tao *Digital Library*

ORGANIZATION IN DISASTER

ORGANIZZAZIONE NEI DISASTRI

FRANCESCO MARIA BARBINI

UNIVERSITÀ DI BOLOGNA

Abstract

Disasters can be seen as magnifying glasses on the behavior of subjects and on their (preliminary and contextual) decision-making processes. In fact, the sudden and disruptive events connected with the disaster do not trigger "unusual" behaviors, instead they offer an accelerated and exaggerated representation of normal organizational behaviors and problems, allowing the observation of the whole process of actions and decisions involved. This contribution proposes a reflection on two case studies (the AZF disaster and the Indian Ocean tsunami) that deals with issues related to the identification and management of risks in an industrial setting and to the coordination of cooperative behavior during post-disaster relief activities.

Keywords

Primary prevention, Risk management, Cooperation and coordination, Disaster management, Organizational action.

Organization in disaster / Organizzazione nei disastri, Barbini Francesco Maria. Bologna: TAO Digital Library, 2015.

tao *Digital Library*

The TAO Digital Library is part of the activities of the Research Programs based on the Theory of Organizational Action proposed by Bruno Maggi, a theory of the regulation of social action that conceives organization as a process of actions and decisions. Its research approach proposes: a view on organizational change in enterprises and in work processes; an action on relationships between work and well-being; the analysis and the transformation of the social-action processes, centered on the subject; a focus on learning processes.

The contributions published by the TAO Digital Library are legally deposited and receive an ISBN code. Therefore, they are to be considered in all respects as monographs. The monographs are available online through AMS Acta, which is the institutional open archive of the University of Bologna. Their stable web addresses are indexed by the major online search engines.

TAO Digital Library welcomes disciplinary and multi- or inter-disciplinary contributions related to the theoretical framework and the activities of the TAO Research Programs:
- Innovative papers presenting theoretical or empirical analysis, selected after a double peer review process;
- Contributions of particular relevance in the field which are already published but not easily available to the scientific community.

The submitted contributions may share or not the theoretical perspective proposed by the Theory of Organizational Action, however they should refer to this theory in the discussion.

ORGANIZATION IN DISASTER

FRANCESCO MARIA BARBINI

Index

Organization in disaster - Introduction

Disasters are sudden calamitous events bringing great damage, loss, and destruction. The subject of the organization of disaster prevention and post-disaster relief management is particularly interesting for the organizational reflection.

From a theoretical point of view, a disaster can be seen as a magnifying lens on the behavior of subjects and in particular on their (preliminary and contextual) decision-making processes. In fact, the sudden and disruptive events connected with the disaster do not trigger "unusual" behaviors, instead they emphasize and make more evident the typical behaviors and problems of "normal" organizational situations. Furthermore, the concentration in time and space of such events allows the observation of the whole process of actions and decisions involved. As a matter of fact, disasters offer, in a "nutshell", an accelerated and exaggerated representation of normal organizational behaviors and problems.

From a practical point of view, the study of the organization in disasters has direct consequences in terms of actual prevention, risk management, mitigation and relief strategies and techniques.

In fact, while the subject of disaster prevention, preparedness and mitigation has been debated since the early 1950s, it has become an important topic of discussion after the natural and industrial disasters of the 1970s and 1980s and has gained a fundamental importance after the 2001 terroristic attacks. Currently, issues related to risk management, organizational resilience, prevention of accidents at work and coordination of post-disaster relief efforts have got a very high rank on the agendas of public policy makers and top managers.

The theoretical reflection has developed consistently with the need for

practical solutions and has proposed many approaches and intervention strategies. In particular, we can identify two main strands of research. A mainstream literature, with a functionalist perspective, that aims to find efficient strategies to identify risks, develop scenarios, implement plans for managing risks and recovering from undesired events. An interactionist literature, which considers disasters as unpredictable events and underlines the impossibility to foresee and plan both prevention and rescue activities.

The first approach is usually shared by policy makers and represents the basis for the most popular techniques of risk management and emergency management: it involves the elaboration of detailed formal procedures aimed to anticipate and control all the possible causes and consequences of a disaster. The second approach is very effective in understanding and representing the failures and the mistakes affecting the mainstream approach, but does not allow any kind of generalization.

The purpose of this contribution is to propose a different approach to the study of the organization in disasters, based on a perspective that considers the the organization as a process of actions and decisions pursuing bounded rationality.

According to this perspective, human decision making processes are always trying to anticipate future events and to plan (i.e. to regulate) future behavior. However, since decision-making processes are affected by bounded rationality, preliminary regulation is never able to perfectly steer the future behavior, thus requiring contextual regulation. Hence, all the decision-making processes involved in disaster prevention, risk management and relief coordination planning can be interpreted as attempts to preliminary arrange future behavior.

The two essays presented in this contribution propose a reflection on two case studies that deals with the main issues related to the organization in disasters: prevention and risk management, planning of interventions to mitigate the effects of the disaster and coordination of relief activities. In particular, the first essay addresses the issue of the identification and

management of risks in an industrial setting. The analysis shows the fallacies of secondary and tertiary prevention systems and the need to focus on primary prevention. The second essay deals with the issue of cooperation and coordination in post-disaster relief activities and highlights how the cooperative action of the rescuers does not guarantee the integration of their actual behavior: the identification and analysis of the various processes of decisions and actions involved explains the coexistence of cooperative attitude and competitive behavior in the relief efforts.

The failure of foresight in managing risks

Francesco Maria Barbini, *Università di Bologna*

Introduction

In the last decades, the issues related to disasters prevention and emergency preparedness have reached the highest positions in the strategic agenda of our Society: industrial hazards, natural disasters and rising terrorist threats are boosting investments and law enforcements for better managing risks and pursuing preparedness (Kovoor-Misra *et al.*, 2000; Tixier *et al.*, 2002; McConnell, Drennan, 2006). Overall, the approach widely adopted by policymakers is based on the assumption that preparedness is a "state of readiness to respond to environmental threats. It results from a process in which a community examines its susceptibility to the full range of environmental hazards (vulnerability analysis), identifies human and material resources available to cope with these threats (capability assessment), and defines the organisational structures by which a coordinated response is to be made (plan development)" (Perry and Lindell, 2003: 338). Furthermore, recent organizational literature has focused on the analysis of causes and modalities by which accidents happens and may initiate disasters (e.g. Perrow, 1984, 2007; Vaughan, 1996; Weick, Sutcliffe, 2007).

However, despite the relevant efforts devoted to risk management and emergency preparedness, disasters still occur and, even though contingency plans are continuously improved, actual post-disaster recovery activities show relevant inefficiencies.

This contribution aims at interpreting the relationships between preliminary regulation and actual post-disaster relief processes to identify strategies for improving risk prevention and disaster mitigation processes. To this end, in the next Paragraph, different research perspectives are described and discussed. Then, the most important facts related to the AZF disaster are

introduced and explained by means of the different theoretical postures. Finally, a new approach toward prevention and planning processes is envisaged.

This contribution is developed around a case study. Such case is not intended to falsify some theories; instead, it is to be considered as "an occasion for reflecting" on the subject of disaster prevention. The AZF case has been selected because of three reasons.

Firstly, at the time of the disaster, AZF was applying state of the art risk management techniques (unlike, for instance, the case of Bhopal): plans for risk management and disaster mitigation were available; the solutions adopted for managing risks were coherent with legal prescriptions and best practices, and inspections and emergency drills were performed regularly.

In addition, the disaster does not appear to have been originated by evident human or organizational mistakes (unlike, for example, the case of Chernobyl). While the causes of the disaster have not been discovered yet, there is no final evidence of particular organizational faults or specific human responsibilities. In fact, in the years following the disaster, experts have proposed many different hypotheses about the cause of the explosion, from those related to a mix of chemicals improperly stored together, to the fall of a meteorite, to the terrorist attack. In particular, the working conditions of workers belonging to subcontractor firms and their training on safety procedures have been debated (Jean, 2002; 2011; 2013 ; Chaskiel, 2007; Suraud, 2007). The long history of the judicial process has not resolved the doubts and on the contrary has fostered the proliferation of hypotheses (Le Figaro, 2009; Le Monde, 2015). For the purposes of this discussion, however, it is sufficient to highlight that the conduct of AZF before the accident was consistent with the provisions of national and international standards and was coherent with the most popular practices for managing risks and mitigating accidents.

Finally, even if the city of Toulouse was applying specific solutions for managing risks and mitigating possible disasters, the actual rescue activities have been carried out without strictly following the emergency procedures.

The AZF case has been drawn up basing on direct and indirect data. To this end, people charged of security tasks and working on the site when the explosion took place, as well as residents who have witnessed the disaster, have been interviewed. Additional information has been gathered during meetings with researchers working on a psycho-sociological research on the effects of the disaster. Finally, indirect material has been drawn from official reports and documentation files.

The research has been performed adopting a qualitative posture. Such a posture is coherent with the objective of this contribution, i.e. to highlight the main facts related to the AZF disaster and to explain them basing on available theories. The theories selected for interpreting the case are dominant in the literature or they are deemed particularly effective for explaining the organization in disaster.

On the effectiveness of preliminary regulation

The disaster prevention and recovery strategies currently applied by policymakers rely on the detailed predefinition of relief strategies and procedures. In other words, policymakers are trying to predict the effects of any kind of disaster in order to minimize the damages and to predetermine relief activities. Coherently with this approach, disaster-ready institutions are used to perform regular emergency drills to test the effectiveness of the emergency procedures and to evaluate the rescuers' efficiency in applying such procedures.

Relevant literature is supporting this approach, stressing in particular the importance to develop flexible and efficient plans (Healy, 1969; Quarantelli, 1982, 1985, 1998; Lagadec, 1993; Perry, Lindell, 2003). Furthermore, the planning process is considered the best place for implementing emergency procedures (Shelton, Sifers, 1994; Perry, Lindell, 2003: 338). In fact, according to the literature, a planning process carried out consistently with a set of specific guidelines should allow the achievement of "rational" responses to emergencies. Quarantelli (1982), proposes ten principles inspiring efficient

disaster planning; similar guidelines are proposed by Alexander (2003), Lagadec (1993), and Perry and Lindell (2003). Recently, the widespread application in the United States of Incident Command Systems (ICS) techniques (Cardwell, 2000; DHS, 2004; FEMA, 2004; Hannestad, 2005; Buck *et al.*, 2006) has revitalized this approach. ICS techniques suggest the full predefinition of rules and organizational roles for efficiently coordinating and managing personnel and equipment at a wide range of emergencies. The proposed system is strictly formalized, characterized by role specialization and detailed procedures, and based on particularized training. A fundamental feature of an ICS is the "escalation principle": the size and the complexity of the ICS are in fact modularized depending on the nature the contingent situation, with detailed adaptation procedures regulating such escalation (Bigley, Roberts, 2001; Lindell *et al.*, 2007). ICSs are supposed to allow the development of high reliability organizations (HROs) based on tight structural regulation (to achieve efficiency) coupled with high operational flexibility (to achieve effectiveness): "this research suggests the possibility of new organizational forms able to capitalize on the control and efficiency benefits of bureaucracy, while at the same time avoiding or overcoming the considerable tendencies toward inertia that are thought to accompany bureaucratic systems" (Bingley, Roberts, 2001: 1281).

Other theoretical studies (e.g. Lanzara, 1983; Gephart, 1984; Roux-Dufort, Vidaillet, 2003) stress the role of improvisation processes in achieving effective relief interventions. According to such interpretations, the organization of the relief activities "emerges" almost spontaneously from a set of creative, random, and sometimes irrational behaviors. Hence, from this point of view, the efforts headed to the predetermination of the relief activities are useless and may inhibit social sensemaking and, ultimately, the self-development of an effective organization (Weick, 1988). Instead, rescuers should be trained and allowed to act creatively, without excessive rules limiting their freedom of action. From a similar perspective, Turner (1976, 1978; Turner, Pidgeon 1997) introduced a theory for interpreting organizational behavior in disasters. Turner, in fact, proposed a framework to explain the process of "construction" of the

catastrophe and identifying the various factors hindering a full rationality in the prevention process. This process of social construction of disasters has been inducted from the analysis of three major disasters and is composed by six stages: (I) Initial beliefs and norms, (II) Incubation period, (III) Precipitating event, (IV) Onset, (V) Rescue and salvage, (VI) Full cultural readjustment. This perspective also devotes high attention to cultural factors permeating the organization and outlines their role in the development of disasters (Gherardi, 1998).

The theoretical perspectives described above are based on particular assumptions about the rationality of human beings. The theories focusing on the predefinition of risk management techniques and on the detailed formalization of emergency activities usually share an attitude toward absolute rationality: they consider the human being as an optimizer, able to foresee and analyze risks, to organize the protection system, and to define recovery actions. On the other hand, theories focusing on improvisation, bricolage and on the social construction of reality generally agree on a concept of contextual rationality, i.e. on the absence of an intendedly rational decision-making process. Instead, they explain human behavior as determined by social sense-making processes. According these authors, the strategies inspiring the actors become evident only after the actual behavior.

A different approach for studying the organization in disaster can be developed from Simon's theory of bounded and intentional rationality. According to Simon, in fact, "human behavior is intendedly rational, but only boundedly so" (Simon, 1947: 88). In other words, decision-making processes cannot be fully rational (since it is impossible identify all the consistent means and to rank and clearly define goals). However, Simon stressed that a decision-making process does exist and human beings direct their behavior toward certain goals, trying (even without succeeding) to select alternatives which are conductive to the achievement of the previously selected (fuzzy) goals. Human beings are continuously trying to plan their future behavior. Plans are just "devices" for influencing future decision, being impossible to fully determine

future decisions and actions; plans are decided, but they are continuously modified and integrated by actual decision-making processes.

