categories was first carried out on the basis of the document “Proposal for the seismic re-classification of Italy”, drawn up in 1997 by the National Commission for the Prediction and Prevention of Large Risks, the key actor in natural risk management at the national level. This document had already been used also for Napoli as the basis for a seismic risk classification of the region Campania in the

Regional Council Deliberation no. 5447 of 7.11.2002. The territory of the entire city is classified at "medium" risk.

For hydro-geological risks, including landslides and floods, the territory is classified in four classes, from low to very high risk. Hazard and risk maps are worked out by the river basin authorities and are available in electronic, paper copies and on-line (at the scale 1:5,000). River basin plans (and related building constraints) have priority over all the other plans as municipal regulatory plans, provincial coordination plans (PTCP), the general zoning plans (PRG), natural park plans, etc. Additional elements for the assessments are also provided on an ad-hoc basis by the Regional Agency for the Environment, land defense, competence centers or universities, according to specific requests. Beside the above mentioned authorities, the Engineering corps (Genio civile), the territory maintenance consortium (Consorzio di bonifica), the regional soil defense department, the provincial and regional civil protection, the forestal corps and the regional agency for land defense share responsibilities for hydrological risk mitigation. Hydrogeological risks pose another challenge for multi-risk assessment: more precisely intense rains on the hill slope of Napoli may cause a landslide which can invest gas pipelines and cause fires.

At present there are different emergency plans for the city of Napoli: the plan for volcanic and seismic emergency prepared by the National Civil Protection (as in both cases the events will be type C, i.e. of national relevance) and the plan for hydro geological risks –currently under preparation by the municipal technical officers.

With regard to the warning system instead, the Campania Functional Centre is the key authority in charge to issue warnings. The warning phases are summarized in the table here below.

Table 2: Warning phases (Citta' della scienza e regione Campania 2008)

State of Attention
In this phase, the hazardousness of the predicted event is assessed. Assessment occurs through the monitoring networks installed along the river gauges (e.g. in case of hydrogeological hazards), but may later be supplemented by direct observation in situ, supported by mathematical prediction models. The agencies entrusted with managing the event are alerted in advance in this phase. An initial series of information flows is established between agencies and structures involved for the purpose of proper coordination. The availability of members of the functional centers is ascertained.
State of Pre-alarm
In this phase links are established with local agencies and the operation centers at municipal level are activated.
State of Alarm

The operation centers are active; the service to protect the population and the production system is running. Evacuation starts and the risk zone is ring-fenced. Relief structures are put on pre-alarm; information bulletins are disseminated on the situation and its development.

4.2. France

General framework

French local administrative structures were first designed under Napoléon I , creating "départements", from which 96 are on the main land and 5 are overseas, and the state local representation on behalf of prefects, configuring then a top-down organization. The regional administrative level in France, was created in 1982 by the decentralization law. It gathers several departments on main land and one department in the case of the overseas territories, which are called Departments-Regions d´Outre Mer (DROM). The Guadeloupe archipelago is one of the 5 overseas French territories (Department – Region d´Outre-Mer). Both regional and departmental levels have an elected local counsel. The decentralization law of 1982 transferred several competencies, and among them the risk management, to the competence of the local counsel. The aim of the law was to improve the bottom-up system. At the same time the selected mayor has major responsibilities at the level of communes. In the last decades, inter-communalities have been created in order to mutualize local competencies, also in some cases of risk prevention.

At the national level two ministries are dealing with questions of natural hazards, the Ministry of Interior, which is in charge of security issues, and the Ministry of Environment, which is in charge of developing knowledge on risks and developing general prevention tools.

At the local level, the regional and departmental collectivities and inter-communalities collaborate on risk prevention for assets, which are in their responsibility such as schools and public buildings. They are responsible for hazard mitigation and management of these assets as well as environmental and land use issues. Their responsibility is also to sustain risk knowledge and awareness.

