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PROGRAMS AND POLICIES THAT OUGHT TO BE  
IMPLEMENTED FOR COPING WITH FUTURE  
DISASTERS

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# PROGRAMS AND POLICIES THAT OUGHT TO BE IMPLEMENTED FOR COPING WITH FUTURE DISASTERS

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## ABSTRACT

There will be more and worse disasters in the future. We as well as other researchers have detailed and documented this elsewhere. This negative consequence will result from the last stages of two worldwide social trends: industrialization and urbanization. However, crisis planning and emergency managing policies can be established and steps can be taken that will reduce and weaken some of the negative effects of the disasters of the 21st Century. Among six major ones are:

1. It is necessary to explicitly accept the fact that all disasters are essentially social occasions that primarily have to be dealt with by social means; far more attention needs to be paid to disasters rather than hazards.
2. The distinction in planning between natural and technological disasters must be dropped; there should be a move to a more generic approach to all kinds of crises.
3. Disaster mitigation should be made at least as much a priority in planning and application as emergency preparedness, response and recovery; this would be to take a proactive rather than just a reactive stance to disasters.
4. An effort should be made to more closely integrate disaster planning with the developmental planning or social change processes of the social system involved; disasters do not occur in isolation from larger social processes.
5. An attempt should be made to ascertain in what ways disaster problems are similar to and different from other environmental problems; there may be similarities that can be concurrently addressed.
6. Newer technologies ought to be implemented in the four phases of the disaster cycle; however, the limits of the technologies must be recognized and the fact that implementation might be more fruitful for certain phases of the cycles than others.

There is no doubt that if the right policies and measures are put in place, the future will not be the past revisited nor will it be only the present repeated.

# SPECIFIC PROGRAMS AND POLICIES THAT OUGHT TO BE IMPLEMENTED TO DEAL WITH FUTURE DISASTERS

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## Future Disasters

We have detailed and documented elsewhere that on the global scene we are inevitably faced with more and worse disasters in the future (Quarantelli 1992a, 1993b, 1996, 1997a; see also Rosenthal 1998). Irrespective of whether the involved agents are natural or technological, there will be both quantitative and qualitative increases in disastrous occasions for all societies. This will result from two master social trends---*industrialization* and *urbanization*---inherent in the very dynamics of societal life anywhere although currently more prominent in developing countries. The first tendency insures that disastrous agents and occasions will increase. The second trend is raising the risks and vulnerabilities of possibly impacted populations and societies.

Industry with its accompanying distinctive kind of technology is spreading everywhere. For example, while in 1888 the five most highly industrialized societies were responsible for 83 per cent of the world's industrial production, a century later the output of the top five was only 57 per cent reflecting the continuing diffusion of industrial technology throughout the world (Lenski, Lenski and Nolan 1991). This trend has been paralleled by an ever swelling involvement of populations in an urban way of life concentrated in constantly enlarging metropolitan areas. By the year 2010, there will be 511 cities exceeding a million inhabitants each and for the first time the world population will be predominantly urban, 51.8 per cent; 15 years later, there will be 639 metropolises of more than a million persons (Jones 1992).

As the world continues to industrialize and urbanize, it is continually creating conditions for more and worse disasters that among other things, will contribute further to environmental degradation and hinder developmental programs. The last stages of the industrialization and urbanization processes, however very positive in effects along many lines, will both increase the number of potential disaster agents and enlarge the vulnerabilities of communities and populations at risk.

Making for an increase is: (a). The accelerating expansion of accidents and mishaps in the chemical and nuclear areas; (b). Technological advances that reduce some risks but make some old threats more dangerous; (c). Some new versions of old and past dangers such as urban droughts; (d). The emergence of new technologies such as computers and biogenetics that present distinctively new dangers; and, (e). An increase in multiple

(e.g., natural disasters creating technological ones) or synergistic type disasters resulting in more severe environmental consequences (Quarantelli 1993c, 1996, 1997a).