A framework for studying the organization in disaster consistent with Simon's theory has been proposed by Thompson and Hawkes (1962). Such framework describes the major events related with the development of the organization of relief activities, highlighting the main decision-making processes involved. Overall, Thompson and Hawkes identified four typical steps in the relief process: (1) survivors (and disaster-ready institutions within the impact area) act individually or in small, auto-regulated, groups to help those in need; (2) professional rescuers arrive from outside the disaster-affected area, thus trying to apply predefined relief routines and procedures; (3) additional uncommitted resources arrive and need to be used; information about the need for additional resources begin to flow; (4) the group of people able to collect information concerning the need for resources and their actual availability, and to coordinate relief cooperative activities affirms itself as the control centre for this emergency.

This organization process is defined as "synthetic organization". A synthetic organization is an ad-hoc organization that takes place to overcome the effects of large-scale disasters, "without the benefit of planning or blueprints, prior designations of authority, or formal authority to enforce its rules or decisions" (Thompson, 1967: 53). The synthetic organization is usually effective (the consensus of all the members and their strong commitment make it very focused on the results) but not efficient. Its lack of efficiency is caused by the fact that, unlike "normal" organizations, the synthetic organization has to act and, at the same time, to structure (i.e. to give an order to) its action. Over time, the synthetic organization produces its own coordination rules thereby making the rescuers' behavior more efficient. In this perspective, the organization in disaster interpreted as a continuous process of decisions and actions performed under conditions of bounded and purposive rationality.

AZF – Azote fertilisants

AZF was a chemical factory located in Toulouse, France. The factory was built by the Office National Industriale de l'Azote (ONIA) in 1924. In 1928, it started producing nitrogen fertilizers. In the following decades, the factory constantly expanded its production, both in terms of figures and variety. In 1967, the factory changed its name into APC SA (Azote et Produits Chimiques). In the years between 1978 and 1983 the French chemical sector was reorganized. In 1983, the GdF Chimie Group gained the control over APC SA, thus creating the Gdf Chimie AZF (AZote Fertilisants) Group. AZF rapidly became the leader enterprise in the domestic nitrogen fertilizer market and enhanced its presence on the international markets. In 1985, the new management of the factory launched a plan of massive investments to enhance production processes and to improve productivity. It has been estimated that, between the end of the '70s and the first half of the '80s, AZF invested more than 1 billion Francs for process innovation. In 1987, AZF was acquired by the OKREM Group and was merged with the SCGP (Société Chimique Grande Paroisse). In 1991, the Grande Paroisse – AZF was acquired by ATOCHEM, the chemical branch of Elf Acquitaine. Finally, in April 2000, Elf Acquitaine and TotalFina announced the merging of all their chemical activities within Atofina. Grand Paroisse – AZF became the branch of Atofina (now ranked within the top five chemical groups in the worlds) in charge for the production of fertilizers (Bordes, 2004).

In 2001, the AZF Toulouse plant was employing 470 people and had an annual turnover of about 100 million Euro. It produced nitrogen fertilizer and industrial nitrates. It also performed activities related to the synthesis of chlorine-containing compounds and the manufacturing of melamine and adhesives and of chlorinated products (French Ministry of the Environment, 2002).

To perform its activities, the factory stored considerable amounts of hazardous substances, in particular (Barthelemy *et al.*, 2001; French Ministry of the Environment, 2002): ammonia, in two cryogenic tanks (5,000t and 1,000t) and in one pressurised storage tank (315t); chlorine, in two tankers (2 x 56t);

ammonium nitrates, 15,000t in bulk form, 15,000t in sacks, and 1,200t in hot liquor solution; oxidants, one tank (1,500t); methanol, one tank (2,500t).

Additional safety concerns about AZF were caused by its location: it was situated on a 70ha site on the left bank of the Garonne, very close to the center of Toulouse (3 km). In the '20s that area was suitable for chemical productions since it was very close to efficient transport infrastructures and it was sufficiently (but not excessively) close to the city. Yet, over time, the urbanization process had almost completely included the site within the city boundaries: hospitals, universities and residential and commercial areas have slowly surrounded the factory.

Risk management at AZF

Because of both the characteristics of the production processes performed in the factory and the short distance from largely inhabited areas, AZF was considered a sensible site and was forced to develop integrated strategies for preventing and mitigating risks and operative plans for recovering from disasters.

In particular, the AZF plant was subject to the French legislation on "classified installations for the protection of environment under the authorization regime" (legislation set out in the law of the 19th July 1976 – then included in the Part I of the Book V of the Environment Code). This legislation submits hazardous installations to a prefectoral authorization. Such authorization is granted only "if these hazards or disadvantages can be prevented by the measures specified in the prefectoral order" (L. 511-2). The safety procedures to be applied are detailed by the decree of 21st September 1977. Over time, the Inspectorate of Classified Installations performed regular inspections of the AZF plant, investigating storage facilities, reviewing environment protection procedures, and analyzing the hazard studies' reports and the whole safety system.

In addition, the AZF plant was subject to the "Seveso I and II directives", a European law (82/501/EEC, 96/82/EC) aimed at preventing major-accident

hazards involving dangerous substances and limiting the consequences of such accidents. The Seveso I Directive forced enterprises to perform hazard studies and imposed continuous inspections and communication activities. It was replaced in 1996 by the Seveso II Directive. The new directive extends the range of applicability of the legislation and imposes the definition of more detailed hazard studies and their re-examination every five years. In addition, enterprises are required to set up a risk management system in which safety solution are proportioned to the all the possible major accidents they are exposed to. Finally, the Seveso II Directive imposes to local authorities to consider, while planning the land use, the risk related with major accidents.

In 1988, the Toulouse authorities passed a General Interest Project (PIG – Projet d'Intérêt Général), a land using plan defining the perimeter inside which urban development was strictly regulated. However, "inside the lethal effect zone [...] (900 m), there were 1,130 inhabitants and 16,000 inside the irreversible effect zone (1,600 m)" (Dechy *et al.*, 2004: 131-132).

At the same time, local authorities and AZF agreed on a Special Intervention Plan (PPI – Plan Particulier d'Intervention) containing a set of procedures for protecting the residents. The PPI detailed procedures for the triggering of alarms, for the coordination of internal and external emergency services, for the treatments for injured people, for the interventions on traffic and communications infrastructures, etc. The general public was made aware of these safety procedures by means of mass media and by direct communications: for example, over 20,000 letters were sent to inform the population about risks and procedures to be fulfilled in the event of an alarm.

Hence, the activities performed by AZF were tightly regulated in terms of working conditions, risk management and quality management. Many information and communication campaigns were carried out to achieve internal and external awareness about security policies and procedures. AZF assessed its risks by means of the root-cause analysis method: the analysis was designed to allow the recognition of major risks, the identification of the possible causes, and the development of coherent auditing policies and emergency procedures.

Various accident scenarios were envisaged, taking into account internal and external contingencies (weather, natural disasters, etc.): "for the Grande Paroisse [AZF] factory the worst scenario is the instantaneous rupture of a chlorine tanker (outside the discharge room) which gives distances of more than 2,500 m for the threshold of lethal effects and more than 5,000 m for the threshold of irreversible effects" (Barthelemy *et al.*, 2001: 19).

The internal procedures for mitigating hazardous accidents were formalized in the Internal Operation Plan (POI – Plan d'Opération Interne). The main objective of the POI was to contain and control the extension of internal accidents, preventing hazardous contingencies from contaminating external areas. The POI was regulating the whole emergency system of the AZF plant and it was strictly coordinated with the PPI in order to allow a coherent escalation of the disaster response behavior.

The AZF plant had a standing group of private firemen ensuring, 24h/24, the security of workers and installations. The firemen were equipped and trained to deal with hazardous materials, and to be able to mitigate accidents in accordance with the security procedures. In the '90s, AZF established an organizational task force gathering safety and medical experts, the "cellule d'hygiène industrielle", introduced to develop and manage hygiene and safety systems for controlling the processes employing hazardous materials. Overall, AZF employed 25 people with safety-specific tasks: in addition to twenty firemen, there were two persons in charge of risk prevention and safety management, one in charge of environment protection, a chief engineer and his assistant in charge of production safety. The emergency staff and the greatest part of the equipment were situated in a building located close to Gate A, in a safe area far away from any sensible installation. This building housed the situation room from where emergency operations would have been managed. The situation room was equipped with a phone ("red phone") directly connected with the prefecture, with the local authorities in charge for the rescue activities (police, firemen, hospitals, etc.), and with the media; it also stored all the books and the reports explaining the emergency procedures.

Finally, Gate A was the place identified for the summoning and the organization of external rescuers in case of emergency.

The procedures defined in POI and PPI were constantly analyzed and improved. On the third Wednesday every month, AZF internal staff simulated an accident and the related mitigation activities. Once per year, a large-scale emergency drill was organized in liaison with firemen and police; then, a debriefing was convened for the assessment of rescue performances and the identification of improvements on coordination procedures.

The process of "construction" of safety rules in AZF has been analyzed by Terssac and Mignard (2011); the two authors detailed the organizational activities related to the development of safety rules and showed how the focus on safety had become a central and shared issue within the plant.

Periodically (twice a year), Atofina gathered all the top managers of its factories to discuss the safety solutions implemented, to evaluate risk management reports, and to exchange experiences. Within the Atofina Group, AZF had an excellent reputation with regard to safety management.

The disaster and the organization of rescue activities

Despite all the efforts devoted to risk management and safety, on 21 September 2001, at 10.17 am, a terrible explosion occurred in the AZF plant. The explosion originated from a downgraded ammonium nitrates store, the hangar 221, which contained between 300 and 400 t of products. It produced a crater measuring 40 meters in diameter and 7 meters in depth, and originated a seismic wave estimated at 3.4 on the Richter scale. It has been estimated that the TNT equivalent mass of the explosion was in a range of 20-40 t of TNT. At the moment of the explosion, 266 employees and 100 agents from sub-contracting companies were on the site.

The explosion devastated the northern part of the plant, but fortunately it did not initiate any domino effect: "the consequences of the explosion in terms of human loss of life and injury could have been much more serious if a storage facility housing toxic products had been seriously damaged or if a tanker of

chlorine or ammonia had been located near the area where the explosion occurred and had been damaged" (Barthelemy *et al.*, 2001: 7). In the same way, the explosion caused heavy damages but did not initiated domino effects at SNPE, a weapons manufacturing company located 500 m away from AZF. The shock wave of the explosion hit Toulouse damaging buildings and injuring people up to 7 km away. More than 25.000 buildings were damaged.

The accident caused the death of 30 people, 22 inside AZF and 8 outside. According to the Haute-Garonne Prefecture, 2,442 people were hospitalised, 30 of them being seriously injured. Injuries included mutilations, pierced eardrums, pleura damages, contusions, etc. More than 8,000 people consulted their general practitioner for acute post-traumatic stress, while about 5,000 persons needed psychotropic treatments (French Ministry of the Environment, 2002; INVS, 2006; Terssac, Gaillard, 2008).

Hangar 221 was located very close (25 m) to gate A and to the emergency building (Figure 1), hence the explosion swept away all the emergency infrastructures and killed or injured most of the emergency staff.
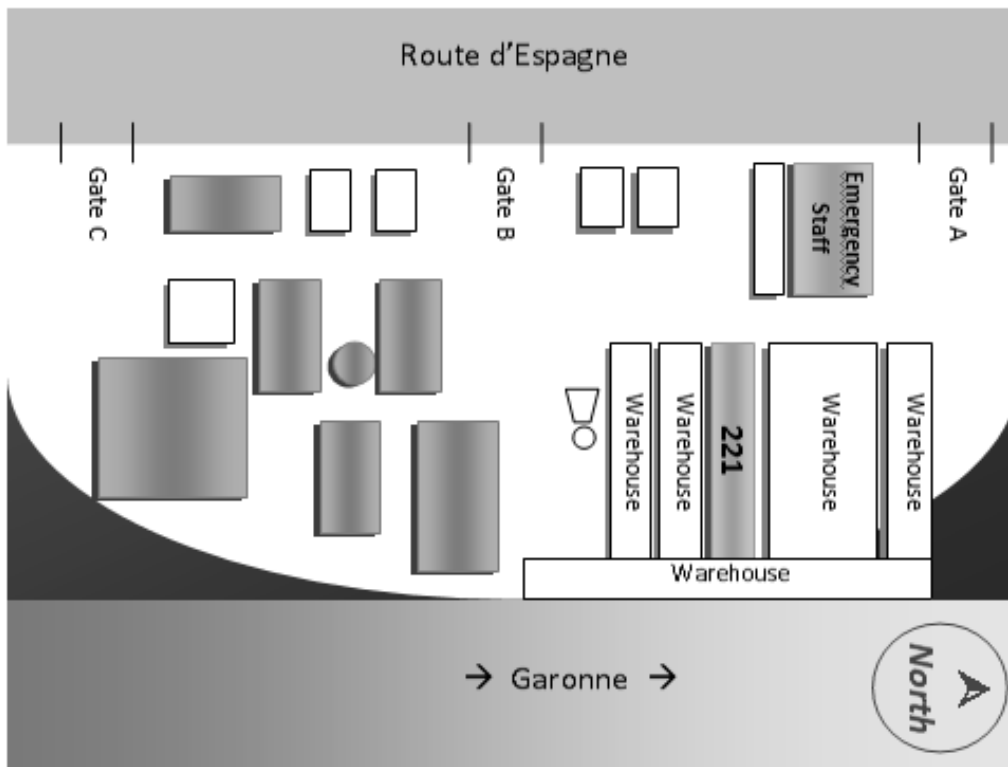

Figure 1: The site.