At the level of cities and communes, the major is in charge for civil security within the limits of his commune. This implies information of known potential risks, prevention measures and actions in case of emergency. If the mayor cannot assume this function, then the prefect at the departmental level acts as his subsidiary. The mayor also reports in his actions to the prefect. The risk mitigation and management questions are within the security area, which includes natural risk knowledge, technological risk and civil security (table 3).

Table 3: Government levels for risks mitigation and management

	State					
	National	Local state representation	Regional counsel	Departmental counsel	Intercommunalities	Communes and town
Natural risk assessment	X		X	X	X	X
Civil security	X	X				X

The table 3 shows that authorities at three different levels, such as central, regional and local, are involved into natural risk mitigation and management. The questions of civil security are regarded however at central and communes levels.

Several public organizations are involved into research and hazard and risk assessment. There are institutions which provide direct help to the policy making process like BRGM, Institute National de l´Environment Industriel et des Risques (INERIS), METEO France, Centre Nationale de Recherche Meteorologique (CNRM), Centre International de Recherche sur l´Environment et de Developpement (CIRED), Institute de Recherche eu Surete Nucleaire (IRSN) and Institute de Recherche en Sciences et Technologies pour l´Environnement et l´Agriculture (IRSTEA), specialized university laboratories like IPG and Clermont are also involved. From that knowledge, ministry in charge of environment develops guidelines, which are based on the risk assessment conducted by experts and scientists. These guidelines serve as a basis for development of documentations at the departmental level under the coordination of perfect.

Policy makers rely on the transfer of results from research for development of policy documents, which serve as information guidelines at different levels and help to inform at different levels as well as in decision-making process for prevention and emergency actions. This task is coordinated by the prefect of department. The departmental document on major risks (DDRM) is one of the central documents at the departmental level. It covers all risks such as natural, technological, transport and conflict, which are classified as “major” risks for a given territory. “Major” is decided in terms of the importance of human, economic and environmental assets exposed. Each risk is described by its processes, typology and driving forces. The document also includes a simplified hazard map. The document summarizes all policies for a given risk and provides advices on behavior of population before, during and after the event. It also indicates all agencies involved and the level of their responsibility. DDRM is usually produced by the prefect or his representatives in charge for equipment, environment, health, security and communication. It is based on the risk assessment and information from experts and scientists as well as stakeholders from private and

public agencies. Following the demand of the mayor, the perfect can also prescribe the elaboration of the risk prevention plans, which are usually developed for single risks at town scale. Further on, these prevention documents are included into urban development plans and municipal mapping. These documents usually lead to protection measures, recommendations and identification of development constraints such as insurances limitations, development under regulations etc. These documents are usually elaborated by scientists in cooperation with policy makers. They then are submitted to public advice and after revision are finally approved by the prefect and are applied.

A communal document, known as Documents Communaux Synthethiques (DCS) represents a declination of the DDRM. It lists all known risks within the town territory. Usually, it is written by the prefect security services and addresses the mayor. The mayor is in charge to address population about the known risk. Further on, the mayor transfers this information to the population through so-called Document d´Information Communale sur les Risques Majeurs (DICRIM). It provides information on the known risks as well as existing and planned measures for prevention, protection and emergency. At this level there is also a row of specific planning documents, which were developed to prepare vulnerable population to specific crisis, such as families and school children and employees in case of seismic hazard in Guadeloupe.

If a hazard occurs, the civil security services are in charge of the crisis management. The prefect is allowed to acquire help from all security services, such as firemen, who are under the departmental counsel responsibility, or hospitals, which are under shared responsibilities between territorial collectivities and state.

After the crisis, insurance companies provide estimations of damages. The organizations, which are involved into hazard knowledge, are required to report about the natural aspects of the event. From this report, the Ministry of Interior decides whether to call specific funds designed to sustain certain kinds of risks, such as storms and other natural risks, or damages, also including the agricultural damages. Those funds rely on the State budget and/or contribution of re-insurances, which use the mechanism of specific contributions of all insured. These funds are used for indemnities of disaster victims, but one part of them is devoted to risk knowledge and management improvement.

