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Disaster and Emergency Planning for Preparedness, Response, and Recovery

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[–] Summary and Keywords

Emergency and disaster planning involves a coordinated, co-operative process of preparing to match urgent needs with available resources. The phases are research, writing, dissemination, testing, and updating. Hence, an emergency plan needs to be a living document that is periodically adapted to changing circumstances and that provides a guide to the protocols, procedures, and division of responsibilities in emergency response. Emergency planning is an exploratory process that provides generic procedures for managing unforeseen impacts and should use carefully constructed scenarios to anticipate the needs that will be generated by foreseeable hazards when they strike. Plans need to be developed for specific sectors, such as education, health, industry, and commerce. They also need to exist in a nested hierarchy that extends from the local emergency response (the most fundamental level), through the regional tiers of government, to the national and international levels. Failure to plan can be construed as negligence because it would involve failing to anticipate needs that cannot be responded to adequately by improvisation during an emergency.

Plans are needed, not only for responding to the impacts of disaster, but also to maintain business continuity while managing the crisis, and to guide recovery and reconstruction effectively. Dealing with disaster is a social process that requires public support for planning initiatives and participation by a wide variety of responders, technical experts and citizens. It needs to be sustainable in the light of challenges posed by non-renewable resource utilization, climate change, population growth, and imbalances of wealth. Although, at its most basic level, emergency planning is little more than codified common sense, the increasing complexity of modern disasters has required substantial professionalization of the field. This is especially true in light of the increasing role in emergency response of information and communications technology. Disaster planners and coordinators are resource managers, and in the future, they will need to cope with complex and sophisticated transfers of human and material resources. In a globalizing world that is subject to accelerating physical, social, and economic change, the challenge of managing emergencies well depends on effective planning and foresight, and the ability to connect disparate elements of the emergency response into coherent strategies.

Keywords: emergency planning, disaster management, recovery planning, reconstruction planning, crisis management, scenario methodology, disaster response

What Is Emergency Planning?

Emergency planning can be defined as the process of preparing systematically for future contingencies, including major incidents and disasters. The plan is usually a document, shared between participants and stakeholders that specifies tasks and responsibilities adopted in the multi-agency response to the emergency. It is a blueprint for managing events and, as such, should be responsive to management needs. It should specify the lineaments of action, collaboration, command, and communication during a civil contingency such as a disaster or major event; in other words, it is the framework for emergency response. The maintenance of public safety, limitation of damage,

protection of the vulnerable, and efficient use of life-saving resources are some of the goals of the plan. Although the end product is a document, emergency planning is more a process than an outcome, especially as the plan itself will need to be updated over time as circumstances change.

The Evolution of Emergency and Disaster Planning

As we know it today, emergency planning for disasters derives from civil defense, a form of social organization designed to protect civilians against armed aggression. The latter is a relatively new concept that in its modern form antedates the Second World War by only a very brief period. Although there had been rudimentary forms of organization for the protection of non-combatants in previous conflicts—for example, the American Civil War of the 1860s—the attack on Guernica, in the Basque country of Spain, on April 26, 1937, by German aircraft was the first concerted aerial bombardment (it killed 1,654 civilians) and the first occasion on which this had to be countered by properly organized measures of protection. It was a curtain raiser to the bombardments of the early 1940s, in which civil defense grew enormously, although largely without the benefits of fully codified plans. During this period, civil defense operatives were responsible for search and rescue, safeguarding and accommodating the survivors of bombing raids, ensuring public safety and interdicting areas that had become unsafe.

The rather temporary apogee reached by civil defense during the Second World War was subsequently followed by reorganization in order to face the demands of the Cold War, in which civilian life was overshadowed by the threat of a thermo-nuclear exchange between the great powers. During this period, plans were usually kept secret and were predicated on the assumption—highly debatable—that citizens could be protected and given shelter against nuclear blasts and radioactive fallout.

Détente and the dissolution of the Eastern Bloc led to the gradual end of the era of civil *defense*, and the slow rise of civil *protection*, which is designed to protect people against the effects of natural, technological, and societal hazards. In its purest form, civil defense is a service provided by the central state and directed at the national level (i.e., it is fundamentally “top-down”). Civil protection is a decentralized service (i.e., “bottom-up”), in which the basis of organization is local, which usually means that it is centered on the municipal level.

Emergency planning is a relatively young field that began to develop systematically in the 1970s, coincidentally with the rise of civil protection. Initially, it did so largely in response to technological hazards such as toxic spills and industrial explosions. Later, there was an increasing emphasis on natural disasters, such as floods, storms and earthquakes.

Academic studies of disaster have a somewhat longer history than does civil defense. They began in earnest in the 1920s with the founding of a sociological approach and, in parallel, a human ecological school of thought, which was mainly based in the discipline of geography. Development was slow until the 1950s, when fear of the consequences of nuclear war gave impetus to the study of how human populations behave in crisis situations, using natural disasters as—rather inadequate—analogs for a thermo-nuclear exchange. Earlier, geographers had started to study the human dimensions of the flood problem, notably Gilbert Fowler White, whose thesis on adaptation to floods was published in 1945. Starting in the 1970s, there was a sustained increase in studies of extreme natural phenomena, which gradually came to grips with the role of such hazards to human life and activities. In the late 1970s, a school of thought developed that suggested that vulnerability, not hazards, is the real key to understanding disaster. Despite countless demonstrations of this axiom, studies of vulnerability have lagged behind those of hazard, the other principal ingredient in the making of disaster. In terms of how academic work supports emergency planning, this means that there has been a plethora of studies of the *inputs* to plans (see, for example, the hazard scenarios in the section “The Use of Scenarios”), but a paucity of studies of how construct and use emergency plans. On this basis, emergency planning has developed in a somewhat faltering mode, in which only some of the activities associated with it are well served with academic inputs.

From Incident to Catastrophe: The Range of Impacts

Most civil contingencies are small enough to be resolved adequately without qualitative changes in daily management procedures or quantitative changes in the availability of resources. Hence, this article will concentrate on the small minority of emergencies, usually fewer than one in ten, that are large enough to substantially disrupt daily life and normal working procedures. There is no consistently reliable way of

distinguishing between major incidents, disasters, and catastrophes (but see Table 1 for an attempt at this). Nevertheless, all of these events have in common the fact that they must be resolved by the suspension of normal procedures and substitution of emergency ones. In the latter, the imperatives, tasks, and relationships between participants are sufficiently exceptional to require substantial reorganization and working methods that differ from those employed in workaday routines.