Inside the AZF plant, employees tried to follow the procedures, as defined by the POI, arresting the hazardous installations placed in the southern part and getting to the predefined summoning points. However, since the emergency staff was missing, emergency activities were slowed down. The northern part of the plant was almost completely destroyed and was being flooded by ammonium nitrate contained in the hangars surrounding the hangar 221. No one had a clear understanding of the situation. The explosion of a "safe" building and the lack of coordination prevented a consistent disaster response. Furthermore, none of the survivors succeeded in getting in contact with the public authorities, mainly because the public communication networks were overwhelmed by the emergency calls from the city. Moreover, "the information to the population was not possible without the buzzer (did not work) or the radio. In a case of a domino effect on a toxic gas storage, the confinement of the emergency action with broken windows was not ensured" (Dechy *et al.*, 2004: 135).

Outside the plant, emergency services heard the explosion and witnessed the effects on the city, but were not notified by AZF. They could not have any information about the source and the causes of the disaster. Additionally, the shock wave damaged the radio infrastructure, temporarily hindering emergency communications (e.g. the radio system of the firemen was malfunctioning for about ten minutes from the explosion).

Firefighters teams standing in their stations were initially dispatched to the urban area to assist injured people. Many of the teams already out for interventions autonomously decided to help the people in Toulouse, without following the formal rule stating the preliminary summoning of the firemen to their base stations. Chaos and lack of information inhibited a rational response to the disaster. Then, about twenty minutes after the explosion, a fireman not in active duty transmitted a message communicating the source and the relevance of the explosion; as soon as such information was received, many emergency teams headed directly to the AZF site, without waiting for specific orders and without being equipped for dealing with hazardous materials. The "red plan"

(i.e. the emergency plan elaborated by the fire brigade for dealing with catastrophic events) could not be applied because of both the massive amount of damages in a very large area and the lack of operational coordination among emergency teams (Kanzari, Thoemmes, 2008).

Within thirty minutes from the explosion, the first external rescuers reached the AZF plant. In accordance with the formal procedures defined by the Special Intervention Plan (PPI), they tried to get to Gate A (the place designated for the summoning with the internal teams), but they found it not viable. Hence, they had to move toward Gate C, but they were hindered by the chaotic traffic reigning on the Route d'Espagne, the road running on the West side of the plant. Finally, when they succeeded in reaching the Gate C, they could not meet the AZF emergency team; instead, they met a large number of shocked and injured people. The rescue operations started immediately: the firemen tried to get to the northern part of the site, even if they were not coherently equipped. Fortunately, the substances freed by the explosion did not present any relevant hazard. Soon, rescue teams were organized in order to remove debris and to try to save injured people.

In a short time, many volunteer firefighters, as well as many firefighters not in active duty, reached the site of the explosion. Their efforts were obviously helpful; however, they contributed to increase chaos and disorder.

Within one hour from the explosion, the emergency teams that had followed the rule imposing to rejoin in the base station and to wait for orders were mobilized. Most of them were dispatched to AZF, while others were ordered to help the population in Toulouse. Teams specialized in hazardous material detection and confinement were also mobilized.

The Prefecture had many problems in coordinating the rescue activities and in dispatching rescue teams in the various locations: in fact, it was very difficult even to have a precise picture of the available resources, since the rule stating the regrouping of the emergency teams was not widely applied. At this time, the lack of information about the nature of the explosion and the

possibility to be dealing with an incumbent chemical disaster made relief efforts very problematic.

In addition, the news of an explosion at AZF shocked the population: they were aware of the risk of chemical releases from the factory and, furthermore, and they were fearing to be experiencing a situation similar to the one they watched on television ten days before (when the Twin Towers collapsed because of suicide terrorist attacks). Panic was mounting. City hospitals and medical services were already running over their capacity, while the number of intervention requests was overwhelming.

During the first six hours from the explosion, the main concern of the rescue teams in AZF was to help injured people while assessing the environmental impact and securing hazardous installations. An emergency medical center was created in a safe building, thus becoming the hub for victims and incoming ambulances. By 1.00 pm, relief efforts were becoming more tightly coordinated by means of the POI, the PPI, and the red plan implemented by the fire brigade. Taking advantage of activity reports and entry/exit records available in the factory, the rescuers were able to compile a list of missing people and to assess their position in the site at the moment of the explosion. In the meanwhile, a considerable number of reinforcements (from the nearby regions and from Bordeaux and Paris) were reaching the AZF plant: in a few hours, more than 1,400 additional rescuers began working on the site. The efficiency of the operations improved and, by 5.00 pm, the emergency could be considered stabilized. However, relief efforts continued for 24 hours. The PPI remained in charge until September 28. The most important activities for securing the site ended in December 2001.

Overall, the relief process succeeded in achieving its objectives, i.e. saving lives and protecting the environment; however, during the first two hours from the disaster, the relief organization was not efficient, and the preliminary plans regulating emergency operations were not widely applied.

The failure of foresight

Hangar 221 was a temporary storage of downgraded (off-specs) ammonium nitrate produced by the different process units of the plant. It housed materials considered below-grade (because of their size or their chemical composition) or returned from customers. From the various workshops of the site, off-specs materials were transported and provisionally stored in hangar 221. The warehouse, though quite old, was in fair conditions, and had not gas or electricity supplies. Periodically, downgraded materials were removed from the warehouse and were sent to other plants of the Atofine Group in order to be recycled. The transportation of these materials was operated by truck, without applying any particular safety measure.

Even after the AZF explosion, it is unclear how dangerous ammonium nitrate is: "[…] ammonium nitrate must be regarded as an explosive substance since, under certain conditions where it is mixed with combustible compounds or catalysts and with a fairy strong source of energy or in event of confinement, it may detonate. This risk is relatively small since it requires a fairly strong source of energy to cause a detonation so that usually the product is consumed more or less quickly" (Barthelemy *et al.*, 2001: 10).

The cause of the explosion is still unknown. Several investigations and inquiries have raised hypotheses to explain the explosion, in particular (French Ministry of the Environment, 2002: 11): unintentional external causes (methane due to bacterial activity, meteorite, falling aircraft parts, explosion following previous site activity); intentional external causes (terrorist attack, mischief, missile); industrial process accident (internal electrical fault at the plant, electric arc, missile effect from a part projected at high speed); chemical reaction in hangar 221 (because of the mixture of incompatible chemical substances).

Whatever the cause was, it is remarkable that the risk assessment studies previously developed and the public and internal inspections had never raised any particular concern about hangar 221. It was simply considered "not sensible": "whilst the risk from fire was contemplated on this type of storage facility, the risk of explosion was considered by the operator to be negligible"

(Barthelemy *et al.*, 2001: 5). More in general, the whole northern part of the site was considered safe, hence emergency services were placed there.

Even the regular inspections performed by the Inspector of Classified Installations did not found any particular problem in the northern area of the plant: "the inspections carried out had been focused, as was quite normal, on those installations deemed to be the most hazardous, which in the case of the Grande Paroisse meant the storage facilities for toxic products (chlorine and ammonia), and the implementation of the new provisions of the Seveso II Directive" (Barthelemy *et al.*, 2001: 22). The last supervisory inspection of AZF took place on May 2001 and was focused on the hazard studies and on the safety management system.

Tight regulation, hazard assessment studies, risk management techniques, periodical inspections, reiterated emergency drills, and analytical emergency plans simply did not succeed in preventing or limiting the effect of a contingency in building 221. Furthermore, it was just by chance (i.e. because of the lack of a domino effect on sensible installations) that the disaster did not originate a terrible catastrophe. Even the rescue procedures, formalized in the Special Intervention Plan, were not managed efficiently, though they proved to be effective. Additional problems affecting rescue operations in the AZF case were redundancy of efforts, rivalry in the emergency management, low degree of communication, and myopia about the general framework of the situation.

The problem is very relevant since AZF was meeting all the dictates imposed by national and international laws and was applying state-of-the-art risk management techniques; in addition, the management of the factory had always shown a strong commitment toward safety and risk management.

Based on the current state of improvement of theory and practice, how to avoid similar accidents or, to limit their consequences or, at least, to efficiently manage relief efforts?

Political reactions to the AZF disaster were headed toward the improvement of the regulation around at-risk sites and the strengthening of hazard studies (with regards to accident scenarios, failure of safety systems,

domino effects) and of risk confinement solutions (back-ups, double confinement of toxic substances, etc.) (Salvi, Dechy, 2005; Salvi *et al.* 2005), will it suffice?

Discussion

Depending on the theoretical framework adopted, the analysis of actual cases allows different interpretations. This is clearly shown by the AZF case.

Positivist theories would emphasize pitfalls and incongruences in the planning process developed by AZF and local authorities. In fact, they presume that, if coherent risk assessment analysis and correct planning are implemented, the disaster recovery activities can be run efficiently. In this case, in particular, the people in charge of the risk analysis process failed in understanding the potential risk arising from hangar 221. Such mistake, legitimated by "distracted" inspectors, provoked an incorrect development of risk management plans and an incoherent predisposition of emergency procedures (both internally and externally). In other words, the mistake is in the human being, not in the system.

However, considering ICS techniques, we have to wonder whether they could have been useful in Toulouse. In effect, it is questionable that an ICS would have had superior performances in the post-disaster crisis: because of the failure of the alarm communication systems, it is likely that the ICS could have not been able to escalate and to organize itself better and more efficiently than the PPI/POI system. In fact, in Toulouse, rescuers failed to recognize the source of the explosion and to understand the nature and the size of the disaster; furthermore, they could not even communicate efficiently. Overall, as noted by Clark and Short (1993: 380), "the normative theory behind this line of thought hold that if only the reality can be ascertained, prescriptions for action will be self evident. While no one would deny we need more and better information, the view has major problems. One is the assumption, palpably false, that information can resolve value conflicts. Another is that organizations often have too much, not too little, information available in decision situations".

From the point of view of improvisation/bricolage theories, we can consider the explosion as a "cosmology episode", i.e. an episode that occurs "when people suddenly and deeply feel that the universe is no longer a rational, orderly system. What it makes such an episode so shattering is that both the sense of what is occurring and the means to rebuild the sense collapse together" (Weick, 1993: 633). AZF employees, residents, and emergency staff lost their system of legitimate meanings and had to collectively initiate a new sensemaking process. Hence, only the bricolage and improvisation skills shown by people and by the rescuers prevented the AZF explosion from resulting in a terrible disaster.

The main problem affecting the organization of the relief efforts was, from this perspective, the excessive formalization imposed by Seveso directives and by local authorities: formal definition and coordination of tasks may in fact stimulate the development of a counter-intuitive system of anti-tasks by which unintended consequences are disseminated along the organization (Turner, 1978). According to this point of view, the planning and prevention process should be less focused on formal, tangible regulation and more oriented at influencing the socialization of common values and cultures to facilitate improvisation and coherent sensemaking in crisis situations.

From a different perspective, based on bounded rationality, the organization of rescue activities in Toulouse may be interpreted as a "synthetic organization" developing its order over time. In the following paragraphs, we are describing the major processes of decisions and actions performed during the crisis.

Immediately after the explosion in hangar 221, survivors followed the procedures stated in the POI and reached the summoning points. However, the formal chain of command and control had been ravaged by the explosion, hence many of the emergency procedures could not be performed (e.g. informing the local authorities, coordinating relief activities with external emergency services, etc.) and the coordination of survivors could not be based on standard rules. Anyway, survivors tried to apply emergency procedures (in

particular, they immediately attempted to secure hazardous installations to prevent domino effects) and someone autonomously decided to move toward the disaster area to help injured colleagues. Rescuers acted in small groups coordinating themselves by mutual adjustment (e.g. by speech and gesture), and without the support of predefined routines.

In the meanwhile, the emergency services (such as civil defence, police, fire department, medical service) located in Toulouse mobilized and planned the rescue activities. The situation was chaotic; no one had a clear understanding of the general relief framework. Requests for interventions were arriving from almost everywhere in the city.

When the first information about the origin of the explosion reached the rescuers in Toulouse, they immediately tried to direct their efforts toward AZF. Their main problem was related to the definition of extent and characteristics of the emergency. Furthermore, they had to decide about the nature and the amount of the resources to be sent, about the locations where to dispatch the rescue teams and about the way resources may take to reach these destinations. In addition, they were forced to modularize their efforts in order to simultaneously help people in AZF and Toulouse inhabitants. Moreover, the breakdown of the communication system did not allow a consistent coordination among prefecture, police, firemen, and medical services.

The rationality of the rescuers' decision-making process was not absolute: they did not succeed in understanding the whole crisis situation, many emergency teams acted autonomously, unnecessary equipment was dispatched, etc. However, the behavior of the rescuers was not random or erratic, instead, it was purposive and direct: they were using the information and the means at hand in order to achieve their immediate goal.

As soon as large numbers of "professional" rescuers arrived on the AZF site, the relief efforts become more orderly. Professional and volunteer rescuers worked in teams coordinated by a group of people able to collect information about critical needs and about resources availability. A local headquarter was established to enable more efficient information flows, the Special Intervention

Plan (PPI) was applied for regulating relief efforts, for setting communication standards, and for elaborating coordination plans; in addition, the availability of additional information allowed a more detailed definition of the intervention priorities. In a few hours, the organization of the relief activities achieved a satisfactory level of order.

The behavior of the rescuers, now coordinated also by means of the rules elaborated by the emergency authorities, was becoming more and more coherent with the relief objectives. Duplication of efforts was virtually overcome, primary support was ensured to all the disaster-affected people, and hazardous installations were secured.