Guadalupe case study

Due to its position on the Caribbean Arc, Guadeloupe is prone to volcanic and seismic activity, which mostly results from the volcanic activity on the subduction zone of the North and the South American tectonic plate under the Caribbean plate. Its mountainous configuration is dominated by the active pelean volcano. Additionally, tsunamis and landslides are often induced by seismic or volcanic activity along the inner Caribbean arc. :a tsunami recently happened on the eastern coast of Basse-Terre due to underwater landslide in Montserrat, itself induced by the Montserrat volcanic

activity. Guadeloupe is also subject to the meteorological risks: during the wet season, which is usually from July to November, it is often hit by cyclones. Cyclones and hurricanes have direct impacts through very high winds up to 200 Km/h. They can also trigger multiple other hazards, by inducing a sea-water surge and marine floods and waves, which erode the coastal zone, and by heavy rainfalls, which lead to inland floods and landslides. A preliminary assessment of the risks prevention organization in Guadeloupe conducted by BRGM ascertained the multi-hazard situation of the islands, as well as the relationships between hazards, with some of them acting as triggers for others. Figure 1 shows meteorological and geological hazards and interrelationship between them in terms of triggering forces and hazards.

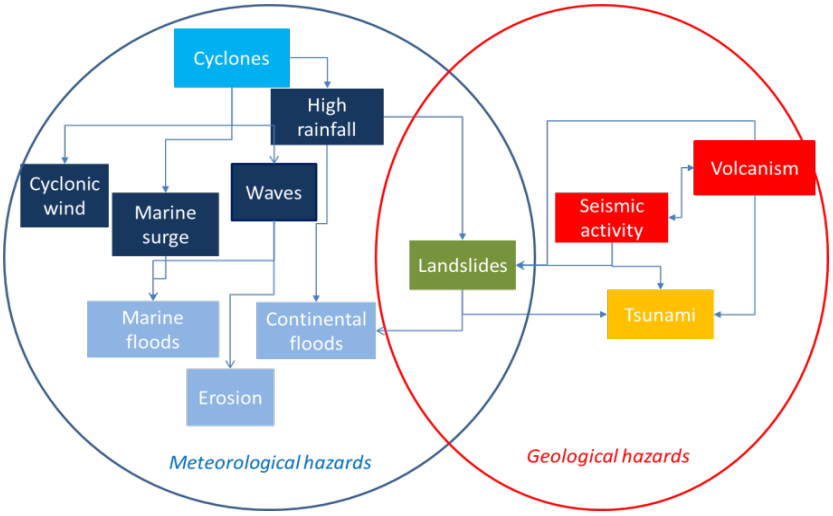

Figure 1: Meteorological and geological hazards in Guadeloupe and their interactions

The vulnerability of Guadeloupe is defined by three factors. First, the biggest part of its 400.000 population lives in the agglomeration of Pointre a Pitre and on a narrow coastal zone around Basse-Terre. Second, its economy relies heavily on agriculture and exports of bananas, sugar cane and tropical fruits. Third, the socio-economic development is marked by high prices of living goods, which are largely imported from the mainland of France, and by high rates of unemployment

Existing currently at Guadeloupe risk assessments are up-to-now developed on a single risk approach. The prevention plans (PPR) were elaborated or are currently under elaboration for the majority of relevant risks, such as cyclones, seismism, and volcanism. The action plans were developed for specific hazards. However, the complexity of hazards interaction, such as seismically triggered landslides, quoted in the seismic prevention plants in reference to the landslides prevention plans, is not reflected in these documents. Different organizations are in charge of hazard assessment and take part in generation of risk prevention documents. Some of them are also in charge for monitoring and alert (table 4).