Emergency response involves a mixture of plans, procedures, and improvisation. To some extent, the last of these is inevitable, but it needs to be limited by preparedness. It is axiomatic that planning and procedures should not be improvised during an emergency when they should have been thought through and created beforehand. The consequence of unwonted improvisation is inefficiency in emergency response, which may have serious or tragic consequences. A degree of uniqueness present in each new disaster means that improvisation cannot be avoided, but foresight and preparedness can constrain it to a necessary minimum. Moreover, emergencies are always occasions for learning, and a significant part of the body of experience on which plans are based comes from the mistakes, inefficiencies, and improvisations of the past. Although many publications have the phrase “lessons learned” in their titles, there is no guarantee that a lesson will indeed be learned. If that does indeed happen, measurable positive change will result directly from the lesson. For example, lack of search-and-rescue equipment may be keenly felt in structural collapses that trap people. Hence, probes, props, and personal protection equipment may be acquired and personnel trained in how to use them.

Table 1. Functional Differences between Different Sizes of Event

	Incidents	Major incidents	Disasters	Catastrophes
Size of impact	Very localized	Fully or partially localized	Widespread and severe	Extremely large in the physical and social sphere
Size of response	Local resources used	Mainly local resources used, with some mutual assistance from nearby areas	Intergovernmental, multi-agency, multi-jurisdictional response needed	Major national and international resources and coordination are required
Plans and procedures activated	Standard operating procedures used	Standard operating procedures used; emergency plans may be activated	Disaster or emergency plans activated	Disaster or emergency plans activated, but huge challenges may overwhelm them
Impact on response resources needed for response	Local resources will probably be sufficient	Local resources and some outside resources needed	Extensive damage to resources in disaster area; major inter-regional transfers of resources	Local and regional emergency response systems paralyzed and in need of much outside help
Involvement of public in response	Public generally not involved in response	Public largely not involved in response	Public extensively involved in response	Public overwhelmingly involved in response
Challenges to post-event recovery	No significant challenges to recovery	Few challenges to recovery processes	Major challenges to recovery from disaster	Massive challenges and significant long-term effects

Note. Adapted from Tierney, K. (2008) Hurricane Katrina: Catastrophic impacts and alarming lessons. In Quigley, J. M., & Rosenthal, L. M., (Eds.). *Risking House and Home: Disasters, Cities, Public Policy*. Berkeley, CA: Institute of Governmental Studies, Berkeley Public Policy Press, 119–136.

There is a fundamental distinction between plans and procedures. An emergency plan should not have to teach a fireman how to put out a fire, or the police how to direct traffic. Instead, it should articulate and integrate the procedures to be used in a major emergency by assigning responsibilities and ensuring that all personnel involved in complex field operations understand both their own roles and those of other participants. Thus, one can make an analogy between the emergency response and a symphony. Individual instrumentalists have their own music (i.e., the procedures), while the conductor has the score (i.e., the plan). The common objective is to work in harmony.

Emergency and Disaster Planning as a Process

Above all, emergency planning should be a *process*, rather than a product or outcome. At its most essential, it must match urgent needs to available resources, and do so in a timely way that avoids procrastination and delay. Good

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emergency plans are realistic as well as pragmatic. For instance, there is no point in making arrangements to use resources that are not available and are not likely to be supplied within a useful time frame. Hence, plans should take account of both the limitations and the capabilities of response. At this point, it is useful to introduce the concept of thresholds (Table 2). The “bedrock” level of emergency planning is the municipal level or local area. This is because, however extensive a disaster may be, the theater of operations for managing and responding to it is always local. However, if local resources are overwhelmed, it becomes necessary to move up the scale of response to inter-municipal, regional, national, or even international responses. Each of these is associated with a threshold of capability, which is determined by the availability of trained personnel, expertise, equipment, supplies, communications, vehicles, and buildings. If the magnitude of the emergency exceeds or overwhelms local capabilities, then it is necessary to invoke higher levels of response. However, these should always aim to reinforce, not supplant the local ability to respond to the emergency. Once the outside forces have departed, inhabitants of the local area will be left on their own to manage the aftermath, and hence they need to be in good shape to do so. Supplanting local resources, decision-making capabilities, and responses will only leave the local area weaker and less able to manage the longer-term aftermath and any emergencies that may occur in the future.

Table 2. Thresholds of Capacity in Emergency Response

Local incident	Local response	A
Threshold of local capacity		
Small regional incident	Co-ordinated local response	B
Threshold of intermunicipal capacity		
Major regional incident	Intermunicipal and regional response	B
Threshold of regional capacity		
National disaster	Intermunicipal, regional, and national response	C
Threshold of national capacity		
International catastrophe	Intermunicipal, regional, and national response, with international assistance	C

Note. Simplified version: A = local response, B = regional response, C = national response.

Emergency planning is an approximate process that, in many instances, is little more than codified common sense. It also involves a collective effort and is thus a participatory process. In order to avoid sins of omission or commission, it requires experience and training. Regarding the former, the lack of a plan could be construed as negligence in the face of a demonstrable need to protect the public. Despite this assertion, some emergency managers have argued that plans tend to be unnecessarily restrictive and an improvised response is somehow stronger and more vital than one conditioned by a plan. Military strategists from Napoleon Bonaparte to Dwight D. Eisenhower have noted that, when preparing for war, plans have little value, but planning is essential. This underlines the importance of planning as a process, and above all a process of discovery. In this sense, whether or not the plan works during an emergency is of secondary importance: more vital is what the plan tells us about the needs of preparedness and organization. Moreover, emergency plans generally need to be adapted to particular emergency situations, which further underlines the view that planning is a process, and an ongoing one.

At this point, it is opportune to consider what sorts of events and situations should be the object of emergency plans.

For What Should One Plan?

Much has been made of the need for “all-hazards” emergency plans. No place on earth is entirely free from hazard and risk. Hence, all places need emergency preparedness, but few of them are likely to be subject to only one kind of hazard. An emergency plan must, therefore, be adaptable to both anticipated and unexpected hazards. For many years, the city of Florence, in Italy, had a municipal emergency plan that only addressed the contingency of flooding. In the post-War period, the largest disaster that the city had to manage was the major flood of 1966. However, during the lifetime of the plan (about 20 years), only limited flooding occurred, and the biggest emergencies were an air crash and a terrorist bomb. Likewise, on September 11, 2001, emergency coordinators in Washington, DC had to manage the response to the aircraft that crashed into the Pentagon (and the ensuing city-wide chaos) by adapting and using a plan made specifically to deal with the so-called “millennium bug,” or in other words anticipated widespread computer failure. A good emergency plan makes provision for managing all the known and anticipated hazards (the seasonal and recurrent events), while at the same time offering generic protocols to manage the unanticipated ones.

One issue that has long perturbed emergency planners is the size of event for which plans should be configured. If one assumes that recurrent hazards are in a steady state, then somewhere there should be a “happy medium,” in which an extreme event is neither too large and infrequent to be expected to occur during the life of the plan, nor too small and frequent to need significant emergency provisions. The first problem with this arrangement is that, especially regarding natural hazards, there are few cases in which an adequate magnitude-frequency relationship has been established. Hence, the likelihood of an extreme event of a given size may be conjectural, rather than scientifically determined. The second problem is that the time series of events may be non-stationary. For example, there is overwhelming scientific consensus on the occurrence of climate change, and few scientists now doubt the speed at which it is occurring. Damage tends to be a non-linear function of extreme meteorological events, in the sense that small increases in, for example, wind speed lead to disproportionately large increases in wind damage to structures. The same may be true of casualties, although here the relationship is complicated by factors of perception and behavior in people’s reaction to immediate risk.