Primary prevention and risk management

As shown by the AZF case, the rescue activities, interpreted as a synthetic organization, can never be completely efficient. As Thompson (1967: 53-54) points out, "it can be presumed that efficiency would be higher if the synthetic-organization headquarters knew in advance either the extent of the problem to be solved or the full array of resources available to it, and that maximum efficiency would be achieved if both were known in advance. Under those conditions it could plan, establish relevant rules, and provide communication channels among its departments". However, under conditions of bounded rationality, it is simply impossible to foresee all the possible future contingencies affecting a system. Routines and plans are useful, but just as decision premises: the rescue decision-making process may benefit of reliable experience formalized in rules, but it evolves depending on the actual situation. Hence, the process of decisions and actions is continuously evolving, creating and re-creating its order (i.e. its behavioral rules) coherently with the evolution of its objectives and with its comprehension of the rescue technology (Maggi, 2003).

The peculiar importance attributed by this approach to preliminary plans and procedures may also call for a different planning process. In fact, traditional emergency and disaster planning is aimed at capturing the

complexities of the real world for identifying and managing risks; in case of failure, emergency plans propose detailed recovery procedures. Such an approach is unrealistic, as empirical evidence shows: it is neither able to prevent disaster, nor to propose efficient disaster-recovery procedures.

From this perspective, human beings are not able (because of their bounded rationality) to design and manage fully safe systems. Even the concept of high reliability organization is misleading: since "HRO studies interpret the absence of low frequency events (such as meltdowns) as evidence of high reliability" (Clarke, Short, 1993: 390): in the end, until 21 September 2001, AZF was a high reliability organization…

In fact, most of the current risk management strategies can be considered as secondary prevention, i.e. they aim at reducing the probability of an accident, while disaster recovery plans seek to reduce the seriousness of injuries resulting from accidents (Ashford *et al.*, 1993; Misomali, McEntire, 2010). In general terms, we may define risk management as "the process of reducing the risks to a level deemed tolerable by society and to assure control, monitoring, and public communication" (Renn, 1998: 51); risk management is generally implemented by means of detailed risk assessment analysis, of predefined risk mitigation strategies, and of formal relief and recovery procedures (Appelbaum, 1977; Morgan, 1990). Such strategies are trying to predict the classes of risk and to prevent them by limiting and controlling the identified initiating causes. In the same way, detailed contingency plans are developed in order to mitigate the impact of disasters.

From a bounded rationality perspective, the global focus on risk management and disaster recovery is a losing game: there will always be unmanaged risks, while managed risks may provoke unintended accidents and disastrous consequences.

Hence, secondary prevention and mitigation strategies are, by themselves, unable to eliminate the risk of catastrophes: "our response to the three sources of disasters needs to be something more than attending to preparation, response, and mitigation, we need to do more than improving the

functioning of our existing organizations; our efforts there can only result in minimal improvements" (Perrow, 2007: 292).

Risk management strategies originate from the risk and try to control it; in other words, they accept the risk, they take it for granted. Perrow (2007) suggests that risk management, by itself, may also create additional risk: for instance, when a territory is exposed to floods, it may invest in shoring up levees (i.e. in managing the risk); such an investment may succeed in protecting from normal risks but, when it happens an exceptional flood, the levees will probably fail thus provoking even higher damages. Another way for dealing with the flood risk can be based on the proactive elimination of the risk: for instance, before or in addition to the levees it could be more useful to implement solutions to avoid the risk of floods (e.g. by creating new storage and conveyance space, or by developing more refined hydro-geological policies).

Evidently, in addition to choices related to secondary prevention, it is possible to envisage strategies that are based on the active pursuit of safety, understood as a state of absence of danger: this approach is called primary prevention.

Hence, governments and enterprises should preliminarily focus on primary prevention approaches, relying on strategies to prevent the possibility of an accident (Figure 2) (Maggi, 1984/1990, 2003; Ashford *et al.*, 1993; Perrow, 2007): it means reducing vulnerabilities instead of managing risks, adopting inherently safer production technologies instead of tightly controlling production processes, storing minimal quantities of hazardous materials instead of double-confining enormous tanks of hazard materials, etc. In other words, "first of all, it is necessary to envisage the possibility to work for avoiding and eliminating the risk, the strategies for limiting the consequences of prevention failures being a logically successive task" (Maggi, 2003: 162). Risk management activities are then necessary, but they are successive and subordinate to the attempts aimed at eliminating the risk.
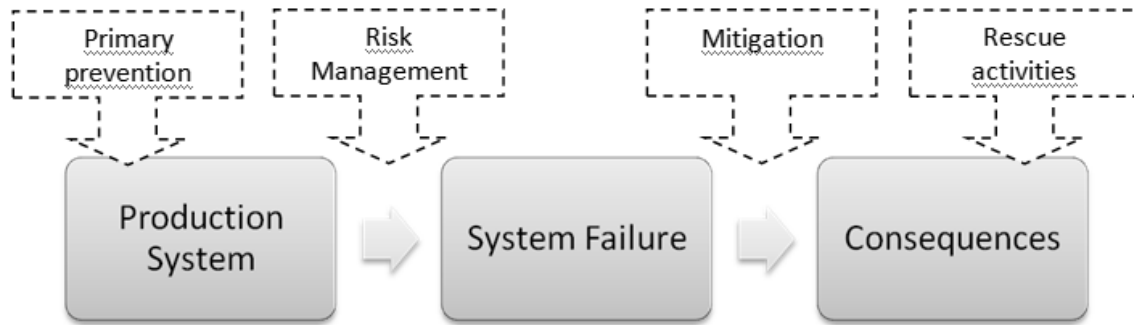
Figure 2: The causal structure of hazard (Adapted from Ashford *et al.*, 1993: II-2).

Obviously, the application of primary prevention strategies does not overcome the necessity of secondary and tertiary prevention. In fact, since bounded rationality prevents decision makers from eliminating all the risks, then such risks must be managed and limited. Primary prevention should be considered as a preliminary, fundamental process to be continuously performed and refined; it should also be integrated and coordinated with risk management and mitigation strategies.

Primary prevention strategies can be applied to any source of disasters (Perrow, 2007) and require a wholly different application techniques, in particular in enterprises: "industrial firms typically regard safety (as well workers health and environmental concerns) as an objective to be satisfied separate from, but consistent with, production output and efficiency. […] Safety responsibility is usually given to safety professionals expert at secondary prevention, but not particularly expert at process design or choice of material inputs. The safety decisions are viewed as the choice among possible (usually off-the-shelf) risk-reducing technologies and practices, not the choice of inherently safe technologies" (Ashford *et al.*, 1993: V-1).

Under conditions of bounded rationality, indeed, the responsibility for primary prevention should not be allocated to management staff; instead it

should become a proactive process involving all the workers. At the end, safety management would require modifications to the labor processes, from their conception to their execution (Maggi, 2003; 2010). Real-world applications of primary prevention strategies, such those described in literature (Maggi, 1984/1990; 2003; Maggi, Rulli, 2010), proved to be viable and effective.

Cooperation and goal conflicts in crisis situations

Francesco Maria Barbini, *Università di Bologna*

Introduction

Cooperation is one of the most debated topics by contemporary Organization Theory; it is often combined and confused with concepts like "interdependence" and "coordination", and is widely investigated and analyzed. Interfirm networks, Internet/ICT-supported collaboration, outsourcing and off-shoring, knowledge networks, social networks, team-working, human resource development are among the most relevant themes involving the concept of cooperation.

This contribution is proposing an organizational discourse to understand and explain the problems and inefficiencies affecting cooperative behavior. The analysis is developed by investigating the most important facts related to the international relief process carried out in the aftermath of the 2004 Indian Ocean tsunami. In particular, it is focusing on the cooperation and coordination problems arising in post-disaster rescue processes. From an organizational point of view, it is important to understand how the subjects involved in the relief process cooperate and coordinate their behavior to effectively meet the needs of disaster-affected people. To this end, the tsunami case study is to be considered a magnifying glass allowing to point out the cooperation and coordination problems arising in every collective behavior.

First of all, the tsunami case will be described and the major cooperative problems related to rescue processes will be highlighted. Then, basing on available literature, the concepts of cooperation and coordination will be explained and declined with a focus on humanitarian emergencies. Finally, a framework for studying cooperative issues will be introduced and applied for explaining the events occurred in the immediate aftermath of the tsunami.

The case study has been drawn up by means of an extensive desk survey. News and official situation reports (covering the period between 26 December 2004 and the end of January 2005) have been analyzed in order to reconstruct the flow of the events and the most relevant facts related to international coordination. In addition, a review of post-disaster official reports and documents (mainly issued by the United Nations or by independent bodies) has been carried out.

Disasters and the international relief system

Humanity has always been forced to cope with disasters. Along the centuries, hurricanes, droughts, earthquakes, epidemics, famines, floods, population movements, volcanic eruptions, blazes have been influencing the evolution, the history, and, ultimately, the survival of humankind. A large number of analysis have been carried out (by geologists, social scientists, geographers, policy-makers, historicists, sociologists, psychologists, military forces, economists, environmental analysts, etc.) to investigate the impact of disasters on the different spheres of a community, to predict and prevent disastrous events, to make the post-disaster recovery process more efficient (Fritz, 1961; Turner, 1976; Turner, Pidgeon, 1997; Quarantelli, 1998; Perrow, 2007).

On a global scale, disaster relief activities are carried out by international agencies, by national disaster-ready institutions (civil defence departments), by non-profit, voluntary entities (Non-Governmental Organizations, NGOs). The main international agencies usually involved in complex relief activities are the International Federation of Red Cross and Red Crescent Societies, the United Nations Development Programme (UNDP), the Food and Agriculture Organization (FAO), the United Nations Children's Fund (UNICEF), the World Health Organization (WHO), the World Food Programme (WFP), the United Nations High Commissioner for Refugees (UNHCR), the Office of the High Commissioner for Human Rights (OHCHR), and International Organization for Migration (IOM). Moreover, a continuously growing number of international,

governmental or voluntary bodies are involved in post-disaster relief and recovery activities.

Such entities act almost independently, deciding their own priorities and their intervention strategies. Consequently, international relief activities are usually managed and carried out by a large number of institutions, playing both complementary and concurrent roles: in case of large emergencies, this autonomous attitude is very likely to result in duplication of efforts, relief ineffectiveness, and in a low rationality of behaviors. The lack of strategic and operative coordination among institutions usually results also in low efficiency and, sometimes, in low effectiveness. For instance, for the 1999 Kosovo crisis, donor countries acted unilaterally, without operational coordination: each country built its own refugee camp and conveyed there forces and resources. The United Nations played a marginal, secondary role. This "chaotic" approach resulted in heavy redundancy of efforts, and, in general, in a poor quality of the humanitarian intervention. In the same year, the United Nations directly and tightly coordinated the relief efforts for the emergency in Timor East. In this case, the international cooperative action was more effective, and the emergency was stabilized in a relatively short time. Redundancy of efforts, rivalry in funds allocation and management, low degree of communication, and myopia about the general framework of the situation are then typical problems arising in complex emergencies, such as the Indian Ocean tsunami.

The present configuration of the humanitarian system was established on 19 December 1991, when the General Assembly of the United Nations, recognizing the need for higher international coordination in case of humanitarian emergencies (mainly as a consequence of the UN system's inability to operate effectively during the 1991 Kurdish crisis), passed the Resolution 46/182 ("Strengthening of the coordination of humanitarian emergency assistance of the United Nations"). The resolution reaffirmed the responsibility and the primary role of the disaster-affected States in the initiation, organization, coordination, and implementation of humanitarian assistance within their territory (Resolution 46/182, title I par.4). In addition, it

assigned to the United Nations a pivotal role in providing leadership and coordinating the efforts of the international community to support the affected countries (Resolution 46/182, title I par.12). To this end, the Resolution instituted the high-level position of Emergency Relief Coordinator (ERC), with the status of Under-Secretary-General for Humanitarian Affairs. The ERC was charged of the coordination of international relief activities in case of humanitarian emergencies. Inter alia, the ERC had the following responsibilities (Resolution 46/182, title VI par.35): (a) processing requests from affected member states for emergency assistance requiring a coordinated response; (b) organizing, in consultation with the government of the affected country, joint inter-agency needs-assessment missions; (c) serving as a central focal point with governments and intergovernmental and non-governmental organizations concerning United Nations emergency relief operations; (d) actively promoting, in close collaboration with concerned organizations, the smooth transition from relief to rehabilitation and reconstruction as relief operations under his aegis are phased out.

The resolution 46/182 also instituted the UN Department of Humanitarian Affairs (DHA) to mobilize and coordinate the collective efforts of the international community and introduced a committee for the promotion of the coordination among international relief agencies (Inter-Agency Standing Committee – IASC), both chaired by the ERC. The DHA was designed to "mobilize and coordinate the collective efforts of the international community, in particular those of the UN system, to meet in a coherent and timely manner the needs of those exposed to human suffering and material destruction in disasters and emergencies", while the IASC was intended as a crucial forum for humanitarian dialogue and decision-making, bringing together all humanitarian partners directly involved in specific relief interventions. IASC was aimed at shaping humanitarian policy and ensuring coordinated and effective response. United Nations, International Organizations, Red Cross and Red Crescent Movement and representatives of NGOs were convened as permanent members of the IASC. Finally, the Resolution introduced the figure

of the Humanitarian/Resident Coordinator, as a central coordinator of emergency preparedness and assistance at national level.