Increasing the vulnerabilities are that: (a). Both natural and technological disaster agents will have more built-up areas to impact; (b). More vulnerable kinds of populations will be affected than in the past; (c). Metropolitan areas will be increasingly impacted and along certain lines the social organizations and group configurations of urban areas are not particularly well suited for coping with disasters; (d). Increasing localities will have disastrous conditions from sources that may be quite distant and even from the past; and (e). Certain future disasters have catastrophic potential although they may produce neither casualties nor do much property damage (Quarantelli 1992b)

We primarily discuss those crisis occasions generated by the threat of or the actual impact of relatively sudden natural and technological disaster agents (such as earthquakes, toxic chemical spills, floods, radiation fallouts, hurricanes, forest and brush fires, landslides, explosions, volcanic eruptions, structural failures, tornadoes, transportation wrecks and crashes, avalanches, etc.). Our observations have to be selectively qualified as to their applicability for those kinds of crises that entail usually slow moving and/or very diffuse agents such as are involved in social threat situations like famines, droughts, epidemics, toxic poisonings through hazardous wastes, and air and water pollution episodes, etc. Some comments will also be applicable, but less so, for different kinds of crises especially the ones involving social conflicts such as in wars, revolutions, riots, terrorist attacks, acts of sabotage, product tampering, and similar hostile happenings (Quarantelli 1993a).

### Policies and Actions for the Future

Policies can be established and steps can be taken that will reduce and weaken some negative effects of the disasters of the future. Let us present six major ways in which improvements can be made. The following normative statements have to do both with policies and means.

1. There is a need not only to note but to accept the fact that since all disasters are initially and essentially social occasions, planning for them has to be primarily by social means.

A major first step for doing anything is to understand the sources of problems, for that will also tell us something about what needs to be done. The character of future disastrous occasions will stem from social factors. It certainly should be clear from our remarks that the more and worse disastrous occasions of the future must be primarily attributed to changes or trends in human or social happenings rather than in meteorological or geophysical conditions or happenings per se.

Thus, the greater vulnerability of the aged to future disasters and catastrophes in developed countries is partly attributable to the fact, for example, that in the United States retired people increasingly live in mobile or trailer home parks in flood plains, hurricane prone and flash flood areas. Likewise, the increasing risk to young populations in

developing countries to typhoons, earthquakes, and landslides is partly attributable to the large number of homeless and very poor rural migrants flocking to and residing in more hazardous zones of metropolitan complexes such as Lima, Calcutta, Lagos, Cairo, and Rio de Janeiro. If so, it follows that solutions are to be sought primarily in the social arena.

This general point is consistent with the view of social science researchers that all disasters are primarily the results of human actions. A disaster is not a physical happening. It is a social occasion. Thus, it is a misnomer to talk about *natural* disasters as if they could exist outside of the actions and decisions of human beings and their societies (interestingly this is always recognized in the case of technological disasters). For instance, floods, earthquakes, and other so called "natural" disaster agents have social consequences *only* because of the pre-, trans and post-impact activities of the communities involved. Allowing high density population concentrations in flood plains, having poor or unenforced earthquake building codes for structures, delaying evacuation from volcanic slopes, providing inadequate information or warnings about tsunamis, for example, are far more important than the disaster agent itself in creating the casualties, property and economic losses, psychological stresses, and disruptions of everyday routines that are the essence of disasters.

This granted, the point is that if something is socially problematical, social solutions must primarily be sought. Sometimes in disaster planning an argument is made, for instance, for the need for more radio equipment to improve communication. Yet studies have consistently shown that good information flow, for example, is mostly dependent on consensus regarding who plays what roles, accepted legitimacy for decision making, social mechanisms for facilitating coordination, preimpact interaction among officials who are most likely to be involved in crises, etc. rather than an increase or improvement in the mechanical means used for communicating (Quarantelli 1988).

As another example, longer run problems can be addressed by instituting such measures as stronger building codes, more appropriate land use management, educational programs on safeguards against risks, as well as other disaster mitigation actions especially of a nonstructural nature. At a more contextual level, there is a need to take into account what influences internal mitigation patterns, the social values attached to places of residence, and economic incentives. The negative effects of disastrous occasions can be weakened if hazardous agents are reduced and populations are made less vulnerable. Conscious and deliberate policies and programs can affect the latter contextual conditions as well as the former immediate ones that have consequences for disasters.

Apart from its negative contribution to potentially increasing disaster agents, technology can positively facilitate in some cases the social solutions. Geographic information systems are a good example of something that can contribute to better decision making and risk assessment. As an international disaster relief expert recently noted:

New technologies are useful . . . although their relevance may vary according to the type of disasters. In the anticipative phase: remote-sensing

and satellite imagery for land use planning, monitoring of droughts and crops, hazard mapping, identification of secondary hazards, modeling for forest fires or spread of floods, simulation exercises for decision-making and preparedness of the public, computer databases of resources and expertise. Before an impending disaster: tracking of cyclones, monitoring of floods and volcanic eruptions, early warning for storms. In the relief and rescue phases: communications for search and rescue, surveys of destroyed areas, assessment of damages, monitoring of external assistance (Lechat n.d.: 2).