It is often said that “we plan for the last event, not the next one.” There is indeed a tendency to base assumptions about the size and characteristics of each event that will be faced in the future on the historical record of such events in the past, particularly the recent past. What if the next event is entirely out of character? The magnitude 9 earthquake that occurred off the east coast of Japan in March 2011 caused a tsunami that was considerably higher than those that most parts of the coast had prepared for (Figure 1). People were washed off refuge mounds, and the Fukushima Da’ichi nuclear plant was overrun with water, leading to meltdown. The plant was protected against a tsunami that would have resulted from an offshore earthquake up to magnitude 7.5. Much emergency preparedness against riverine flooding is based on the notion of the 100-year flood, and the depths and geographical areas that such an event would inundate. Leaving aside the question of whether estimates of the magnitude of a flood with an approximate recurrence interval of once in a century are accurate, there is no hard-and-fast *operational* reason why the 100-year flood should be more significant or damaging than any other. However, it is legitimate to discuss the size of flood with a 1%, or once in a century, probability of occurring in any given year, whether or not that should be the flood for which protection measures are designed. In the final analysis, emergency planning has to be realistic. This means that it can only be applied to resources that actually exist or can be obtained within an appropriately brief time frame. On that basis, the question of what size of event to prepare for is more a policy issue than a planning one. In synthesis, the problem of how to prepare for exceptionally large events remains unresolved, both in terms of what is necessary and what is feasible.



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Figure 1. The remains of the emergency management center at Shizugawa, on the northeast coast of Japan. Here, the tsunami of March 11, 2011 was higher than the building. Personnel were drowned while they struggled to broadcast warnings, although a few of them survived by climbing up the radio mast on top of the building. The size of the tsunami underlines the difficulty of estimating the magnitude of events when planning for them.

Anatomy of an Emergency Plan

Emergency and disaster planning is a relatively new field, and one that is evolving rapidly, driven by intensifying hazards, burgeoning vulnerabilities, and emerging risks. Hence, there is no established formula according to which a plan should be prepared. Nevertheless, there are canons and practices that must be respected. As noted above, a plan should focus on ensuring that a good response to threats, emergencies, and recovery processes occurs at the local level.

Emergency Planning and Emergency Management

The primary resource is information, and hence everything possible should be done to ensure that flows of vital data and communications are unrestricted and properly focussed on essential needs. Emergency management, as supported by prior and on-going planning, should ensure that organizations can work together effectively under unfamiliar circumstances, possibly including organizations that have no formal relations under normal, non-emergency circumstances. The plan should ensure that every participant in the response to an emergency has a role, and that all anticipated tasks are covered such that the risk of hiatuses or disputes about responsibilities is minimized.

One way to demonstrate the connection between emergency planning and emergency management is through the provisions to manage information. Emergency communication needs to be sustained, flexible, and clear. Decisions and communications need to be recorded. The emergency planner can help this process by ensuring that the technological means of communication are present and are robust in the face of potential failure, the protocols for sending messages are established, and the priorities for communication are known to participants.

Emergency Planning and Urban and Regional Planning

The process of formulating an emergency plan is similar, and parallel, to urban and regional planning. Sadly, the two disciplines rarely enjoy sufficient connection and interchange. This is unfortunate, because they have much in common. In emergency planning, as in urban and regional planning, perhaps 70% of the problem to be solved is spatial (i.e., geographical) in nature. The answer to the question “what is where?” is at the root of many provisions designed to manage emergency situations. Like urban and regional planners, emergency planners need to study the geography, demography, economics, social relations, and culture of the area that forms the jurisdiction of the plan. This is essential if the plan is to respond well to local hazards and vulnerabilities and be compatible with local perceptions, traditions, activities, and expectations. Other than that, the five stages of emergency planning are research, writing, publicity, operations, and revision. Research will ensure an adequate basis of knowledge of hazards, vulnerabilities, local characteristics, and capacities. Writing will create the plan, and its appendices and abbreviated aides memoires. Publicity and training will make it known to the users and the organizations they represent, and operations will test elements of the plan in terms of feasibility, appropriateness, and efficiency. Finally, the plan should be a living document; hence, it will need to be updated frequently and consistently to take account of changes and new knowledge.

The essence of emergency and disaster management is its capacity to tackle pressing needs with maximum efficiency and celerity but with scarce resources and in the absence of much necessary information. Before the event, the plan must make assumptions about what is needed during the event. Those assumptions need to be considered within the compass of what is feasible with the available human and technical resources. One reason why the plan must constantly be updated is that one assumes there will be a program of continuous improvement in the resources, and one trusts that it will take place in the light of the evolving body of knowledge of hazards and the needs that they provoke.

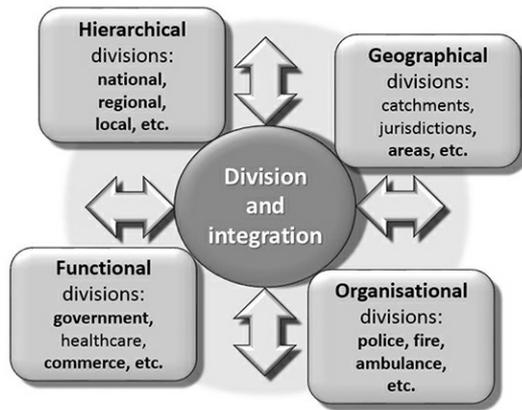
Plans and Relevant Legislation

Emergency plans need to be written in the light of the prevailing legislation, as well as the provisions it makes for tackling major incidents and disasters. In many countries, legislation exists at both the national level and the level of regions, states, provinces, departments, counties, or prefectures—what is known as the intermediate tier of government. In the United States, the main federal law is the Robert T. Stafford Disaster Relief and Emergency Assistance Act (the Stafford Act), which has evolved since 1974. In India, another federal republic, the national law was formulated in 2005. In the United Kingdom, the Civil Contingencies Act dates from 2004; and in Italy, a law passed in 1992 establishes the national civil protection system. In most cases, the basic law assigns responsibilities for the principal tasks to be accomplished in national emergency situations. There may be a legal obligation to draw up emergency plans, but it seldom, if ever, extends to the quality and compatibility of such plans.

Usually, compliance with legislation is simply a matter of comparative reading, or in other words ensuring that there are no glaring incompatibilities. The compliance may also have to extend to other kinds of legislation, such as that pertaining to health and safety at work, environmental protection, industrial safety, national security, and the division of responsibilities between different tiers of government. Once again, compliance can usually be assured by comparative reading, although there may be cases in which legal requirements conflict with one another, for example between environmental legislation and laws about resource utilization.