In 1998, within the framework of a global institutional reform of the United Nations, the DHA changed its name into Office for the Coordination of Humanitarian Affairs (OCHA). In addition, OCHA's coordination functions were emphasized by transferring many of its operational attributions to other UN agencies and by enforcing its responsibilities related to the advocacy for human rights (OCHA, 2000). Having lost its operative attributions, OCHA ceased to be a "player in the field" during emergencies, thus becoming able to play a super-partes role, coordinating the action of the institutions directly involved in the relief process. In addition, thanks its new linkages with both the higher directional offices of the UN and the national governments, OCHA was now in a position strong enough to promote integrated and holistic (i.e. politically and, if the case, military supported) interventions in areas afflicted by humanitarian emergencies (OCHA, 2000; 2006). Since 2004, OCHA has two headquarters: one in New York (which is in charge of the relationships with the political organs of the UN and of the management of emergencies provoked by natural disasters) and the other in Geneva (in charge of the management of complex emergencies). The mission of OCHA is to mobilize and coordinate humanitarian action in partnership with national and international actors to alleviate human suffering in disasters and emergencies, to advocate for the rights of victims, to promote preparedness and prevention, and to facilitate sustainable solutions (OCHA, 2008). OCHA's main intervention body is IASC, which is convened and headed by ERC. ERC may also deploy other rapid-response bodies, such as the UN Disaster Assessment and Coordination Teams (UNDAC), International Search and Rescue Advisory Group (INSARAG), and the Geographic Information Support Team (GIST).

With reference to information sharing among emergency agencies, the United Nations deploys three tools: the IRINnews (Integrated Regional Information Network), a humanitarian news and analysis service; the Humanitarian Information Centre, an emergency-specific, data-exchange

platform; and the ReliefWeb web-based information systems aimed at harvesting and sharing information about emergencies and relief activities. In particular, ReliefWeb was launched by OCHA in 1996. In 1997, the General Assembly of the United States passed Resolution 51/194, endorsing the creation of the system and encouraging the widespread adoption of ReliefWeb as standard information systems for emergency management. Today, ReliefWeb is "an independent vehicle of information, designed specifically to assist the international humanitarian community in effective delivery of emergency assistance, it provides timely, reliable and relevant information as events unfold, while emphasizing the coverage of forgotten emergencies at the same time" (ReliefWeb web site). In 2002, its web site (www.reliefweb.int) received 1,5 million hits per week, in 2004 it reached 1 million hits a day, during the Indian Ocean tsunami emergency it received 3 million hits a day on average; in the first two months following the tsunami, ReliefWeb published more than 4.000 documents and 90 maps on the disaster. The number of ReliefWeb information partners is continuously growing (from 250 in 1996, to 800 in 2001, and to more than 2.500 in 2007), as well as the amount of information managed by the system (Naidoo, 2007).

Globally, the international relief system is complex and multiform, and it is characterized by high dynamicity (mainly caused by the continuous proliferation of NGOs) and low inter-institutional communication.

The coordination of such a large and varied web of entities is the main task of OCHA, which operates by collecting information from the various sources in the field, elaborating such information, identifying core intervention needs, soliciting and deploying resources. Moreover, OCHA has the authority to convene the actors involved in the relief activities to agree shared intervention strategies. Finally, OCHA proposes relief routines and procedures and develops communication standards.

The Indian Ocean tsunami

On 26 December 2004, at 7.58 am, an earthquake registered 9.0-9.3 magnitude on the Richter scale struck the Indian Ocean. The epicenter was located in the Ocean, close to the West coast of northern Sumatra, 250 kilometers South-West of Banda Aceh. The enormous energy (equivalent to that of thousands of Hiroshima bombs) unlashed by the quake, the stronger registered by seismographs in the last forty years, triggered a massive tidal wave (tsunami) that hit the coasts of the Indian Ocean (Titov *et al.*, 2005). In less than an hour, waves moving at speed of more than 500 km/h struck Indonesia (provoking 167.540 people lost) and Thailand (8.212 people lost). Then, propagation waves reached Sri Lanka (35.322), Maldives (108), Malaysia (75), Myanmar (61), Bangladesh (2), India (16.269), Seychelles (2), and, seven hours and thousands of kilometers later, Somalia (289), Yemen (2), South Africa (1), Kenya (1), and Tanzania (13).

The tsunami flooded coastal areas and destroyed or damaged houses, buildings, farms, markets, infrastructures, and water and electricity supplies (OCHA, 2006). Entire costal ecosystems were wiped away. The flood left more than 5 million people without primary resources, with their own survival threatened. The total damage provoked by the tsunami was estimated at about US$ 10 billion (TGLLPSC, 2009). The official number of people killed by the earthquake and the following tsunami is unknown, however, it is estimated at about 228.000. In addition to the 14 affected countries, 40 other countries reported dead or missing citizens.

In terms of death toll, the Indian Ocean tsunami disaster was not the worst humanitarian emergency of our time (for instance, in 1970, the storm surge in the Bay of Bengal killed 300.000 to 500.000, in 1976, the Tangshan earthquake killed at least 242.000, and the 1974 tornado in Bangladesh killed 400.000); however, never, in our recent history, a disaster provoked similar disruption in such a wide area, impacting two continents (Asia and Africa).

Immediately, an extraordinary media coverage started (perhaps because of the period of the year - Christmas holidays - or because of the involvement of

many Western tourists), contributing to the amplification of the impact of the news on the public opinion. Such a relevant psychological impact on the public opinion paved the way to unprecedented fund-raising campaigns. In a very short time, US$ 13,5 billion were pledged or donated, constituting the largest international fund-raising campaign on record (Telford, Cosgrave 2006; TGLLPSC, 2009).

In the immediate aftermath of the tsunami, local people carried out the large majority of search and rescue activities. "Survivors were rescued by their neighbors and by other survivors using whatever means were at hand. Surviving doctors, nurses and paramedics rendered first aid in makeshift or remaining health facilities" (Telford, Cosgrave, 2006: 42). Rapidly, national agencies mobilized to support the local communities affected by the tsunami, trying in particular to restore hospitals and infrastructures.

The United Nations immediately sent assessment teams to collect information and develop a detailed representation of the emergency. The entire international relief system mobilized; many national governments did the same, alerting their civil defence agencies and their disaster-ready institutions. NGOs promptly got in contact with local governments to obtain the permission to send men and resources in the disaster areas.

A second (humanitarian) tsunami was approaching…

Within the first few hours, international first aid and assessment teams (mainly UNDAC teams) were dispatched to the most affected areas. Subsequently, large international rescue forces started reaching the most prostrated countries with the objective of alleviating the sufferings of the survivors by supplying them with food, drinkable water, first aid kits, and field tents. International rescuers initially acted in three main directions: (a) sustaining and supporting the victims, (b) collecting detailed information about the extent of the disaster and about the resources needed by the survivors, and (c) defining, refining, and adopting operative routines and defining communication standards. Furthermore, the UN Secretary-General immediately appointed a Special Coordinator for Humanitarian Assistance to

the tsunami Affected Communities to provide leadership and support to the UN country teams and to facilitate the delivery of international assistance through high level consultations with the concerned governments (Bennett *et al.*, 2006: 30).

In a relatively short time, camps and health services were set up in many areas; however, relevant relief coordination problems emerged: the unmatched scale of the emergency, the lack of reliable information about the amount and the nature of resources needed by each country called for higher synchronization and modularization of the intervention. On the other hand, the extraordinary amount of funds made available by governments and by private donors generated a counter-intuitive problem: how to allocate such resources?

Specifically, at least during the initial phase of the post-tsunami emergency, rescuers were forced to invert the typical procedures for the relief process. Usually, in fact, this process starts with the analysis of the size of the disaster and with the classification of the most needed resources. Then, the intervention is planned and resources solicited and dispatched consequently. This approach depicts a situation in which relief interventions are pulled by the victims' actual needs. Instead, at least for the first two weeks from the tsunami, the relief process was managed on the basis of available resources and donations. In that case, available resources were "pushed" in the affected area. "The response was supply-led rather than demand-driven. In the initial phase particularly, agencies were under pressure to spend money quickly to enable reporting of activities to the general public" (Cosgrave, 2005: 11).

By the eve of January, hundreds of international NGOs were working on the field, supporting national and international disaster-ready institutions and agencies. "Inappropriate aid was just as evident, however: there were numerous instances of duplication, as well as of the distribution of inappropriate goods. [...] Despite the large amounts of funding raised for the tsunami response, important gaps in crucial humanitarian sector persist" (Telford, Cosgrave, 2006: 51). Certain affected areas were overcrowded by rescuers, while others remained under-supported. In addition to duplication

and overlapping of efforts, many instances of inappropriate aid were reported, such as the provision of Viagra, ski jackets, expired drugs, tinned pork dispatched to Muslim areas, and expired food. Inappropriate or delayed aid frustrated the victims and provoked (besides the waste of resources) a raising resentment in the affected populations.

In such a complex and chaotic situation, UN's coordination capabilities were inhibited by political and operational problems. The need for coordination mounted. "The size and speed of this operation, and the ever growing number of those involved in providing assistance, make effective coordination absolutely critical, and we are devoting the resources we need at all levels. We also have to do everything we can to ensure that all of the assistance gets to those in need, and that none of the pledges made remain unfulfilled. (…) Today our greatest challenge remains how to make sure that the right kind of relief reaches the people who need it most" (Egeland, 2005).

OCHA established a local Inter-Agency Standing Committee (IASC) in Banda Aceh to support coordination by proposing standard routines and procedure, and to assist the Resident Coordinators / Human Coordinators who were overwhelmed by the size of the interventions required and the resources available. However, the local IASC could not gather all the stakeholders involved in the relief process thus suffering of under-representativeness.

On December 29th, the President of the United States of America announced the establishment of a Regional Core Group (RCG) with India, Japan, and Australia aimed at deploying military contingents and equipment to support civilian-led humanitarian efforts. The RCG, lacking a reliable definition of the resources needed, modularized its military forces in small rapid intervention teams to efficiently meet the different needs of the victims. Such teams, helicopter transported, were able to perform rapid search-and-rescue missions, to dispatch everywhere food and medications, to install water-treatment systems, to repair roads, and to restore primary communication infrastructures.

On January 6th 2005, an operative meeting for the coordination of the international relief efforts was held in Jakarta. Later on the same day, the Regional Core group disbanded: OCHA was now fully in charge for the coordination of relief strategies and operational decisions. The dissolution of Regional Core Group was justified by the need for a more integrated and agreed relief strategy. However, the modular and flexible military forces deployed by the RCG had proved very useful for supporting initial relief activities and, in general, reached their objectives. Based on the resolutions of the Jakarta meeting, OCHA launched a Flash Appeal for US$ 977 million to meet emergency needs of about five million people over a six-month period.

On January 11th, the political leaders of more than 80 countries met in Geneva to set the objectives of the ongoing relief activities and to agree a medium-term intervention strategy. The main objective of the meeting was to match available resources with the needs of any country, thus making the relief process "pulled" by the needs of affected people, instead of "pushed" by the availability of some kind of resources.

On January 26th 2005, one month after the tsunami, the United Nations estimated that all the disaster-affected local communities were receiving a primary support. The World Food Programme was constantly supplying food to 1,2 million people. More than 500.000 people were supplied with drinkable water. Children were going back to school. The humanitarian emergency was declared "stabilized". "Despite the weakness and delays in the response, the relief phase passed rapidly and reasonably effectively" (Telford, Cosgrave, 2006: 54).

Theoretical background

The cooperation and coordination problems highlighted by the tsunami case are common issues in humanitarian emergencies. Most of the literature focusing on disaster response deals (more or less directly) with cooperation and coordination themes and proposes specific intervention strategies.

A dominant stream of research emphasizes the importance to develop flexible and efficient plans (e.g. Quarantelli, 1982; 1985; Lagadec, 1993; Perry, Lindell, 2003). From this point of view, the planning process is the ideal place for implementing procedures for coordinating the behavior of the subjects involved in the rescue activities (Shelton, Sifers, 1994). The objectives of the rescue activities are clearly predefined: "a shared, well-defined mission is at the core of successful management in any setting, and the same is true during disaster management. The ability to specify relevant objectives requires that the incident be well understood and that active jurisdictions and authorities be well defined relative to it. If incident managers discover areas in which the mission, objectives, and priorities are unclear, unattainable, or participating agencies do not agree about them, they must work to generate clarity and explicit consensus" (Donahue, O'Keefe, 2007: 79). Coordination problems may emerge because of inefficient communication systems or ineffective leadership.

Other contributions consider the disasters as events breaking the social equilibrium of a society, and analyze how a new, legitimate and long lasting equilibrium might be re-established (e.g. Chapman, 1954; Form *et al.*, 1956; Baker, Chapman, 1962; Healy, 1969; Quarantelli, Dynes, 1977; Drabek, 1986). Underlying this approach, there is the assumption that external shocks modify the functional requirements a society must fulfil to survive; hence, after a disastrous event, an evolution toward a new equilibrium is required. Usually, such theoretical contributions belong to sociological studies and share a functionalist point of view. Their objective is to understand the strategies and the techniques (i.e. the coordination strategies) for allowing a community to efficiently move from a standing equilibrium to another (hopefully better).

Other theoretical studies (e.g. Lanzara, 1983; Gephart, 1984; Weick, 1993; 2007; Roux-Dufort, Vidaillet, 2003) highlight the role of improvisation processes in achieving effective relief interventions. According to such interactionist interpretations, the organization of the relief activities "emerges" spontaneously (ad-hoc, contextual coordination) from a set of creative, random, and sometimes irrational behaviors. Cooperation is emergent, and coordination is contextual

and based on direct communications, while predefined rules are usually ineffective and sometimes dangerous: "... [analyzing the facts related to a disaster] it means analyzing the preparedness, response, and recovery operations as they actually occurred, in contrast to what had been expected or ignored. It means separating the reality of action from the myths of planning and learned ignorance and recognizing that the basis for building effective crisis management lies in the human ability to recognize and correct mistakes" (Comfort, 2007: 189).