Table 4: Main actors of hazard knowledge and risk prevention in Guadeloupe

Hazards	Institution	Description	Function	Website
Hurricane/cyclone	Météo France	France meteorological survey	Knowledge, prevision, Alert	http://www.meteo.gp/
Marine flood	Météo-France			
Inundation	DEAL		Knowledge, PPR	
Seismic + Volcanic hazard	OVSG	"Observatoire volcanologique et sismologique de Guadeloupe" – Observatory volcanologic and seismological of Guadeloupe	Knowledge, prevision, alert	http://www.ipgp.fr/pages/030304.php?langue=1
	BRGM	French Geological survey Departmental « Plan Seisme »	Knowledge, PPR	
Landslides	BRGM (SGR)	Local office of BRGM : Knowledge , report of events	Knowledge, PPR, report of occurrence	
Tsunami	CEA		Tsunami watch	http://www.cea.fr/english_portal
	BRGM		Knowledge	

In Guadeloupe, on the levels of regions and departments the prefect is in charge of civil security. Therefore he is also in charge of coordination of the crisis management. He also takes part in risk mitigation and management by prescribing mitigation prevention plans. The prefect is the representative of the central government and is directly linked to the relevant ministries of Interior and of Environment and can requisite any service of organisms if relevant in the crisis management. The mayor of municipality is responsible for guaranteeing security to citizens of his municipality. If the mayor fails to satisfy his responsibilities, the prefect can act as subsidiary.

5. Discussion

5.1 Barriers to effective decision making on multiple hazards in the Italian case study

In Italy natural hazard prevention results from maps, procedural studies, reports, programs that must be developed by different agencies and at different geographical scale. There is not a unique strategy connecting for example geological reports to river basin plans to seismic requirements. They are only loosely connected one to the other. The interviewees generally agree that one of the key barriers to move in the direction of the management of multiple risks, regards the interactions between hydrogeological vs. seismic and volcanic risk management. Some interviewees explicitly mention that in the past more resources have been devoted to the former in comparison with the latter. This depends on the single hazard characteristics as well as on the historical evolution and organization of risk management.

Many interviewees mention that monitoring, forecasting and hazard/risk assessment for hydro geological risks is characterized by lower levels of uncertainty in comparison with the volcanic and seismic one. The most often reported example regards the forecast of earthquakes, which is still very difficult, versus floods, which is possible if an efficient monitoring system is in place. Also the methodological approaches are different: for example the seismic risk assessment is based on maps and on the study of the vulnerability of single households, while the hydro geological risk assessment is grounded on hazard and risk maps as well as event modeling and simulations. In the recent past, hydrogeological events have also been more frequent than seismic or volcanic ones and therefore more resources have been devoted to them e.g. in the reconstruction/recovery and mitigation phase.

What really makes the difference – again in the opinion of the majority of interviewees - is the institutional framework which changed through time following the results of research on risk assessment. In the case of hydro geological risks, the risk assessment system is highly decentralized and the river basin authorities play a key connecting role between national and municipal agencies. In the opinion of many interviewees this makes the management structure more efficient, more information and studies are available and interagency cooperation is easier in comparison with other risks. For volcanic and seismic risk instead, the high level of centralization does not support interagency communication.

With regard to emergency management a key problem regards the responsibility of the mayors which are often unprepared to take emergency decisions, even if by law they have to. The regional civil protection managers lament that the mayors rely more and more on specialized corps for their decisions.

Another problematic issue regards the difficulties for the setting up of the municipal emergency plan: in Napoli the plans for seismic and volcanic emergency management are prepared by the

National Civil Protection, while hydro geological plans are under the responsibility of the municipal and provincial authorities, because they are usually considered as type A or B events. The geological plans are still under development at the moment. At present there is not unique strategy connecting information from different plans and a multi hazard/risk approach would be very useful in this respect.