Multi-Agency Planning

One source of complexity in emergency planning is the need to integrate several dimensions into the programmed emergency response. *Hierarchical divisions* refer to the tiers of government—from national, through regional, to local. *Geographical divisions* indicate the spatial jurisdictions to which plans refer, and possibly also to questions of mutual assistance. *Organizational divisions* refer to the different agencies that participate in emergency responses, such as the “blue light” services (police, fire, and ambulance), technical groups, and volunteer organizations. Lastly, *functional divisions* indicate the different fields involved, such as government, health care, public order, public works, economy and employment, finance, and the private sector (Figure 2). The emergency plan is one contribution to the process of articulating a system of response to civil contingencies, in which an optimum balance is sought between integrating these forces and allowing them a degree of autonomy and freedom of action.



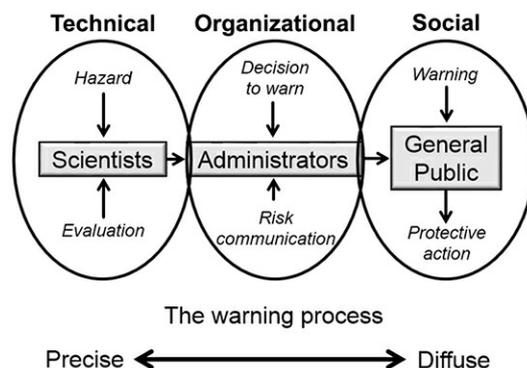
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Figure 2. The different dimensions of division and integration in emergency planning and management.

The Plan and Warning Processes

Whether natural or anthropogenic, hazards vary considerably in their predictability and the amount of lead time, if any, for preparations to take place. Nevertheless, warning and associated responses are two vital elements of most emergency plans. Short-term warning must be distinguished from the longer-term predictability of hazards. Earthquakes, for instance, are mostly predictable in terms of the basic tenets of magnitude, frequency, and location, but not with regard to impending shocks in a short time window, such as 48 hours. In contrast, with adequate monitoring using Doppler radar, warnings can be issued for tornadoes with lead times of 20–120 minutes, and remote sensing together with digital modelling can give a reliable picture of a hurricane track many hours before the storm makes landfall.

Warnings have three essential components: scientific and technical, administrative, and social (Figure 3). The absence or ineffectiveness of any of them renders the warning system inoperable. Scientific information on an impending hazard must be transformed into a message to be acted upon, and a decision must be taken to warn affected people, who must then hear and react appropriately to the warning. The emergency plan should determine how to transform information on hazards to advice or orders on how to react. It should prescribe the means of disseminating the message and monitoring the social reaction to it. In practical terms, evacuation or sheltering is usually the most appropriate reaction to warning and the best way of moving people out of harm's way. However, the means and the routes to evacuate people must be available (or there must be appropriate, safe locations for in situ or vertical evacuation). Horizontal evacuation may require reception centers with staff, bedding, methods of procuring, preparing, and distributing food, and so on.



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Figure 3. The components of the warning process.

The Role of Information and Communications Technology

Modern emergency responses are heavily reliant on information and communications technology (ICT). Many

algorithms have been written to assist emergency operations, for example, by providing an “expert system” that aids decision making, or by helping record decisions as they are made. For example, terrestrial trunked radio (TETRA) systems can be used to provide flexible communications between different services and groups of responders. Emergency plans should reflect these innovations and the opportunities they bring for sharing information and developing a synoptic picture of a rapidly evolving situation on the ground. Plans can include or refer to protocols for messaging and communications, and thus help clarify and standardize them.

The emergency plan should either prescribe or describe the structure of command and management to be utilized in the case of a disaster or major incident. Modern information technology has tended to flatten the chain of command and has given rise to a more collaborative form of management, which lessens the reliance on militaristic principles of “command and control.” Nevertheless, there will need to be a web of formal relationships between different organizations and units that participate in the response to disaster. The focal point of many of these is the emergency operations center (EOC), which is usually also the “natural home” for an emergency plan, or in other words, the place where it is most appropriate to draw up and maintain such an instrument. The EOC needs to be a center of communications and management, one that has functional autonomy (e.g., its own electrical generator and fuel stocks).

In a fully functional civil protection system, emergency resource hubs such as EOCs usually operate as a nested hierarchy. They will function within the compass of plans made at different levels of government and by different jurisdictions. It follows that the emergency plans themselves will need to ensure interoperability and a rational division of responsibilities, so that all tasks can be covered in emergencies of different sizes. Once again, this involves comparative reading of plans and, preferably, some national guidelines for ensuring compatibility.

Specialized Emergency Planning

A further issue is the need for emergency planning in different sectors. The United Kingdom’s Civil Contingencies Act of 2004 obliges the providers of fundamental services in the private sector to draw up emergency plans. This is necessary, as much of the nation’s critical infrastructure is run by private-sector operators. Industrial firms also need plans, so that they can cope with technological failures and their consequences, and commercial companies need to ensure business continuity. Emergency plans are needed in both hospitals and the health systems of which they form a part. Hospital plans should state the preparations needed for internal and external emergencies. The former refers to contingencies such as fire, structural collapse, or contamination, and the latter mainly deals with the need to cope with mass casualty influxes. In addition, public transport services need emergency plans to guarantee the movement of people and goods during a crisis and its aftermath. For example, the plans for an airport should be integrated with those of the city and region in which it is situated. Finally, there is an increasing realization that emergency plans are needed to protect cultural heritage, which includes a huge variety of sites and artefacts, many of which have highly specialized conservation requirements. Loss of cultural heritage in disasters such as floods and earthquakes can deal a catastrophic blow to the intellectual and artistic life of a country by obliterating or damaging an irreplaceable legacy.

Among specialized emergency plans, it is worth singling out those required for educational institutions. The collapse of thousands of schools in earthquakes in Pakistan (2005) and China (2008), and the consequential loss of thousands of young lives, underlines the importance of providing a safe education to pupils and students. This is a moral requirement, as well as one that all parents would support. Despite this, emergency planning for schools tends to be neglected and underrated. It is not merely a question of evacuation. Plans need to assess hazards and design strategies to manage situations safely. As in other forms of emergency planning, scenarios are needed. In one exemplary case, a school has developed different strategies to manage the response to floods and earthquakes, both of which threaten it. As teachers are *in loco parentis* for their young charges, there is a requirement to ensure that school students are looked after in safety throughout an emergency. Schools and other educational institutions have been the target of natural hazards such as earthquakes, tornadoes, landslides, floods, and snowstorms; terrorism, such as marauding gunmen; and structural collapse and fire. When many young lives are lost the sense of moral inadequacy can be universal, but not enough has been done to ensure that emergency planning for schools is transformed into universal practical measures to protect children and young adults.