Hence, even if declined and interpreted in different ways, cooperation and coordination are central concepts for understanding the organization in disaster. The definition of these concepts, however, is often implicit, fuzzy, omitted. Therefore, it is useful to refer to classic definitions and, in particular, to the fundamental contributions proposed by Chester Barnard and Herbert Simon.

Simon (1947) stated that a collective behavior may be qualified as cooperative when the involved subjects prefer the same set of consequences, i.e. share (deliberately or not) a common goal. The fundamental characteristic of any cooperation is its common finalization (Maggi, 2003: 126). More in detail, subjects start to cooperate when they cannot achieve their personal goals independently, because of physical, biological, and/or cognitive limitations (Barnard, 1938). Obviously, for every participant, the objective of the cooperation is instrumental to the attainment of his own goals.

Coordination may be defined as the process "providing each one with knowledge of the behaviors of the others upon which he can base his own decisions" (Simon, 1947: 81), it is the *ordination process of the cooperative collective action* (Maggi, 2003: 129-130). As Barnard pointed out, "activities cannot be coordinated unless there is first the disposition to make a personal act a contribution to an impersonal systems of acts, one in which the individual gives up personal control of what he does" (Barnard, 1938: 84). By means of coordination, the behavior of any subject is integrated into a cooperative pattern; if coordination is formally stated and agreed, cooperation may achieve

higher levels of efficiency. Based on these classic definitions, we can state that every cooperative action is coordinated, and that both the effectiveness and the efficiency of the coordination depend on the extent to which each subject involved in the cooperation is able to gather reliable information on the behavior of others.

With reference to the organization in disaster, almost all the literature prefigures the presence of a common objective catalyzing the atomic behaviors of rescuers into a cooperative pattern. Contributions aimed at proposing efficient strategies for planning in advance the relief procedures consider the identification of a common objective as a necessary prerequisite for the breakdown of the plans. The whole architecture of the rescue plans is built around a clearly stated objective (e.g. Quarantelli, 1985; Lagadec, 1993; Perry, Lindell, 2003). For the literature interested in investigating the interventions necessary to re-establish a functional equilibrium in a society hit by a disaster, the final objective is the restoration of the equilibrium. The forces available in the field coalesce and are driven by the unavoidable need for a stable, legitimate equilibrium (e.g. Baker, Chapman, 1962). Even the interactionist propositions, focusing on ephemeral, temporary organization arising from creative "bricolage" processes, assign a considerable attention to the shared objective as an "occasion for structuring". On the other hand, in the process of sensemaking driving the reconfiguration of the formal organization in case of emergency, the availability of a common goal allows the participants to develop shared representations of the reality (e.g. Weick, 1988; 1993).

In general, the disaster-related literature takes the presence of a common goal for granted: in the extreme post-disaster conditions, all the rescue activities are supposed to be aimed at saving lives and alleviating sufferings. This means that, during post-disaster emergencies, cooperation would be arising almost spontaneously. Hence, all the problems related to actual rescue behavior should be attributed to the process of definition of the steps to be followed to achieve the common goal; ultimately, all the problems derive from decisions concerning the coordination of the relief behavior. As Simon (1947: 115) pointed out, "the

attainment of the best result implies that each member of the group knows his place in the scheme and is prepared to carry out his job with others. However, unless the intentions of each member of the group can be communicated to the others, such coordination is hardly possible. Each will base his behavior on his expectations of the behaviors of the others, but he will have no reason to expect they will fit into any preconceived plan. Lacking formal coordination, the result will be highly fortuitous".

According to this interpretation, the problems in the relief processes are associated with the definition of goals, but would be related to another analytical level, that of the coordination of the cooperative action. Hence, in order to improve the effectiveness and efficiency of relief processes, it would be necessary to focus on coordination and regulation processes. However, it is interesting to focus on goal-setting processes in order to understand how how the agreement on very general goals, such as "to save lives", may be able to ensure a consistent integration of the cooperative behavior.

Barnard (1938: 87) suggested that "if in fact there is important difference between the aspects of the purpose as objectively and cooperatively viewed, the divergences become quickly evident when the purpose is concrete, tangible, physical; but when the purpose is general, intangible, and of sentimental character, the divergences can be very wide yet not recognized"; in particular, he stresses that "when the purpose is less tangible – for example, in religious cooperation – the difference between objective purpose and purpose as cooperatively viewed by each person is often seen ultimately to result in disruption". This point of view can be explained by adopting the Simon's theory of bounded rationality. Indeed, according to Simon (1947), every decision making process carried out by the subjects is intendedly rational but only boundedly so.

The rationality of the decision making process is limited by (1) the subject's incapability to clearly define all the objectives of his behavior (and to accurately rank them in order of preference) and by (2) his incapability to exactly understand the cause-effect relationships to be developed to attain a

desired outcome. Even if not efficient, the behavior of the subject is not erratic, it is continuously directed toward a (roughly defined, variable) goal. In fact, at any moment, the subject addresses (more or less deliberately) his behavior coherently with his means-ends schema. This schema represents in hierarchical chain the goals inspiring the subject. In conditions of bounded rationality, such hierarchy would never be an integrated, fully connected chain. Furthermore, it is variable over the time, since it is influenced by the development of subject's knowledge and by the evolution of his values: "instead of a single branching hierarchy, the structure of conscious motives is usually a tangled web or, more precisely, a disconnected collection of elements only weakly and incompletely tied together; and the integration of these elements becomes progressively weaker as the higher levels of the hierarchy – the more final ends – are reached" (Simon, 1947: 74). Nonetheless, even if incomplete and variable, the means-ends schema is fundamental for attaining integration and consistency in the behavior, for pursuing coherence.

Consequently, the subject places (deliberately or not) every goal he identifies within his means-ends schema; this new goal requires the attainment of intermediate goals (means) and it is instrumental to the achievement of higher-level goals. In this way, the subject depicts (under conditions of bounded rationality) a strategy consistent to the attainment of the desired state of world. The subject develops his hierarchy of objectives taking into account (1) his experience and his knowledge in order to derive some insights about the cause-effect relationships that actually link the phenomena involved, and (2) his system of values, to select coherent objectives. All the goal-setting activities involve two judgments: factual judgments and value judgments (Simon, 1947).

The common goal of the cooperation is integrated by any subject into her means-ends schema. However, there is no evidence attesting the actual consistency of means-ends schema of the various subjects involved in a cooperation (Figure 3). In this case, the efforts aimed to coordinate the actual behavior of the subjects are unlikely to achieve their results, since the subjects

formally operate to achieve a common goal but they adopt intermediate goals consistent with the pursuing of their own hierarchy of goals.

In case of problems in the integration of the subjects' means-ends schemes, the attempts aimed to encourage coordination between them will be doomed to failure since they focus operational aspects, not the root of the problem, which concerns the hierarchy of goals.

The diagram on the left shows a hierarchy with boxes: Goal Z and Goal W at top, feeding into Goal XY in the middle, which connects down to Sub-goal X₂ and Sub-goal Y₂, then to Sub-goal X₁ and Sub-goal Y₁, and finally to Subject A and Subject B at the bottom.

The bullet points on the right:
- XY is the common objective, without the agreement on XY cooperation is impossible;
- To reach XY, every subject introduces a set of intermediate goals (X_1, X_2, Y_1, Y_2);
- For every subject, the attainment of XY is a means for pursuing other goals (Z, W);
- The more the super-objective Z and W are different, the higher is the risk of conflicts;
- The "higher" the cooperative goal is, the more likely are differences in sub-goals;
- The more the partners' intermediate goals are different $X_1 \neq Y_1$, $X_2 \neq Y_2$, the less integrated is the behavior of the partners;
- X and Y may cooperate for achieving the goal XY and compete for higher-order goals, or compete for attaining intermediate objectives
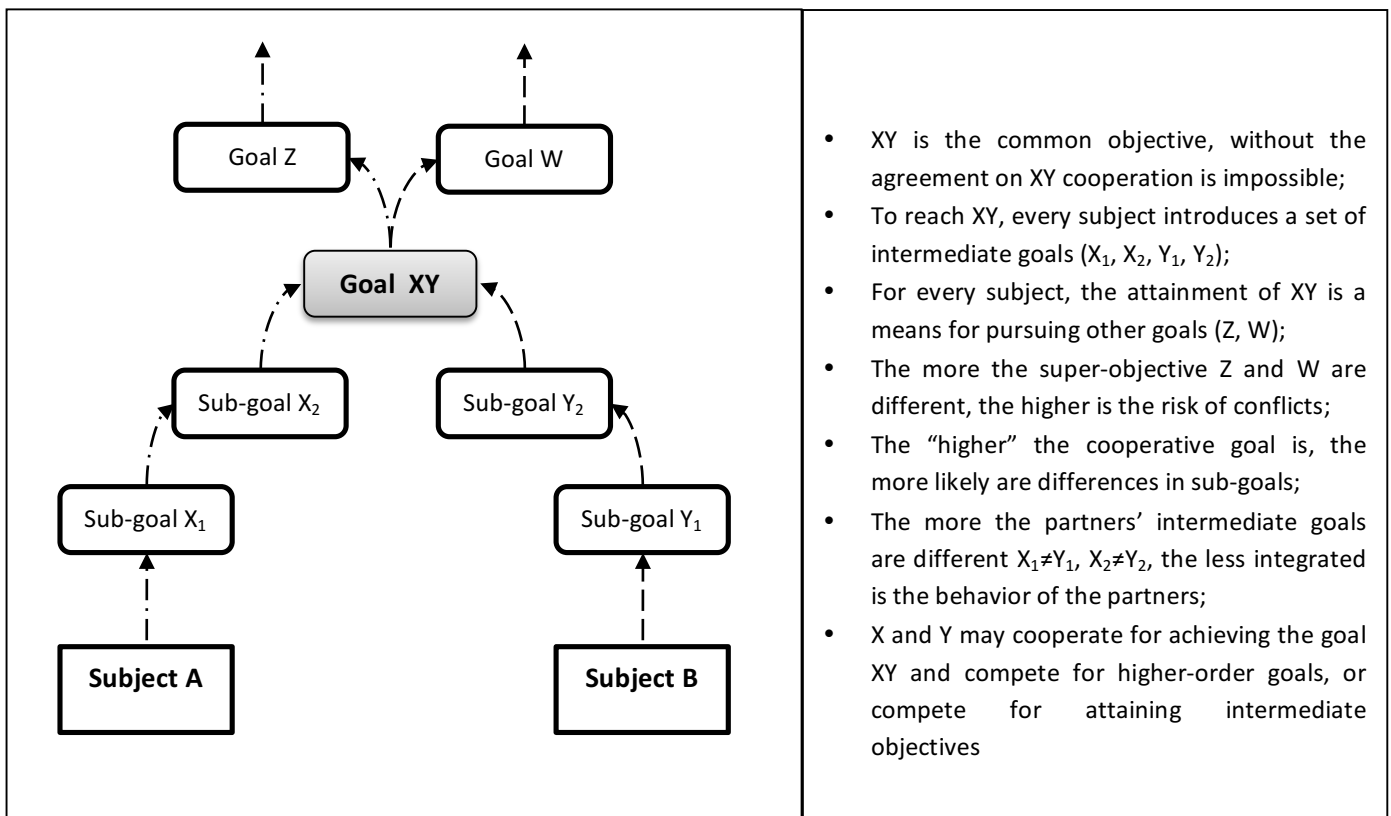
Figure 3. Cooperation and the integration of the cooperative behavior: a simplified representation of the partners' means-ends schema.

For instance, the general objective "to save lives" may be pursued by disaster-ready institutions to make the world a better place, to maintain the geo-political equilibrium in the area, to gain visibility to attract additional resources, to keep the workforce alive and able to perform its activities, to establish partnerships in the area, or to demonstrate their reliability and to keep a continuous support of donors. In the same way, in order to save lives, disaster

ready institutions may arrange their intermediate objectives to save people immediately in need, to heal injured persons, to avoid epidemics, to keep the hit area safe, to accommodate the homeless, to protect the environment, to sustain the economic activities, or to restore the infrastructures. The elaboration of such hierarchical patterns of objectives is an individual task, there are no "invisible hands" ensuring the integration of the autonomous intermediate objectives into cooperative ones.

The common tension toward a very general goal may result in ambiguities of the means-ends schema and, eventually, in cooperation inconsistency. Many of the operational coordination problems experienced in actual collaborative ventures are direct consequence of the lack of coherence among the participants' intermediate goals, the general agreed objective being unable to foster the integration of individuals' means-ends schema. The more the cooperative goal is general and indefinite, the more inconsistent the intermediate goals of the subjects will be.

Reinterpreting the post-tsunami relief process

As described above, as soon as the tsunami was over, survivors and available disaster-ready institutions, acting individually or in small auto-regulated groups, started the relief activities.

Their objectives were clear and (more or less deliberately) agreed: to save the people more in danger. The cooperating subjects shared a very immediate goal, and their behavior was tightly integrated by direct communication.