Now, technological developments relevant to the disaster area continue apace if not at an increasing rate. There are many positive outcomes of such innovations. Nevertheless, like all technology, something can and will go wrong (Quarantelli 1997b). This cannot be eliminated for as has been written:

The impact of human fallibility and malice on hazardous, essential, and highly engineered systems is not at root an engineering problem but a people problem. It arises because the world is peopled by human beings rather than by angels and robots. Whether the resulting failures can be kept small enough without an undesirable degree of social engineering--whether the degree of control required to protect fragile technical systems is acceptable in a free society--is a profound political issue (Lovins and Lovins 1981).

In addition, such problems are not static but evolve as societies evolve. Even two decades ago some said that it was plausible that:

fallibility problems . . . [will] become more prominent as [vulnerable systems] . . . proliferate, salesmen outrun engineers, investment conquers caution, routine dulls commitment, boredom replaces novelty, and less skilled technicians take over especially in countries with little technical infrastructure or tradition (Lovins and Price 1975: 17-18).

This is not an argument against the use of technology for disaster planning purposes. However, any technology cannot be any better than the social infrastructure that uses it. Those who would use it must use it correctly, and that will not always be the case.

2. There is a need to drop the distinction in planning between natural and technological disasters and moving to an all hazard or generic approach.

The growing mergers and links between natural and technological disasters reinforces our belief that a distinction that was never valid in the first place should now be discarded. Disaster theorists who argue that *all* disastrous occasions are attributable to human and group actions, usually see no meaningful conceptual distinction between "natural" and "technological" disasters (Wijkman and Timberlake 1984; Stallings 1988; Rochford and Blocker 1991; Clarke and Short 1993). As such, the argument is that for planning and managing purposes it is *not* useful to approach disasters in agent specific terms, e.g., as a cyclone, a toxic gas leak, a radiation fallout, a flood, etc. Instead it is more valid to

approach all disasters as having important common elements and emphasizing those across-the-board features. Increasingly this all generic view of disasters is coming to the fore.

There are two general reasons for this shift to a generic approach. One is theoretical, the other is empirical. From a theoretical point of view there has been a shift away from a focus on the physical aspects involved toward a more social conception of disasters. This has partly resulted from a logical recognition that, for instance, the occurrence of an earthquake or a chemical explosion as such does not automatically result in a "disaster." Thus, a natural land movement of a certain kind is an earthquake and the transformation of an inert liquid into an expansive gas is a chemical explosion. Yet unless there are significant negative social consequences, such happenings remain only a geophysical event or a chemical process (e.g., an earthquake in uninhabited land or a chemical explosion caught within a safety container), what geographers see as hazards.

From this perspective, a disaster can be identified *only* in terms of some features of a social occasion, that is, some behavioral characteristics of the individuals and groups reacting in the situation. The socially oriented conception of a disaster forces a focus on the common or similar properties of the social happening and away from the physical features of natural and technological agents and impacts.

Even more critically crucial for this issue, is that cumulative social science studies have found that sociobehavioral features of disasters are not generally agent specific, but are manifested across many different types of natural and technological agents (Quarantelli 1991). For very many human and organizational problems the specific kind of agent that might be involved does not matter. Whether the emergency time task is warning, evacuation, sheltering, feeding, search and rescue, disposal of the dead, mobilization of resources, communication flow, interorganizational coordination, public information, etc., and whether the tasks involve individuals or groups, the same general activities have to be undertaken irrespective of the specific agent in the situation.

For example, the same kind of warning messages and the same kind of warning system is needed and is effective in getting people to evacuate, irrespective of the specific agent involved. It does not matter if the agent is a volcanic eruption, an oil spill, a tsunami or a major fire in a hazardous waste site—what will motivate people to give credence to warning messages, what kinds of warning information will be effective, what will limit the acceptance of a warning, etc., will be the same in all cases. These human aspects of a disaster do not depend on the specific type of agent involved. The same is true with respect to organizational level responses (Belardo and Harrauld 1992).