The art of emergency planning involves “anticipating the unexpected.” For example, one important aspect that is

often overlooked is veterinary planning. This has three main categories: domestic, farm, and wild animals. Many people will not evacuate in the face of a major threat unless they can take their pets with them, and hence, provision needs to be made to accommodate domestic animals. In pastoral areas, farm economies are dependent on the care and welfare of animals, which can be trapped and drowned by floods, frozen by blizzards, affected by epizootic diseases, or deprived of feedstock. Planning to manage wild animals mainly refers to threats to the human population posed by ecological disruption in disasters due, for example, to the migration of dangerous reptiles or the possible spread of rabies. Another form of planning that is roundly neglected is that associated with prison populations. In floods, storms, and earthquakes, these individuals have been either confined to dangerous localities or released indiscriminately into the community. Prisoners have human rights, including the right to custodial safety, but to release hardened criminals into society may pose risks to the general population. Finally, during the difficult circumstances engendered by disaster, pharmaceutical emergency planning is needed in order to ensure continuity of medication for patients who depend on medical drugs.

Using the Plan in an Emergency

One ingredient of most emergency plans is a stipulation of the alert and call-up procedures for personnel. These need to be integrated with the potential phases of warning, which at their simplest are hazard watch (impact is possible or likely) and hazard warning (impact is highly likely or certain). A part of the plan may be dedicated to the preparations to be made before impact, if time is likely to be available to carry them out. Examples include putting up mobile flood defenses, marshalling and readying vehicles and equipment, and testing and readying the means of field communication. The impact phase of a disaster is usually a period, more or less brief, characterized by dynamic evolution and acute shortage of information. One of the first needs is for an assessment that determines whether to move into emergency mode. The declaration of a state of emergency allows the formal abandonment of normal working procedures and the immediate adoption of those that pertain strictly to the disaster. Hospital beds will be cleared, leave will be cancelled, personnel will move to predetermined locations, lines of communication will be opened, and so on. The emergency phase may continue for hours or days, and in exceptional cases for weeks. However, it should end with a formal declaration of “stand-down,” as prescribed in the plan, which releases personnel for leave and ordinary duties.

Testing and Revising the Plan

In most parts of the world, major incidents and disasters are, thankfully, rare, although they may be an ever-present threat. The emergency plan therefore needs to be tested under hypothetical conditions. Exercises and drills can be divided into table-top, command post, and field-based simulations. The last category is clearly the most onerous, and it may require up to six months of meticulous planning. Generally, none of these methods is capable of testing the whole plan, and so elements of it must be selected for verification by simulation. One common element is the ability of different organizations to work together under specific, unfamiliar circumstances; for example, the ability of different medical response organizations to set up and run a field hospital together. Exercises need to be designed with clear, well formulated objectives, and the progress of the simulation needs to be carefully monitored so that any need for improvements can be detected and communicated to participants in post-exercise debriefings and reports. All of this needs to be done in an atmosphere of constructive support, and certainly not recrimination, as the aim is not to examine but to help participants improve their performance during future emergencies. Simulations need to be treated as learning processes, from which it may be possible to derive improvements to the plan. One hopes that in real emergencies it will also be possible to learn lessons and improve the emergency plan on the basis of real experience. One such lesson is that personal familiarity with other participants in emergency operations greatly improves the ability to work together. This underlines the value of emergency simulations and drills.

The emergency plan should be a living document. In fact, there is nothing worse than the “paper plan syndrome”—or its modern digital equivalent—in which the plan is formulated and relegated to a desk drawer (or a hard drive) without being used or updated. Such plans can do more harm than good when they are eventually put to the test by a crisis. As time wears on, both small and large changes will occur. Hence the plan should include provisions, not only for disseminating it and training its users, but also for a process of constant updating, with checks at regular intervals, perhaps every six months.

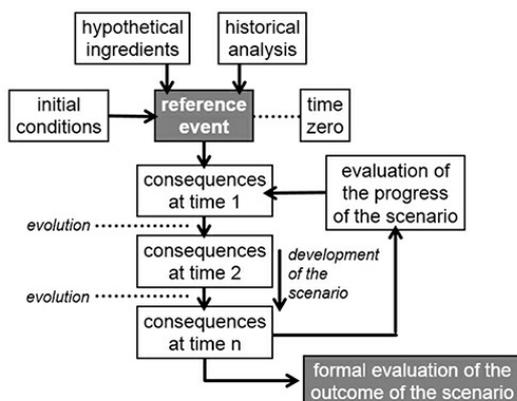
The next section will discuss the contents of emergency plans in more detail.

The Use of Scenarios

Hitherto in this entry, emergency plans have been viewed as if they consist of nothing but collections of generic provisions for managing a notional crisis. These are necessary, in that the plan may need to be adaptable to unexpected crises. However, many—perhaps most—emergencies are predictable events, at least in terms of what is likely to happen. Not all disasters are cyclical events (those of seasonal meteorological origin are the closest to this), but many are recurrent according to established magnitude-frequency relationships, although, as noted, these may be imperfectly known. Over the last 30 years or so, knowledge of natural hazards has increased spectacularly. The threats, probabilities, time sequences, and effects of floods, landslides, storms, earthquakes, volcanic eruptions, and so on, are now much better understood than was the case half a century ago. Unfortunately, despite calls in the early 1980s to make it a central issue, understanding of vulnerability to natural hazards has not evolved at the same pace. In most places, vulnerability, not hazard, is the key to disaster potential; this is unfortunate and needs immediate improvements in research. Nevertheless, in places where hazards are recurrent, emergency planning against them should be based on scenarios. These will enable urgent needs to be foreseen and situations to be anticipated by providing the right resources in the right place and at the right time. Hence, scenarios should be a vital ingredient of emergency plans.

A scenario is a postulated sequence or development of events. Scenarios can be used to reconstruct past disasters, where the evolution of these is incompletely known. However, the main use in emergency planning is to explore possible future events and outcomes. A scenario should not be a rigid prediction of future developments. It is instead an exploratory tool. In most scenarios, there is not one outcome of developments, there is instead a range of outcomes. To establish this is to think creatively about the future.

Typically, an emergency planning scenario will be based on a “reference event,” or possibly more than one event. This will be a disaster that in the past affected the area covered by the plan, and which it is deemed may be repeated in the future. Efforts must be made to assemble a plausible set of hazard data that represent the range of possibilities for the physical impact: for example, the wind speed, precipitation, and track of a storm, or the magnitude and epicentral location of an earthquake. The nature of the built environment, the economy, demography, and social characteristics of the area, and the assets at risk will all have changed since the reference event. Modern conditions must be added to the scenario. This then needs to be developed as a temporal sequence of evolution in terms of hazard occurrence, the impact on vulnerable people and assets, and the response of emergency services (Figure 4). Because aggregate patterns of human behavior change during the day, the week, and possibly also the year, several runs of the scenario may be needed. For example, an earthquake scenario may use the last seismic disaster as its reference event, but the future projection may need to be made for an earthquake that occurs during the night, on a working day, and on a holiday, as there will be different effects on people and the buildings and structures that they use.



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Figure 4. Scenario methodology in emergency planning.