5.2. Barrier and strengths of the institutional system in case of Guadeloupe, France

The top-down approach, dominating in the French risk management, can be an advantage and a disadvantage at the same time. The French organization of risk management remains to be based on the top-down administration despite recent decentralization laws. The actions in crisis management lay in responsibility of a state local representation such as the prefect and the state delegate services. This top-down situation, when all responsibility lies at the level of the State, can be an advantage in situations of dysfunctions at the other levels. However, it can also be a barrier as the top-down organization can refrain to other levels implication, due to a concurrence of other competencies.

The shared responsibility for risk assessment and prevention can be a barrier. The procedure for risk assessment is divided between state representative services, the local administrative levels and the scientific organizations. The state maintains responsibility over risk prevention management with the help of prefect and the state decentralized services. It provides guidance for assessment and prevention procedure. At some decision levels the risk prevention might bring conflicts with other competencies. For example, the mayors can have both competencies on risk prevention and on spatial planning as well as on economic development; those objectives can have contradictory character to special planning and risk prevention. This shared responsibility also encourages single risk approaches, related to specific competencies and knowledge of organizations in charge.

The shared responsibility for risk assessment can be also crucial and beneficial in the occurrence of hazards. For example, if monitoring and alert of seismic or volcanic activity is guaranteed only by IPG, then this organization does not have the tools to predict ground movement. BRGM is in charge to predict the ground movements. If METEO France has the tools to monitor and alert on cyclones in Guadalupe, and share the tools with others to predict heavy rains and sea level surge, this can build bridges with other organizations which deal with cyclone-triggered hazard such as landslides, inland and marine floods, soil and coastal erosion.

5.3. Comparative analysis

During the risk assessment phase most of organizations, which are involved into research and policy-making process are specialized only on single hazards and risks. This point is definitely in common in the two case studies: natural hazard prevention and spatial planning do not constitute a system but result from procedural studies, reports, programs that must be developed by different agencies and at different geographical scale. Moreover as shown by the results of the preliminary

interviews in Italy "in spite of the declared attention to risk assessment, risk maps are generally obtained through overlapping of individual hazard maps and maps showing the localization of the exposed elements without a quantitative assessment of the exposed elements and a vulnerability assessment" (interview with an urban planner from the University of Napoli; 2012).

The analysis of two real cases allowed us to identify similarities and differences in the Italian and French risk management systems. It showed that in both countries the multi-risk approach still needs to be implemented. With regard to emergency management, in both countries the mayor has key responsibilities. In France, the state intervenes for coordination at a wider scale, and will only act as a subsidiary, if the mayor fails to satisfy his responsibilities. At the same time as in Italy, some major risks are dealt with directly at national level (type C events).

Another substantial difference between the two systems regards the presence in legislation of a mandatory requirement for insurance of buildings and properties against natural hazards: this is present in France, but not in Italy.

In general terms, the risk assessment and management may benefit from the multi-hazard perspective. In Italy the local authorities consider the multi risk assessment as a valuable tool to face one key problem they have. This helps the identification of priorities for their actions in multi-hazard environment. As until now the decision-makers make priorities for the risks that could be mostly reduced, and not necessarily on the highest risks. In France the existing risk management documents (DDRM, DCS and DICRIM) as well as risk management plans (PPR) are well connected with the existing urban planning tools. They deal with the majority of risks and also provide recommendations on priority to deal with certain risks in terms of intensity or value of exposed assets. However, the majority of these documents do not consider possible interactions between the risks.

Finally, the analysis of two real case countries as well as the suggestions of some interviewees, allowed us to identify three possible steps to move towards a multi-hazard risk assessment:
1. Multi-risk assessment information is shared among the competent authorities;
2. A unique agency for multi-hazard risk assessment is created dealing with hydro-geological, volcanic and seismic risk, which are strongly interdependent;
3. An autonomous agency dealing with natural and technological risks is created

6. Literature

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