As professional rescuers and additional resources arrived and new, wider objectives emerged (for example, the initial objective of saving those in needs was complemented with the necessity to make the disaster area safe and healthy and to provide affected people with primary means of support), the need for coordination became more and more relevant. Now, cooperative goals were "higher" (i.e. more generic, less direct) than the previous ones. Cooperating subjects "put" these general goals within their means-ends schema and the integration of the cooperative behavior became less obvious. In

addition, with a growing number of people and equipment in action, the coordination complexity increased considerably and it became impossible for the rescuers to coordinate just by mutual adjustment: the initial contextual regulation process was becoming not only inefficient, but also ineffective. Professional rescuers coordinated their behavior also by means of predefined rules, hence making relief activities more efficient. Nevertheless, relevant problems related to the global coordination of the international relief efforts remained: many disaster areas were not receiving any support, while others, usually the ones located closers to ports or airports, were crowded by large quantities of unnecessary resources. In addition, the continuous flow of resources and equipment was immobilizing the airports and other communication infrastructures. Three main problems emerged: "the proliferation of agencies made coordination more expensive and less effective; generous funding (especially private) reduced agencies' need to coordinate; and the perceived need for quick, tangible, agency-specific results fuelled competition for visibility, 'beneficiaries' and projects. The absence of agreed field representation mechanisms for (well funded) NGOs and poor coordination skills among some managers complicated coordination. These were compounded by lack of clarity between coordination at the operational level (who does what) and coordination at the policy level (including joint advocacy)" (Telford, Cosgrave, 2006: 22).

These problems emerged because every subject involved in the relief process was integrating the common goal, e.g. "to save lives and to alleviate sufferings", into his means-ends chain; this integration imposed the definition of a set of intermediate goals and behaviors instrumental to the achievement of the final goal and imposed to put the final goal in relationship with higher-level goals. Many means-ends schema were being developed, hence every institution directed its behavior toward a particular set of objectives consistent with its own schema.

At this time, the disaster-ready institutions were cooperating for saving lives, but they were also competing for resources, for visibility, and, ultimately,

for gaining the leadership of the relief process. In addition, the intermediate goals deployed by such institutions were unable to allow efficient instrumental behavior. Agencies were competing for projects, locations, staff, and publicity: "high levels of funding led to heightened competition both for partners and for the area in which to work" (Telford, Cosgrave, 2006: 57); "Hundreds of national and international organizations – some experienced, some inexperienced – were under pressure to show quick results amid relentless media attention. [...] Unprecedented funding further limited the incentive to coordinate and led to competition among cash-rich agencies for projects and, ultimately, publicity" (TGLLPSC, 2009: 22); "Despite major demands elsewhere for staffing (in Afghanistan, Iraq and sub-Saharan Africa, for instance), most agencies were able to deploy personnel, including a number of experienced managers, in a relatively short time. Some personnel were shifted from other emergencies" (Telford, Cosgrave, 2006: 54); "Some donors prefer reconstructing primary schools due to higher visibility and long-lasting nature of the support" (World Bank, 2005: 75). Even the assessments and the situation reports elaborated by the relief institutions were influenced by their individual objectives: "too often, situation reports and assessments served the interest or mandate of the assessing agency more than those of the potential beneficiaries" (de Ville de Goyet, Morinière, 2006: 12).

OCHA, which was in principle in charge for the coordination of international relief efforts, was overwhelmed by "political" (i.e. related with the definition and coordination of the objectives of the relief activities) problems. Many resources were used to coordinate activities instead of in direct mitigation activities (Flint, Goyder, 2006). "Despite the best efforts of OCHA to harness and broadcast information and technical know-how within the humanitarian community, it had neither the authority nor in some cases the influence to direct events. It was thus constantly in a responsive mode, frequently criticized for not providing timely information, though rarely questioned as the pre-eminent international coordinating body. The reduction of operational costs thanks to, for example, common services was not always

self-evident, as many well-funded NGOs developed their own logistics and information services, including bilateral relations with military forces. Where there were gaps at sectorial or geographic levels, these were often due to the "crowding" of agencies in certain areas, the selection of high-visibility sectors and the stretching of traditional mandates within agencies" (Bennet *et al.*, 2006: 78).

It is possible to identify the lack of coordination of intermediate objectives as the fundamental problem inhibiting a coherent development of the instrumental behavior. Relief coordination problems were direct consequences of such lack of higher-level coordination.

At the end of December, the Regional Core Group was introduced: in this case the participants succeeded in defining intermediate objective, thus being able to develop integrated intervention processes and to coordinate their behaviors by means of efficient standard rules and plans. On January, the need for cooperation and coordination became so pressing that the United Nations had to hold an international conference and a summit meeting to coordinate intermediate objectives and instrumental relief behavior. In particular, the international conference held in Jakarta gathered the subjects involved in field operations, but it was not sufficient to overcome all the problems affecting the relief process. It was necessary to convene the political leaders of the countries involved in the relief process in order to define the general guidelines to be followed. In other words, the intermediate objectives of the international relief process were detailed and coordinated only at the eve of January. From now on, the relief process gained in terms of unity of efforts and became easier to coordinate. In fact, thanks to the intermediate objectives agreed in these meetings, OCHA was finally able to develop a coherent instrumental behavior. In particular, OCHA became an "information hub" for the disaster-affected area and was soon in a position strong enough to match populations' needs with available resources, to define intervention priorities, to set relief general rules and operational routines. In addition, IASC proved to be a very useful forum (both in global and local terms), enabling the actual coordination of the

international institutions and NGOs acting in the field. In such a situation, the Regional Core Group became useless and it was soon dismantled. The rescue teams were now acting with higher levels of order, by applying the preliminary regulation set by OCHA and IASC. Thanks the higher integration of the behavior achieved by rescuers and the unprecedented amount of resources mobilized, by the end of January OCHA declared the Indian Ocean tsunami emergency "stabilized".

The reform of the international humanitarian system

As a result of the apparent failure of the international humanitarian system in occasion of the tsunami emergency, governments, public opinion and mass-media asked for an urgent reform of the whole system. Hence, the tsunami emergency revitalized the debate on prospected reform of international humanitarian response system which was being developed by the United Nations.

In such a situation, the United Nations stimulated the reform process by means of two fundamental initiatives: the Hyogo Framework for Action 2005-2015, and the Humanitarian Response Review carried out in 2004-2005. From a strategic point of view, "The Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disaster" (issued by the World Conference on Disaster Reduction held on January 2005 in Kobe) represent a fundamental milestone for the future interventions on the subject. Indeed, the Hyogo Framework identifies the strategic goals and priorities for action of the whole humanitarian response system for the next years (ISDR 2005). Previously, in 2004, the ERC had launched the Humanitarian Response Review to assess the humanitarian response capacities of the UN, NGOs, Red Cross Red Crescent Movement and other key humanitarian actors including the International Organization for Migration, and identify the gaps and make recommendations to address them (Adinolfi *et al.*, 2005: 14).

An immediate outcome of these policies and analysis has been the adoption of the "cluster approach", i.e. a deep redefinition of the leadership and

coordination roles assigned to international relief agencies. This redefinition, agreed and developed by IASC, introduced the cluster as sets of relief agencies involved in tasks headed toward similar results (e.g. camp coordination an management, emergency telecommunication, early recovery, emergency shelter, health, logistics, nutrition, protection, water and sanitation). Each cluster is coordinated by a "lead agency" accountable to the ERC for "ensuring system-wide preparedness and technical capacity to respond humanitarian emergencies, and for ensuring grater predictability and more effective inter-agency responses" (IASC, 2006: 4). The lead agency has to set standards, build response capacity, and manage operational activities within its cluster.

Initially, nine global clusters have been identified and assigned under the responsibility of specific lead agencies: camp coordination and management – UNHCR (for conflict-generated internally-displaced persons) and IOM (for disasters); emergency telecommunications – OCHA as overall process owner; UNICEF for data collection; WFP for common security telecommunications service; early recovery – UNDP; emergency shelter – UNHCR (for conflict-generated internally-displaced persons) and International Federation of Red Cross (for disasters); health – WHO; logistics – WFP, nutrition – UNICEF; protection – UNHCR (for conflict-generated internally-displaced persons) and UNICEF and OHCHR (for disasters); water and sanitation – UNICEF. Other sectors (with lower coordination problems) have not been organized in global clusters; such sectors are food (led by WFP), refugees (UNHCR), education (UNICEF) and agriculture (FAO) (Bennet *et al.*, 2006: 24).

At the country level, the cluster approach involves the identification of leading agencies with clearly defined responsibilities and capacities. Obviously, country clusters have to arrange their activities in accordance with the global strategy and guidelines. Moreover, at the country level, a Humanitarian Country Team (HCT) has been introduced, as a local forum gathering the agencies involved in humanitarian prevention, mitigation, and recovery activities. The HCT would act as a local replica of IASC, supporting the

Resident Coordinator / Humanitarian Coordinator in the development of contingency planning and in the coordination of humanitarian activities.

As to this initial stage, the cluster approach developed by OCHA appears as a coherent step toward the overcoming of the cooperation problems highlighted by the tsunami case. In particular, the delimitation of the final objective of each global cluster would allow easier internal agreement on the intermediate objectives and on the instrumental decisions and behaviors. Hence, the integration of behavior within the cluster should be stronger and the coordination more efficient.

As a matter of fact, some remarks remain in terms of integration of behavior among clusters, both at the global and country level. In fact, due to the lack of formal solutions for integrating the intermediate objectives of different clusters, ineffectiveness and inefficiency may affect the relief process. To overcome such risks, the roles of OCHA and IASC (at the global level) and of Human Coordinator and HCT (at the country level) are fundamental and critical. Additional concerns originate from the attribution to some agencies of a leadership role in more than one cluster (e.g. UNICEF leads, or co-leads, four cluster) thus preventing focalization and specialization.

Nevertheless, the reform's rationale appears to be consistent with the need for higher operational coordination; the reform has also the merit of not imposing additional predetermined formalized procedures.

Synthesis

This essay analyzed the problems affecting the cooperative relief processes in post-disaster emergency situations, evidencing how a generic finalization of the cooperation cannot enable highly integrated behaviors, thus creating relevant coordination problems.

The perspective adopted by this contribution is based on the assumption that a collective behavior becomes cooperative when the involved subjects share a common goal. In case of post-disaster relief activities, the large majority of the relevant literature takes for granted the agreement of the rescuers on a

common goal; then, all the problems affecting the cooperation process are attributed to a lack of coordination, e.g. to synchronization problems, to communication inefficiencies, to inconsistencies affecting the authority breakdown system. We have proposed a different interpretation: the agreement on a common, generic goal is not, by itself, sufficient for ensuring the integration of partners' decision and behavior processes, instead, the final goal is placed by every subject within his own means-ends schema. Hence, the final goal of the cooperation is interpreted by each partner as a means for achieving individual higher-level objectives. On the other hand, every partner defines a set of intermediate goals, which are (according to his knowledge and values) consistent to the attainment of the final goal of the cooperation. Finally, every partner defines a set of instrumental goals for achieving the intermediate goals. The means-ends schema developed by the participants in the cooperative action can be very different and, in many ways, conflictual or competitive. As a consequence, the agreement on coherent and consistent intermediate goals becomes fundamental to allow the achievement of higher levels of effectiveness in the cooperative action, as evidenced by the case of the Indian ocean tsunami

In any case, the adoption of a perspective based on Simon's theory of bounded rationality (1947) does not allow to assume that partners' agreement on intermediate goals can make the cooperative action objectively rational. In fact, even if it could be possible to foster the integration of behaviors that are instrumental toward the cooperative goal, each subject would make this goal instrumental with respect to her own additional goals.. Hence, it is necessary to understand that the subjects involved in a cooperative action actually develop behaviors that are, at the same time, cooperative and competitive. For example, while we are used to think that the players of a football team will cooperate with teammates and compete with opponents to win the match, if we take into account the different decision-making levels, it becomes possible to highlight more complex phenomena in which cooperation and competition coexist at the different levels of decision-making processes. The same situation takes place in cases of interfirm cooperation or teamworking.

In other words, the agreement on a common goal (i.e. the cooperation toward the achievement of that goal) is not by itself sufficient to ensure the integration of the atomic behaviors of the partners, since every participants will base the behavior on her means-ends schema. Finally, it is important to consider that, under conditions of bounded rationality, it is impossible to objectively define goals and to perfectly make the sub-goals consistent, at any level of the scheme.

References

ADINOLFI C., BASSIOUNI B.S., LAURITZSEN H.F., WILLIAMS H.R.
2005   *Humanitarian Response Review. An Independent Report Commissioned by the United Nations Emergencies Relief Coordinator & Under-Secretary-General for Humanitarian Affairs*, Office for the Coordination of Humanitarian Affairs (OCHA), New York: United Nations.

APPELBAUM R.P.
1977   The future is made, not predicted: technocratic planners vs. public interests, *Society*, 5: 49-53.

ALEXANDER D.E.
2003   Toward the development of standards in emergency management training and education, *Disaster Prevention and Management*, 12, 2: 113-123.

ASHFORD N.A., GOBBELL JV., LACHMAN J., MATTHIESEN M., MINZNER A., STONE R.
1993   The encouragement of technological change for preventing chemical accidents: moving firms from secondary prevention and mitigation to primary prevention, *Official report*, Center for Technology, Policy and Industrial Development, Cambridge: Massachusetts Institute of Technology.

BAKER G.W., CHAPMAN D.W. (EDS.)
1962   *Man and society in disaster*, New York: Basic Books.

BARNARD C.I.
1938   *The functions of the executive*, Cambridge: Harvard University Press.

BARTHELEMY F., HORNUS H., ROUSSOT J., HUFSCHMITT J.P. , RAFFOUX J.F.
2001   Report on the Grande Paroisse company's factory in Toulouse, *Report to the Minister for Regional Development and the Environment on the accident that occurred at the Grand Paroisse company factory in Toulouse on 21st September 2001.*

BENNET J., BERTRAND W., HARKIN C., SAMARASINGHE S., WICKRAMATILLAKE H.
2006   *Coordination of International Humanitarian Assistance in Tsunami-Affected Countries*, London: Tsunami Evaluation Coalition.