It is opportune to use a simple systems theory methodology to construct the scenario. The inputs are the reference

event and accompanying conditions (social, environmental, economic, etc.). The output is the outcome of the disaster and its management. The throughputs and transformations are the evolution of the scenario over time. One can, if necessary, construct subsystems that embrace, for example, the health system response to the disaster, or the impact on local civil aviation. The point of using scenarios in emergency planning is to be able to explore and anticipate needs generated by predictable future disasters. Hence, the scenario should produce a range of possible outcomes and should be used as an exploratory tool. It should be used in conjunction with an audit of emergency resources designed to answer the question of whether they are sufficient and appropriate to match the anticipated needs.

Emergency planners need not be frightened of the unknown. There has been much debate on the existence of so-called “black swans,” or unanticipated events. These may be all very well in economics, but in disaster management the black swan has become extinct, and its ecological niche has been occupied by the red herring—or thus is the present author’s opinion. This means that there is very little in future events that will not have occurred in some form in the past. The scale and configuration may be different, but the components are present in the historical record. However, this should not be interpreted as a call to look resolutely backwards. Scenario builders will require considerable skill if they are to make a reliable assessment of the magnitude and consequences of future events. This underlines the value of scenario methodology as an exploratory tool, in which known regularities and established evidence are projected into a hypothetical future space and allowed to develop in an “envelope” of possible developments.

The Uses and Abuses of Emergency Plans

One way of extending the emergency plan into the crisis phase, and adapting it to rapidly changing needs, is to continue the planning process during the emergency (Figure 5). Strategic planning is essentially about finding resources and ensuring that the assemblage of response units, plans, and initiatives is generally going in the right direction, so that it will meet the needs of the population affected by disaster. Tactical planning is largely about apportioning resources so that they can be used on the ground by operational units. Operational planning is about assigning tasks, constituting task forces, and monitoring the evolution of the situation so that tasks are set and accomplished. At all three levels, the permanent emergency plan is a backdrop to activities. It should neither be slavishly and rigidly followed nor ignored. One hopes that it will ensure that fundamental tasks are apportioned, responsibilities are clear, and appropriate action is stimulated.



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Figure 5. The dynamic hierarchy of emergency plans.

Emergency planning should be a co-operative effort in which the users and beneficiaries of the plan are stakeholders who have an interest in ensuring that the plan works well. It is also important to create and maintain interoperability, so that emergencies that require large-scale responses do not lead to chaos and to groups of people working at cross purposes.

A Variety of Administrative and Political Contexts

One example of success in ensuring co-operation is the introduction and diffusion of the incident command system

(ICS) in the United States since 1970, when it was first devised as a measure to combat wildfire in California. ICS is a modular system that is usually implemented at the site of an incident and can be aggregated to higher levels. It has been codified by the U.S. Federal Emergency Management Agency and is available online at National Incident Management System, which ensures a degree of interoperability among many different forces. This is highly necessary, as in a major incident or disaster, scores of agencies and organizations may work together—not at cross purposes, one hopes!

In Europe, interoperability is gaining ground, but the diversity of legal and administrative systems among the states of Europe, and the different histories of civil protection that they enjoy, means that the process is slow and complex. During the response to the earthquake in Haiti on January 2010, field hospitals sent from European countries lacked interoperability of equipment and procedures, because they were functioning according to different, not entirely compatible, standards. Thus, they experienced difficulty in supporting each other's work.

One absorbing question about disaster response is the relationship between emergency planners and emergency or disaster managers. In some countries (for example, Italy), they are one and the same, which makes sense, in that the plan needs to be prepared by people who understand the dynamics of managing an emergency. In other countries, such as the United Kingdom, the planners and the managers tend to be separate figures. In traditional systems, the emergency manager is a commander, much as military officers command their battalions. In more modern, evolved systems the manager is much more of a coordinator, a person who manages resources and ensures that autonomous work by experts and task forces is able to go ahead in a co-operative mode. Over the years, as emergency response has become more professional, the need for command has diminished. This does not reduce the need to apportion and assume responsibility, but it does make a subtle and profound shift in the way that that occurs. Modern emergency planning is less about specifying chains of command and more about ensuring a “joined up,” coordinated, approach that covers all essential tasks and uses resources in the most efficient, effective way possible.

The statement that “the need for command is diminishing” needs to be qualified by the cultural requisites of different countries. This observation is broadly true, thanks in part to the effect of information technology, but the degree to which it applies varies considerably from one country to another. In the United States, the management of large emergencies (such as Hurricane Katrina in 2005) still relies on considerable input from military and paramilitary forces (i.e., the National Guard). It should be noted that the response to Katrina revealed a terrible lack of preparedness at the key levels: state and local authority. Here, planning was extemporaneous, but compensatory response of the Federal level of government was slow and initially rather disorganized. Militarized responses are very important in China, where the national government has been suspicious of the rise of volunteer groups. In many other countries, military forces are used in disasters to compensate for deficiencies in civilian response, which may be poorly organized and underfunded. However, in almost all cases, the civilian organization of response to disaster is improving, including in the field of planning, which lessens the need for help from military forces.

Emergency Planning and Ordinary Citizens

A significant portion of a good emergency plan will provide instructions on how to relay information to the general public. The role of and tasks allotted to a spokesperson may need to be defined. In democratic countries, the mass media are expected to have a role that is independent of government, but also to bear a sense of responsibility that induces them to provide public service information in times of crisis. Generally, emergency plans can specify the arrangements for working with the media, but they cannot fully co-opt the media as if they were public servants. In news services, a degree of editorial independence is necessary, in order to draw attention to any abuses of office committed by members of a government, or, for that matter, emergency responders.

Increasingly, response to the threat and impact of disaster is a matter of human rights. There are many ways in which this is true. For example, the safety and well being of girls and women need to be ensured in disaster, as well, of course, as at all other times. Disaster should not be an opportunity for abuses to be committed, or for discrimination against women. Emergency planning can also contribute to human rights, for example, by embodying the principle of “design for all” that seeks to ensure that people with disabilities are not forgotten, discriminated against, or abused in disaster situations, and indeed, that they are given the assistance they need to give them as much parity as possible with people who do not have disabilities.

Disaster and Emergency Planning for Preparedness, Response, and Recovery

In the modern world, disasters have been occasion for forced migration, the imposition of restrictive ideologies, the persecution of minorities, and discrimination against marginalized groups. These are human rights abuses that need to be counteracted.

Forced migration has occurred in the wake of disasters in countries as diverse as Myanmar (formerly Burma), Indonesia, and the United States. In this, the upheaval caused by disaster, and in particular the destruction of housing and livelihoods, has been used as an opportunity to achieve a form of social engineering, by moving people to settle areas deemed less hazardous. A darker form of this is the persecution of minorities, possibly by propelling them into “ghettos” and enclaves. Concurrently, recovery from disaster has occasionally become the opportunity to impose ideologies, as was the case with the introduction of Islamic Sharia law, after both the 2004 tsunami in Banda Aceh and the 2009 Padang earthquake in Indonesia. There is little doubt, moreover, that Cyclone Nargis, in 2008 in Myanmar, did nothing to alleviate the persecution of the Muslim Rohingya people by the Burmese junta. Generally, disasters have been associated with the occurrence, and possibly intensification, of marginalization right across the board, from the homeless in Tokyo to rural communities in Zimbabwe, minorities in the United States, and the poor of Latin American cities such as Managua and Lima.