It is no different with regard to mitigation or prevention planning. For example, the same kinds of bureaucratic arguments advanced for a physical solution to potential disaster problems, the social sources of support and resistance in the governmental and private sector to such measures, citizen views of the legitimacy and acceptability of suggested planning, and willingness to put preventive measures on a political agenda, show

considerable similarity irrespective of the particular disaster agent involved. Thus, what researchers have found about the nontechnical difficulties in implementing earthquake mitigation measures are similar to the problems involved in instituting chemical disaster prevention measures. Put another way, most human, group, organizational, community and societal aspects of mitigation planning, are generic rather than disaster agent specific.

In addition, apart from theoretical, logical or empirical research reasons for taking a generic approach to disaster planning, there are also practical ones. These include being: (a) cost efficient in terms of expenditure of time, effort, money and resources; (b) a politically better strategy in that it mobilizes a wider range of groups interested in disaster planning, thus creating a more powerful constituency for the process; (c) a major way of avoiding duplication, conflict, overlaps, and gaps in planning and managing disasters; and (d) a way of increasing efficiency as well as effectiveness in any effort to cope with disastrous occasions. These points should be taken seriously in the sense they ought to guide policies and programs.

Of course, vested interests in both the public and private sectors focused on one kind of agent whether, for instance, earthquakes or chemical risks, do not see it that way and act as major barriers to adopting an approach that cuts across specific agents. In fact, groups may compete with one another for resources and advance claims that their particular agent should be given higher priority in the political arena. Stallings (1995) has documented how in the United States those interested in earthquakes, be they engineers or emergency managers, have been able to obtain higher priority for their agendas than those concerned with other disasters.

3. There is a need to make disaster mitigation as much of a priority in planning and application as emergency preparedness, response and recovery.

Our view is that the basic sources for disastrous occasions are to be found in the basic social structures and social processes of societies. If this is the case, it suggests that ameliorative and preventive measures should be attempted in those dimensions. This in turn, means that greater emphasis needs to be placed on mitigation programs and policies.

The term "mitigation" is used in a variety of ways in the planning and managing of disasters, sometimes unfortunately being equated only with structural measures such as the construction of dams. While such engineering feats may be part of structural mitigation, even within that category it includes such other measures as construction and building codes, design standards, retrofitting, housing inspections, flood proofing, etc. and the implementation and enforcement of all measures such as through the certification of building inspectors. Equally if not more important are other mitigation activities such as legislative and regulatory measures including developmental and redevelopment policies and programs (e.g., land use management, density reduction, setback regulations, zoning, relocation, etc.); plus economic measures such as insurance and financial and taxing incentives; educational measures including training and educational programs (for



professionals such as architects, city planners, personnel in mass communication systems as well as citizens).

To argue for giving more priority to mitigation is not to downplay the necessity of actually improving disaster preparedness, response and recovery planning. Mitigation should *never* aim at replacing such measures as more effective warning systems, better management of evacuations, or quicker and more effective integration of relief and recovery activities by multiple organizations. Instead, mitigation should be seen as an addition to the other kinds of disaster planning. Normally one does not try to ameliorate or prevent immediate symptoms of pain and suffering in an ill person because there is an intent to perform an operation or give a drug treatment that in the long run will eliminate or change the basic conditions responsible for the illness. The same general principle is applicable here--other disaster planning should not be stopped because mitigation planning is given greater attention.

It can be assumed without question that mitigation will never prevent all disasters, or even most. Yet, especially in developing countries, as already has happened in developed societies, such planning could particularly and significantly reduce casualty tolls and weaken psychological stresses and social disruptions that result from disasters. While some reduction of economic losses might be anticipated in ordinary or typical disasters, it is possible there will be less effect on such losses from catastrophic ones (Quarantelli 1996).

4. There is a need to more closely integrate disaster planning to the developmental planning or social change processes of the social system involved.

We have stressed that the disasters of the future especially stem from the social changes that are going on in social systems. Again, if true, it suggests a point of attack. This is that disaster planning should be linked to both societal and community level developmental planning.

Mitigation lends itself somewhat better to linkages with non-disaster kinds of planning than other kinds of disaster planning. As noted, a wide variety of measures can be used to support and implement effective mitigation. Many of them already exist in the activities that communities pursue on a day-to-day basis even absent a postimpact disaster environment. This is an important point because it is saying that mitigation is often already latently embedded in those activities that are routinely undertaken in the typical community in developing societies (oddly this seems to be less recognized in developed societies such as in the United States where much mitigatory activity is linked to emergency organizations and personnel rather than to planning and development agencies).