BIGLEY G.A., ROBERTS K.H.
2001   The Incident Command System: high reliability organizing for complex and volatile task environments, *Academy of Management Journal*, 44, 6: 1281-1299.

BORDES J.C.
2004 *De l'ONIA à Grande Paroisse, une aventure industrielle et humaine*, Toulouse: Éditions les Arts Graphiques.

BUCK D.A., TRAINOR J.E., AGUIRRE B.E.
2006 A Critical Evaluation of the Incident Command System and NIMS, *Journal of Homeland Security and Emergency Management*, 3, 3: 1-27.

CARDWELL M.D.
2000 Nationwide application of the Incident Command System, *FBI Law Enforcements Bulletin*, 69, 10: 10-15.

CHAPMAN D.W. (ED.)
1954 Human behavior in disaster: A new field of social research, *Journal of Social Issues* (special issue), 10, 3: 1-73.

CLARKE L., SHORT J.F.
1993 Social organization and risk: some current controversies, *Annual Review of Sociology*, 19: 375-399.

CHASKIEL P.
2007 Syndicalisme et risques industriels. Avant et après la catastrophe de l'usine AZF de Toulouse (Septembre 2001), *Sociologie du Travail*, 49: 180-194.

COMFORT L.K.
2007 Crisis management in hindsight: Cognition, communication, coordination, and control, *Public Administration Review*, Special Issue: 189-197.

COSGRAVE J.
2005 *Tsunami evaluation coalition: Initial findings*, London: Tsunami Evaluation Coalition.

DE VILLE DE GOYET C., MORINIÈRE L.C.
2006 *The role of needs assessment in the tsunami response*, London: Tsunami Evaluation Coalition.

DECHY N., BORDEAUX T., AYRAULT N., KORDECK M.A., LECOZE J.C.
2004 First lessons of the Toulouse ammonium nitrate disaster, *Journal of Hazardous Materials*, 111: 131-138.

DHS - DEPARTMENT OF HOMELAND SECURITY
2004 *National incident management system*, Washington: DHS.

REFERENCES

DONAHUE A.K., O'KEEFE S.
2007   Universal lessons from unique events: Perspectives from Columbia and Katrina, *Public Administration Review*, Special Issue: 77-81.

DRABEK T.E.
1986   *Human system responses to disaster: An inventory of sociological findings*, New York: Springer-Verlag.

EGELAND J.
2005   Press Release of the Emergency Relief Coordinator and Under-Secretary-General for Humanitarian Affairs, UN WebSite, Geneva, 11 January.

FEMA - FEDERAL EMERGENCY MANAGEMENT AGENCY
2004   *National incident management system: An introduction*, Washington: FEMA.

FLINT M., GOYDER H.
2006   *Funding the tsunami response*, London: Tsunami Evaluation Coalition.

FORM W.H., LOOMIS C.P., CLIFFORD R.A., MOORE H.E., NOSOW S., STONE G.P., WESTIE C.M.
1956   The persistence and emergence of social and cultural systems in disasters, *American Sociological Review*, 21, 2: 180-185.

FRENCH MINISTRY OF THE ENVIRONMENT - CLASSIFIED INSTALLATIONS INSPECTORATE
2002   Explosion in a fertilizer plant – Grande Paroisse in Toulouse, in *Proc. of the Meeting on Lessons Learnt from Industrial Accidents*, Bordeaux, June 11-12.

FRITZ C.
1961   Disasters, In Merton R.K., Nisbet R. (Eds.), *Social Problems*, New York: Harcourt Brace.

GEPHART R.P.
1984   Making sense of organizationally based environmental disasters, *Journal of Management*, 10, 2: 205-225.

GHERARDI S.
1998   A cultural approach to disasters, *Journal of Contingencies and Crisis Management*, 6, 2: 80-83.

HEALY R.J.
1969   *Emergency and disaster planning*, New York: Wiley.

HANNESTAD S.E.

2005   Incident command system: A developing national standard of incident management in the US, in *Proc. of the 2nd International ISCRAM Conference*, Brussels.

JEAN R.

2002   La sécurité au travail écartelée entre hyperprescription procédurale et déréglementation sociale, in Evesque J-M., Gautier A-M., Revest Ch., Schwartz Y., Vayssière J-L. (Eds.), *Les évolutions de la prescription*, Actes du 37° Congrès de la SELF: 154-160, Aix en Provence: Greact.

2011   AZF 10 ans après. Retour sur une catastrophe qui ne doit rien à la fatalité, *Droit d'Alerte. La lettre d'information de CIDECOS*, 13.

2013   AZF 2001. Quand la sous-traitance mène à la catastrophe, *Chroniques du travail*, 3.

KANZARI R., THOEMMES J.

2008   Le travail des sapeurs-pompiers dans la crise: le cas de l'explosion AZF, in de Terssac G., Gaillard I. (Eds.), *La catastrophe d'AZF : L'apport des sciences humaines et sociales*, Paris: Lavoisier.

KOVOOR-MISRA S., ZAMMUTO R.F., MITROFF I.I.

2000   Crisis preparation in organizations: prescription versus reality, *Technological Forecasting and Social Change*, 63: 43-62.

IASC - INTER-AGENCY STANDING COMMITTEE

2006   *Guidance Note on Using the Cluster Approach to Strengthen Humanitarian Response*, New York: Office for the Coordination of Humanitarian Affairs

INVS - MINISTÈRE DEL LA SANTÉ ET DES SOLIDARITÉS

2006   Conséquences sanitaires de l'exposion survenue à l'usine AZF le 21 septembre 2001, *Rapport final sur les conséquences sanitaires dans la population toulousaine*.

ISDR - UNITED NATIONS INTERNATONAL STRATEGY FOR DISASTER REDUCTION

2005   Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters, *Final Report of the World Conference on Disaster Reduction*, 18-22 January, Kobe, Japan.

LAGADEC P.

1993   *Apprendre à gérer les crises. Societé vulnerable, acteurs responsables*, Paris: Les Editions d'Organisations.

LANZARA G.F.

1983   Ephemeral organizations in extreme environments: Emergence, strategy, extinction, *Journal of Management Studies*, 20, 1: 71-95.

LE FIGARO
2009   Explosion d'AZF : les experts divisés, 13/03/2009,
        http://www.lefigaro.fr/actualite-france/2009/03/13/01016-
        20090313ARTFIG00008-explosion-d-azf-les-experts-divises-.php

LE MONDE
2015   AZF : la Cour de cassation annule la décision d'appel et ouvre la voie à
        un nouveau procès, 13/01/2015,
        http://www.lemonde.fr/societe/article/2015/01/13/azf-la-cour-de-
        cassation-annule-la-decision-d-appel-et-ouvre-la-voie-a-un-nouveau-
        proces_4555241_3224.html#jiw5GT0eZiWhQ5p5.99

LINDELL M.K., PRATER C.S., PERRY R.W.
2007   *Introduction to emergency management*, New York: Wiley.

MAGGI B.
1984/1990   *Razionalità e benessere. Studio interdisciplinare dell'organizzazione*,
        Milano: Etas Libri.
2003   *De l'agir organisationnel. Un point de vue sur le travail, le bien-être,
        l'apprentissage*, Toulouse : Octarès Éditions; 2006 ed. port., *Do agir
        organizacional. Um ponto de vista sobre o trabalho, o bem-estar, a
        aprendizagem*, São Paulo: Editora Blücher; 2009 ed. sp., *El actuar
        organizativo. Un punto de vista sobre el trabajo, el bienestar, el aprendizaje*,
        Madrid: Modus Laborandi.
2010   *Organizational analysis, occupational medicine and union action: A possible
        encounter / Analisi organizzativa, medicina del lavoro e azione sindacale: Un
        incontro possibile*, http://amsacta.cib.unibo.it, Bologna: TAO Digital
        Library.

MAGGI B., RULLI G. (EDS.)
2010   *Lavoro organizzato e salute in un laboratorio di analisi cliniche*,
        http://amsacta.cib.unibo.it, Bologna: TAO Digital Library.

MCCONNELL A., DRENNAN L.
2006   Mission impossible? Planning and preparing for crisis, *Journal of
        Contingencies and Crisis Management*, 14, 2: 59-70.

MISOMALI R., MCENTIRE D.
2008   Rising Disasters and their reversal: An identification of vulnerability and
        ways to reduce it, in Pinkowski J. (Ed.), *Disaster Management Handbook*:
        19-35, New York: CRC Press.

MORGAN M.G.
1990   Choosing and managing technology-induced risks, in Glicksman T.S.,
        Gough M. (Eds.), *Readings in risk*, New York: Resources for the future.

NAIDOO S.
2007 Redesigning the ReliefWeb, *The Information Management Journal*, September/October: 52-58.

OCHA - OFFICE FOR THE COORDINATION OF HUMANITARIAN AFFAIRS
2000 *UN disaster assessment and coordination, Field handbook*, New York: United Nations.
2006 *OCHA in 2006, Activities and extra-budgetary funding requirements*, New York: United Nations.
2008 *OCHA in 2009, Annual plan and budget*, New York: United Nations.

PERROW C.B.
1984 *Normal accidents: Living with high-risk technologies*, Basic Books, New York.
2007 *The next catastrophe, reducing our vulnerabilities to natural, industrial, and terrorist disasters*, Princeton: Princeton University Press.

PERRY R.W., LINDELL M.K.
2003 Preparedness for emergency response: guidelines for the emergency planning process, *Disasters*, 27, 4: 336-350.

QUARANTELLI E.L.
1982 Ten research-derived principles of disaster planning, *Disaster Management*, 2: 23-25.
1985 Organizational behavior in disasters and implications for disaster planning, *Report series n. 18*, Disaster Research Center, University of Delaware, Newark.
1998 Major criteria for judging disasters planning and managing and their applicability in developing societies, *Preliminary paper n. 268*, Disaster Research Center, University of Delaware, Newark.

QUARANTELLI E.L. (ED.)
1998 *What is a disaster?*, London: Routledge.

QUARANTELLI E.L., DYNES R.D.
1977 Response to Social Crisis and Disaster, *Annual Review of Sociology*, 3: 23-49.

RENN O.
1998 Three decades of risk research: accomplishments and new challenges, *Journal of Risk Research*, 1, 1: 49-71.

ROUX-DUFORT C., VIDAILLET B.
2003 The difficulties of improvising in a crisis situation, *Studies of Management and Organization*, 33, 1: 86–115.

SALVI O., DELCHY N.
2005 Toulouse disaster prompts changes in French risk management, *Environment & Poverty Times*, 3: 14.

SALVI O., MERAD M., RODRIGUES N.
2005 Toward an integrative approach of the industrial risk management process in France, *Journal of Loss Prevention in the Process Industries*, 18: 414-422.

SHELTON J., SIFERS S.
1994 Standardizing training assessment, *Military Review*, 74, 10: 5-13.

SIMON H.A.
1947 *Administrative Behavior,* New York: McMillan.

SURAUD M.-G.
2007 *La Catastrophe d'AZF : de la concertation à la contestation*, Paris: La Documentation Française.

TELFORD J., COSGRAVE J.
2006 *Joint evaluation of the international response to the Indian Ocean Tsunami: Synthesis report*, London: Tsunami Evaluation Coalition.

TERSSAC DE G., GAILLARD I. (EDS.)
2008 *La catastrophe d'AZF : l'apport des sciences humaines et sociales*, Paris: Lavoisier.

TERSSAC DE G., MIGNARD J.
2011 *Les paradoxes de la sécurité. Le cas d'AZF*, Paris: PUF.

THOMPSON J.D.
1967 *Organizations in Action*, New York: McGraw-Hill.

THOMPSON J.D., HAWKES R.W.
1962 Disaster, community, organization, and administrative process, in Baker G.W., Chapman D.W. (Eds.), *Man and society in disaster*: 268-300, New York: Basic Books.

TITOV V., RABOINOVICH A.B., MOFJELD H.O., THOMSON R.E., GONZÀLES F.I.
2005 The global reach of the 26 December 2004 Sumatra Tsunami, *Science*, 309, 23: 2045-2048.

TGLLPSC - TSUNAMI GLOBAL LESSONS LEARNED PROJECT STEERING COMMITTEE
2009 *The tsunami legacy*, New York: Tsunami Global Lessons Learned Project.

TURNER B.A.

1976   The organizational and interorganizational development of disasters, *Administrative Science Quarterly*, 21, 3: 378-397.

1978   *Man-made disasters*, London: Wykeham Publications.

TURNER B.A., PIDGEON N.F.

1997   *Man-made disasters*, Oxford: Butterworth-Heinemann.

TIXIER J., DUSSERRE G., SALVI O., GASTON D.

2002   Review of 62 risk analysis methodologies of industrial plants, *Journal of Loss Prevention in the Process Industries*, 15, 4: 291-303.

VAUGHAN D.

1996   *The Challenger launch decision: risky technology, culture, and deviance at NASA*, Chicago: University of Chicago Press.

WEICK K.E.

1988   Enacted sensemaking in crisis situation, *Journal of Management Studies*, 25, 4: 305-317.

1993   The collapse of sensemaking in organizations: the Mann Gulch disaster, *Administrative Science Quarterly*, 38, 4: 628-652.

WEICK K.E., SUTCLIFFE K.M.

2007   *Managing the unexpected: Resilient performance in an age of uncertainty*, San Francisco: Jossey-Bass.

WORLD BANK

2005   *Aceh and Nias one year after the tsunami: The recovery effort and way forward*, Jakarta: BRR and International Partners.