At the very least, emergency planners need to ensure that there is nothing in the plans that could be construed as a means of facilitating such abuses. It is as well to remember that the legacy of two world wars was political hostility to emergency planning, which was seen by some politicians as a handmaiden to totalitarianism. This was because the invocation of special powers to deal with emergency situations was viewed as a dangerous development that could easily be subverted towards forms of dictatorship. Fortunately, these fears have diminished over time. They have largely been supplanted by an understanding of the imperatives of natural and technological hazards, with their capacity to retard human and economic development, or even to throw such processes into reverse.

Planning the Recovery from Disaster

The so-called “disaster cycle” refers to the phases of resilience building, preparation, emergency response, recovery, and reconstruction. A cycle is used because many disasters are recurrent, although not all are truly cyclical. Clearly, emergency and disaster planning refer primarily to the response phase. However, they have some relevance to all the other phases as well. Emergency planning is largely practiced during the risk mitigation, or resilience-building, phase—the calm periods between major adverse events. It must address the preparation phase as well as the response phase, as there is a need to make preparations systematic, especially where there is enough prior warning of impact for this to be accomplished successfully. While recovery planning may be regarded as a separate process from emergency planning, the two go together in that the phases of recovery offer an opportunity to improve general emergency planning and readiness for the next impact.

In most sudden impact disasters, there is no reason why recovery planning should not begin the day after the event. Having made that point, however, it is important to note that time is socially necessary in recovery. Consultation must take place, and alternative strategies must be investigated. The aim should not be to “bounce back,” but to “bounce forward” to a more resilient society that is able to face up to future disasters by a better combination of resistance and adaptation than that which existed before the current impact. Recovery from a major disaster can take decades, and during that time socio-economic conditions will change, and so probably will environmental and hazard conditions. A disaster characterized by death, injury, psychological impairment, destruction, damage, and loss of economic activities, assets, and employment will engender a complex aftermath. In this there is much potential for wrong decisions, unless objectives are carefully set, procedures are clearly identified, and there is a consensus about how the process should take place.

Major disasters such as large floods, cyclonic storms, and earthquakes may not only take a large toll of casualties but may also destroy a great deal of housing stock and business premises. This will stimulate a process of providing shelter, which may involve temporary and transitional solutions to the housing problem before permanent reconstruction of building stock can be achieved. In this process, there is, or rather there should be, a social contract that indicates that survivors will endure the privation of temporary or transitional housing providing it is for a finite and not excessive period of time. In the aftermath of the March 2011 earthquake and tsunami in northeastern Japan, for example, 88,870 houses were damaged, most of them being completely demolished by the waves. Reconstruction will take about seven years, which is a remarkable achievement that has required very

intensive planning at the local, regional, and national levels. Moreover, the planned reconstruction has to be secure against future tsunamis; land must be elevated, sea walls must be constructed, and residential areas need to be relocated to higher ground, all on an unprecedented scale.

The example of Japan's response to the most expensive natural disaster in human history can be contrasted with that of other, less wealthy nations. The impact of disaster must be seen in relation to national wealth and the effect of a catastrophe on a nation's commerce, trade, and livelihoods. In this sense, when Cyclone Haiyan (known locally as Yolanda) made landfall in the Philippine province of Eastern Visayas in November 2013, the storm surge, which reached 5 meters in height, was very much like a tsunami and every bit as devastating. Evacuation saved many lives, but 7,300 people nevertheless died and almost 29,000 were injured. In this economic backwater of Philippine life, recovery was slow and patchy. Many survivors received very little assistance, which helped to perpetuate vulnerability. Although evacuation was more successful when the next major cyclone (named Hagupit) struck in December 2014, many of the reconstructed shelters of poor people living in coastal communities were once again washed away.

Planning for Critical Infrastructure and Supply Chains

One of the most complex and challenging aspects for recovery planners is the rebuilding of critical infrastructure. In the case of the Japanese Sanriku coast, where the 2011 tsunami came on land, much of the infrastructure was completely devastated: roads, railways, and utility distribution networks had to be rebuilt after sustaining a very high level of damage. Critical infrastructure (which also includes sectors such as food distribution and banking) can be divided broadly into that of national importance and that of purely local significance. In many cases, resilience in networks is a function of being able to find different routes through the network. However, blockages can be critical, and infrastructure may be peculiarly susceptible to cascading disasters. In these, the consequences of one failure are the cause of others, in a sort of "domino effect." Thus, the Japanese Tōhoku earthquake and tsunami caused the Fukushima Dai'ichi nuclear reactor meltdown and radiation release. The tsunami also caused failures in manufacturing supply chains around the world, as a result of shutting down vehicle production in Japan.

Supply chains are essential to humanitarian operations and emergency responses. Emergency planning for them has two aspects. The first is an element of business continuity. It seeks alternative ways to ensure supplies of goods or services, in order to keep productivity from falling as a result of interruption of normal business. It thus depends on redundancy, which is potentially an expensive quality, as it may require the duplication of assets. This requires planners to determine which assets are critical, and where the destruction or failure of assets may have a critical effect on the whole production cycle. The second aspect of supply chain planning involves ensuring efficiency in humanitarian supply, such that the forces on the ground are not left bereft of the equipment, goods, and manpower that are needed to tackle the emergency effectively.

Reconstruction Planning

Planning to manage the reconstruction of housing involves some difficult choices about who should build what and where. It is important to avoid excessive price rises in the market for building materials. It is also essential to involve local people, the beneficiaries in the process of designing, constructing, and adapting permanent housing. In some situations, the best housing is built by its users, while in others it is not possible to learn the necessary skills and so contractors must be used, but the designs should respond directly to the users' needs.

An important matter in reconstruction planning is the extent to which transitional shelter should be provided. If the terrain studies, site urbanization, preparation, and building processes are likely to take years, and if funding for them is short, then it may be necessary to put people in temporary accommodation, usually consisting of prefabs or so-called "barrack houses." The space allotted per family varies from 10 to 40 square meters. The upper limit is a tacit international standard that comes from the provision of transitional shelter in countries such as Italy and Turkey, while the lower limit refers to very basic "bunkhouse" provision for families in rural locations in countries such as Indonesia and the Philippines. In Japan, transitional shelters erected after the 2011 tsunami had floor areas of 27–33 square meters, while those in Sichuan, China constructed after the 2008 Wenchuan earthquake were slightly smaller than 20 square meters in floor area. Hence, the figure tends to be lower in Asian countries, where urban space is limited and populations are large. One risk of transitional housing is that it may reduce the impetus for permanent reconstruction, and thus leave the survivors in limbo for years or decades. The solution lies in both

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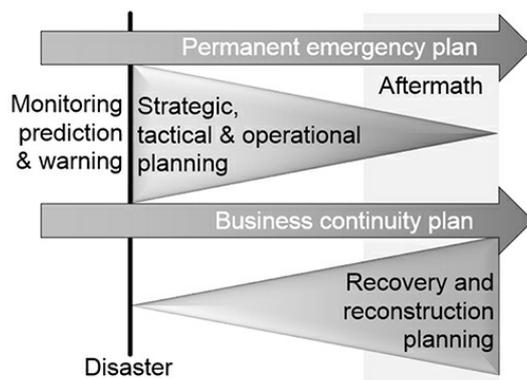
a constant provision of resources for recovery and a transparent, democratic process of achieving it, with ample public participation.