A fundamental weakness of much of the contemporary approach to disaster planning, is the separation from everyday decision making about community development (Anderson and Woodrow 1989). There should be no sharp boundary between routine village, regional

and national developmental planning and disaster planning. Every decision about residential land use, plant siting, and indeed every industrial and economic policy or program, carries with it some consequence for risk. As a result, every decision increases or decreases the potential for a disaster. If the effects of natural and technological disasters are to be reduced, then the risk implicit in everyday routine planning must be given greater explicit recognition by every level of government as well as the private sector at all stages of planning and decision making. In essence, the most effective way to reduce the impact of disaster is to incorporate or integrate risk assessment and disaster planning into the process of community project formulations and development planning, and their implementation.

Or as two disaster researchers have recently written:

It is important to realize that the post-disaster "recovery process" is one in which an underdeveloped system is forced to achieve a readaptation to an environment using limited resources, a process not unlike the processes by which development or underdevelopment are produced to begin with . . . In other words, we must recognize that "recovery" especially in an underdeveloped society, is a "development process" in and of itself. It amounts to the establishment of a set of patterns which reassert the adjustment of a human population to an environment. After all, development itself amounts to a process by which a population improves its level of adaptation to an environment and through such improvements raises the level at which it satisfies human needs and wants, and at the same time lowers its levels of vulnerability to disruptions. For these reasons, the recovery process can be one which either increases or decreases the level of development of a human community (Bates and Peacock 1989: 362-363).

Linking the two processes is not easy. It requires the convergence and integration in an ideal type sequence of citizen awareness leading to political will for action, leading to policies and programs based on laws and legislation, leading to implementation of risk reduction measures that will be consistent with other developmental activities. All this furthermore requires the presence of knowledgeable personnel, good planners, adequate resources and politically astute managers--often in short supply particularly in developing countries. However, because something is difficult in no way implies it is not the appropriate course to be followed.

In addition, looked at from another angle, some questions need reliable answers. What are the present and future costs (social and political as well as economic) of the contemporary tendency to compartmentalize disaster and developmental planning? Especially in developing countries, would not the possible overheads of integration make development plans more economically costly? Are "costs" less than would be incurred in efforts to integrate the two planning processes? Moreover, while there could be "gains" in the long run in a stronger linking of the planning for development and for disastrous occasions, might not short-term development interests take priority? Would transnational corporations that seek lowest-cost economies in setting up operations, see "gains" or "costs" in linking the two processes? What actual data exists one way or the other on such questions?

5. There is a need to ascertain in what ways disaster problems are similar to and different from other environmental problems.

As we have discussed elsewhere, there is a tendency to compartmentalize the attention paid to disasters. In the United States, for instance, at the community level there usually is separate planning for disasters resulting from hazardous chemicals, separate plans for flood threats, separate planning for emergencies in nuclear plants, etc. In Great Britain which national agency takes the lead role in dealing with a nuclear threat depends on such matters as the source of the threat, whether for example it originates within the British Isles or outside, etc. The United Nations itself has a variety of different agencies focusing on different types of disasters, such as famines, oil spills, earthquakes, epidemics, etc. There are major gaps especially in developing countries between those concerned with disasters and those with developmental planning. Such kinds of social organizational arrangements, although often understandable in terms of bureaucratic and political realities, are poor models of how to deal effectively and efficiently with disasters. They are unnecessarily economically costly, generative of conflict among agencies, administratively duplicative, and wasteful of the time, effort and attention of anyone genuinely interested in doing something about disasters.

Unfortunately, there is yet another widespread separation of disasters from something else to which they might be linked, i.e., other environmental problems. The personnel, organizations and resources committed to disasters are frequently in social circles and worlds different from those focused on other environmental problems. More important, they are seldom studied or discussed in any common framework (Faupel 1987; Quarantelli 1993c; Bates and Pelanda 1998).

Our view is that it would not be very useful to fully equate disasters with all other environmental problems (apart from the fact that technically in sociology, disasters are not "social problems" ). As written elsewhere, many ecological problems often thought of as part of environmental problems, especially those that operate at a macrolevel, differ from disasters in some of their origins, careers and effects (Smelser 1991). We have in mind such global processes as atmospheric warming with attendant ozone depletion and sea level rises, desertification and drought along with deforestation, acid depositions into the biosphere and soil degradation, and the decrease in biodiversity.

That said, this does not mean that there are not some common elements in all environmental problems, particularly if the latter are thought of in a broad sense so as to include natural and technological disasters. What these are need to be established for the present day research base on this is weak. Yet even now we can see some similarities.

Interestingly, the very general pattern we have stressed, that the world is faced with more and worse disasters, has been also stated for environmental problems, with in both cases the problem being seen as most acute in developing societies. Thus, it has been written:

The various environmental crises that the world is facing--exhaustion of resources, spoilage, toxicity, and pollution--will grow worse before they grow better. The logic behind this assertion is that the impulse among nations to develop economically and compete with others is so strong that they will give greater priority than impulses to protect the environment. In the short run, environmental considerations constitute a cost and a liability in the drive toward competitive productivity. This effect will no doubt be stronger in those nations struggling to catch up--the former Eastern bloc and the Third World countries--than in the developed nations with developed environmental movements (Rasmusson et al 1975: 63).

Along somewhat similar lines, Smelser in fact singles out as a source of most such environmental problems, the industrialization in developing countries that we also see as a source of future disaster problems. Likewise, both kinds of crises--disastrous occasions and environmental problems tend to have similar negative consequences--casualties, economic losses, psychological stresses, social disruptions, and political costs not to mention further environmental degradation and ecological imbalance, and of course serious impediments to national socioeconomical development.

What is implied by these observations is that we should attempt to ascertain in what ways disaster are similar to and different from environmental problems. To that the extent there are similarities over and above those we have just generally mentioned, it suggests that there be a pooling of strategies, policies, programs and measures that could be commonly treated.

6. The newer computer related technologies need to be selectively implemented at different phases of the disaster cycle, as well as recognizing the limits of these technologies

Among one of the more obvious changes in the modern world, in the last two decades or so, has been the development of computer and related technologies. They clearly have value in disaster planning and managing. That cannot be questioned.

On the other hand, there is perhaps not enough recognition that perhaps the technologies are not equally applicable in all four major phases of the disaster cycle. Our observation is that there is a tendency to assume that the most value is in dealing with the emergency or crisis time periods of disasters. We do not agree with this view. From our perspective the greatest value is in the mitigation and recovery phases of disasters. There are a number of reasons for this, but in general, it is because the crisis period is too fluid and there are too many contingencies that cannot be preplanned.

In addition, there are a number of problematical aspects in the implementation of computer related technologies in disaster planning and managing. We have discussed these extensively elsewhere (see Quarantelli 1997b). So for our purposes here we merely listed a dozen problems in the use of the newer technologies. They are (1) the probability that the "rich will become richer" in dealing with disasters; (2) the possibility that an overemphasis on technology may turn what should be a "means" into an "end" in itself; (3) the inevitable information overload problem; (4) the likelihood that there will be a reduction

of learning from errors; (5) the greater diffusion of inappropriate or incorrect disaster relevant information; (6) an even further diminution of nonverbal communication in planning and managing processes; (7) the intra and interlevel group communication in crises may be made even more difficult; (8) negative consequences from the probable acceleration of fads and fashions associated with disaster planning and managing; (9) the difficulty in creating supportive social infrastructures and subcultures needed for the adequate functioning of any disaster relevant technology; (10) the difficulty stemming from the changing and different role of the private sector in dealing with disasters; (11) a possible acceleration of the distinctive features of many 21<sup>st</sup> Century disasters; and, (12) the creation of a new type of disaster associated with computer system failures.

None of these problems are arguments against the use of the new computer and related technologies. But they should be seen as issues that need to be addressed, along with a recognition that advances along some lines may bring difficulties along other lines.

### Final Observation

In concluding, we need to note there is a need to be realistic about what can or cannot be achieved. There are limits. A risk-free society is a chimerical dream. If the production of mushrooms were invented today, there would be those that would urge their total prohibition. The notion that risks and subsequent disastrous occasions can be completely eliminated is not borne out by history. In fact, it is even difficult to foresee where the risks might be even in the technological area. For instance:

The sheer complexity of many technical systems can defeat efforts to predict their failure modes. "The sequence of human and mechanical events leading to the two most serious power reactor failures in the U.S. [at Browns Ferry and Three Mile Island] were excluded from fault tree analysis in the most comprehensive study of reactor safety ever undertaken" (23).

Nevertheless, that not everything can be done, does not mean that something cannot be done. We can decrease future disasters and catastrophes and lessen somewhat the qualitatively worsening of their effects. We should take the necessary steps to do so. If the right policies and measures are put in place the future will not be the past revisited nor will it be only the present repeated.

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