Recovery and reconstruction planning should aim to revive the local area while at the same time making it safer against future disasters. Revival means rebuilding basic facilities, such as housing, infrastructure, and amenities, but it also means ensuring that livelihoods and the local economy are rebuilt. Experience suggests that this is easiest for settlements that are well connected politically and geographically, and hardest for those that are politically, spatially and economically marginalized. There is a welfare function in recovery from disaster, and this begs the question of what welfare should involve. At its worst, copious but ill-thought-out assistance to a disaster area can bring the population into a state of aid dependency that is bound to end in negative consequences, as the assistance is unlikely to be perpetual. Reviving the local economy can instead create self-sufficiency and tax revenues that help the area revive itself.

Other Aspects of Recovery and Reconstruction Planning

The fundamental purpose of welfare is to support people who lack the ability and resources to provide themselves with a minimum acceptable standard of living. Disaster throws this issue into high relief by differentially affecting the poor and needy more than the wealthy. Welfare should not mean largesse, however attractive this may seem to politicians when they remember that disaster victims are also voters. Instead, scarce resources should be utilized to provide a safety net for the most vulnerable people in society, and thus to mitigate the differential effect of disaster.

From these reflections, it should be apparent that there will be parallel processes of planning that have different weights and salience at different points in the cycle of recurrent disasters (Figure 6). To ensure a holistic response to the threat of disaster, recovery, and reconstruction, planning should be linked to on-going emergency planning initiatives and to business continuity planning. Urban and regional planning should have links to all of these processes, because they are all about reducing the risk to development and all about the “hazardousness of place.”



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Figure 6. Parallel forms of planning in the sequence of response to and recovery from disasters.

Conclusion: The Future of Disaster and Emergency Planning

In recent decades, there has been a consistent upward trend in the impact of disasters. Rising populations in the areas of greatest hazard, increasing investment in fixed capital in such places, the complexity of global interconnections, and the impact of climate change in producing more extreme meteorological events all conspire to drive this trend. It has propelled disaster management from a *recherché* concept to a vital discipline, in which there is an increasing process of professionalization. Standards and guidelines for disaster planning do exist, although none has been universally accepted as the basic model. Nevertheless, there is a gathering consensus on what emergency plans should seek to achieve and how they should be structured.

Dealing with disaster is a social process that has environmental and economic ramifications and implications in

terms of governance. Emergency planning needs to fit into a comprehensive program of risk reduction, in which structural defenses are built—for example, river levees and sea walls; non-structural measures are used in a diversified strategy to bring risk under control and reduce the impact of disasters. The non-structural approach includes not only emergency planning and management but also land-use control, public education, and possibly, relocation of the premises that are most at risk.

Emergency planning now has to face up to the challenges of the information age, in which there is much more immediacy to the means of communication. Social media can be used to warn people, collect information from the field, manage public response, answer the public's questions, and devise new ways of managing the emergency. For example, social media have begun to have an important role in accounting for missing people in disaster. Crowd sourcing and cooperative efforts can be powerful tools in the response to crises and emergency situations. Hence, social media and Internet communications need to be taken into account in emergency planning.

Over the period 2004–2013, almost two billion people were directly affected by disaster. In 1995, the Kobe earthquake in Japan was the world's most costly disaster ever to have occurred, with total losses and costs of US\$132.5 billion. The 2011 Tōhoku earthquake and tsunami will easily surpass this. Moreover, enormous potential for casualties and losses exists in the world's megacities, such as Tokyo, Tehran, and Istanbul. Emergency planning is thus facing a challenge that is very much greater and more complex than it appeared to be in the 1960s, when the first attempts were made to devise a systematic approach to it. Emergency planners will need to be more professional and to benefit from more, and more sophisticated, training. Information technology will play an increasing role in planning. It is already prominent, for instance, in the use of geographic information systems (GISs) to depict hazards, vulnerabilities, and patterns of emergency response. GIS is already an integral part of many emergency plans.

Another challenge of contemporary emergency planning is internationalization. Cross-border disasters are common, and any increase in the size and strength of meteorological disasters will increase their importance. Most emergency planning is designed to cope with local, regional, or at least domestic inputs, but less so international ones, as these tend to be much less predictable. However, it will become increasingly necessary to guarantee international interoperability, common supply chains, reciprocal aid arrangements, and procedures for working together across borders.

Finally, more informed decisions will have to be made about the magnitude of events for which a response needs to be planned. The apparent tendency for climate to drive increases in extreme meteorological events is only one element of a complex picture in which the distributions of magnitudes and frequencies are not accurately known. Resources are too scarce to permit lavish preparations for notional high-impact events that may occur only once in a millennium. However, preparedness does need to raise its sights and tackle larger events than those that can confidently be expected to occur in a decade. Given restrictions on public spending, this will mean achieving efficiencies and reducing waste in emergency response, as well as developing a robust moral philosophy and ethical position on who deserves what in the post-disaster period.

Future emergency plans will be digital creations that are networked, interactive, and dynamically supported by different kinds of media, including real-time filming and photography and networked teleconferencing. One challenge here is to ensure that the increasing dependency on sophisticated electronic algorithms and communications does not create vulnerability in its own right. Discharged batteries and failed networks of electricity supplies can be enough to make information and communications technologies useless at the height of a crisis.

As noted, emergency planning needs to be a co-operative endeavor and, as such, it is bound up with questions of rights, responsibilities, and democratic participation. The plans that work the best have the broadest support. They are also well known to participants and are frequently referred to. Like all of the principal aspects of modern life, emergency planning and management need to be sustainable endeavors. There are two sides to this. One is to ensure that the planning process is continuous, and support for the civil protection system in which it takes place does not wane during the intervals between disasters. Budget cuts can throw valid programs of safety and security into reverse, but disasters are, unfortunately, inevitable events. The other side is the need to integrate emergency planning into the general process of planning to make human life more sustainable. It will therefore require interfaces with climate change adaptation plans and programs of sustainable resource usage. These are significant

challenges, and they add up to a process of “mainstreaming” emergency and disaster planning. The alternatives, inefficient and ineffective responses to the threat and impact of disasters, delayed recovery, and vulnerable reconstruction, should not be allowed in any society, rich or poor.

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